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ILLUSTRATED MANUAL
OF
OPERATIVE SURGERY
AND
SURGICAL ANATOMY.
BY
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EDITED, WITH NOTES AND ADDITIONS,
AND ADAPTED TO THE USE OF THE AMERICAN MEDICAL STUDENT,
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ILLUSTRATED WITH STEEL ENGRAVINGS, FROM DRAWINGS AFTER
NATURE,
BY M. J. LÉVEILLÉ.
DESIGNED TO SERVE AS A COMPANION TO THE ORDINARY TEXT BOOKS
OF SURGERY.

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PREFACE TO THE AMERICAN EDITION.

IN presenting to the American Student of Surgery the beautifully illustrated work of MM. Bernard and Huette, the editors flatter themselves that they have contributed to the supply of a want which has not been unfrequently experienced heretofore, viz.: a complete and concise picture of the science and art of Operative Surgery, in its present advanced and perfected condition, in a portable form. The admirable and extensive works of Bourgery and Jacob, and Prof. Velpeau, with the translation of the latter under the auspices of Prof. Mott, and the equally excellent treatise on Operative Surgery by Prof. Pancoast of Philadelphia, can never be replaced by the present work. Yet its compactness and portability will render it more desirable to the student as a companion in the lecture and dissecting room, where its copious and graphic illustrations will assist him materially in acquiring correct general ideas as to the nature and objects of the individual operations of surgery; whilst for more minute and varied details with regard to their history and numerous modifications, the less accessible and more expensive treatises alluded to can be consulted at a more advanced period of study. In fact they are better calculated for works of reference to the practitioner of surgery, than as text books for the student, designed to set forth concisely the elements of the art. Our manual, whilst it is intended mainly to illustrate the intri-

cacies of operative surgery by appealing to the eye as well as to the understanding of the student, and by familiarizing him with that most useful department of anatomy which immediately relates to surgical operations, will also be found, it is hoped, not entirely useless as a work of reference to those already engaged in practice.

It has been the object of the translators to Americanize the language of the work to as great an extent as possible, making use of the terms in ordinary use in this country by teachers of anatomy and surgery, in order that the American student may not be annoyed by meeting with foreign modes of expression with which he is not familiar, and which, in their opinion, it is rarely desirable to introduce into common use. This almost invariable peculiarity of French translations has heretofore interfered both with their popularity and general utility; it has therefore been their endeavor to avoid it.

The additions, in the form of notes, which it has been thought proper to append to the original text, will not, it is hoped, be found to detract from its value.

New-York, October, 1851.

TABLE OF CONTENTS.

PLATES AND DESCRIPTIONS.

MINOR OPERATIONS.

	PAGE
PLATE I.—Methods of holding the bistoury—1st, 2d, and 3d positions, <i>Incisions</i> .—1st, simple incisions : 2d compound incisions : 3d, incisions from within outwards.	3
PLATE II.—Union of wounds, <i>Sutures</i> .—1st, simple suture : 2d, zigzag, or basting suture : 3d, twisted suture,	6
PLATE III.—Seton : vaccination : scarification : acupuncture,	9

METHODS OF BLEEDING.

PLATE IV.—Bleeding in the arm and foot, Surgical anatomy of the bend of the arm and the internal portion of the foot.	12
PLATE V.—Bleeding from the jugular, <i>Instruments</i> .—Different shaped lancets. <i>Operations</i> .—1st, bleeding from the temporal artery : 2d, bleeding from the external jugular vein.	16

LIGATURES.

PLATE VI.—Ligature of arteries, Anatomy of the arteries, Effects produced by a ligature upon an artery. General rules for the ligature of arteries.	18
PLATE VII.—Ligature of the ulnar and radial arteries, Surgical anatomy. Mode of operating.	21
PLATE VIII.—Ligature of the brachial artery, Surgical anatomy. Operation. Mode of operating.	23

TABLE OF CONTENTS.

	PAGE
PLATE IX.—Ligature of the axillary artery, Surgical anatomy. Operation. Mode of operating.	25
PLATE X.—Ligature of the axillary and subclavian arteries, Surgical anatomy. Operation. Mode of operating.	27
PLATE XI.—Ligature of the primitive carotid, lingual and facial arteries, Surgical anatomy. Operations. Mode of operating.	32
PLATE XII.—Ligature of the radial and dorsalis pedis arteries, Surgical anatomy of the radial artery at the wrist : operation. Surgical anatomy of the arteria dorsalis pedis : operation. Modes of operating.	36
PLATE XIII.—Ligature of the anterior tibial artery, Surgical anatomy. Operation. Modes of operating.	38
PLATE XIV.—Ligature of the posterior tibial artery, Surgical anatomy. Operations. Modes of operating.	41
PLATE XV.—Ligature of the popliteal artery, Surgical anatomy. Operation. Modes of operating.	44
PLATE XVI.—Ligature of the femoral artery, Surgical anatomy. Operation. Modes of operating.	47
PLATE XVII.—Ligature of the femoral artery under Poupart's ligament, of the external iliac and epigastric arteries, Surgical anatomy. Operation. Modes of operating.	50

AMPUTATIONS THROUGH THE JOINTS, OR DISARTICULATIONS.

General rules for determining the position of a joint. Rules for cutting through an articulation. Of the mode of operating. Of the formation of flaps,	54
PLATE XVIII.—Disarticulation of the last two phalanges of the fingers, and of the whole finger, Surgical anatomy. Operations. Modes of operating.	58
PLATE XIX.—Disarticulation of the four fingers; of the metacarpal bones, Modes of operating.	64
PLATE XX.—Amputation through the carpo-metacarpal, and radio-carpal articulations, Surgical anatomy. Operations. Modes of operating.	66
PLATE XXI.—Amputation at the elbow joint, Surgical anatomy. Operations. Modes of operating.	69

TABLE OF CONTENTS.

	PAGE
PLATE XXII.—Amputation at the shoulder joint, Surgical anatomy. Operations. Modes of operating.	71
PLATE XXIII.—Disarticulation of the toes, Surgical anatomy. Operations. Modes of operating.	74
PLATE XXIV.—Amputation through the tarso-metatarsal articulation, Surgical anatomy. Operations. Modes of operating.	76
PLATE XXV.—Amputation through the tarsus, or Chopart's operation, Surgical anatomy. Operations. Modes of operating.	79
PLATE XXVI.—Amputation at the knee joint, Surgical anatomy. Operations. Modes of operating.	82
PLATE XXVII.—Amputation at the hip joint, Surgical anatomy. Operations. Modes of operating.	85

AMPUTATIONS IN THE CONTINUITY OF LIMBS.

PLATE XXVIII.—Amputations of the foot and hand, Operations. Modes of operating.	89
PLATE XXIX.—Amputations of the fore-arm and arm, Operations. Modes of operating.	91
PLATE XXX.—Amputation of the leg, Operations. Modes of operating.	93
PLATE XXXI.—Amputation of the thigh, Operations. Modes of operating.	95

EXSECTIONS.

PLATE XXXII.—Exsections performed in the superior extremity, Operations. Modes of operating.	97
PLATE XXXIII.—Exsections performed upon the inferior extremity, Methods of operating.	103
PLATE XXXIV.—Exsection of the superior and inferior maxillary bones, Methods of operating. Exsection of the bones of the trunk.	106

TREPANNING.

PLATE XXXV.—Trepanning of the bones of the cranium, Surgical anatomy. Mode of operating.	110
---	-----

TABLE OF CONTENTS.

	PAGE
OPERATIONS UPON THE EYE AND ITS APPENDAGES.	
Operations upon the eyelids,	112
Surgical anatomy,	
PLATE XXXVI.—Operations upon the eyelids,	114
PLATE XXXVII.—Operations upon the eyelids, continued,	115
Methods of operating. Coloboma. Ankyloblepharon. Symblepharon. Epicanthus. Blepharoptosis. Entropium. Trichiasis. Ectropium. Tumours of the eyelids. Blepharoplasty.	
PLATE XXXVIII.—Operations upon the lacrymal apparatus,	127
Surgical anatomy.	
PLATE XXXIX.—Operations upon the lacrymal apparatus, continued,	130
Lacrymal tumour and fistula. Modes of operating.	
PLATE XL.—Operations upon the muscles of the eye,	137
Surgical anatomy. Strabismus. Modes of operating.	
PLATE XLI.—Operation for cataract by depression,	144
PLATE XLII.—Cataract and artificial pupil,	145

CATARACT.

Page		149
	Modes of operating.	

OPERATION FOR ARTIFICIAL PUPIL.

Page		158
	Spots upon the Cornea. Pterygium and Pannus. Hypopion. Phlegmon. Hydrophthalmia. Extirpation of the eye. Insertion of an artificial eye,	162

OPERATIONS UPON THE EAR.

PLATE XLIII.—Operations upon the external ear,		166
	Surgical anatomy. Perforation of the lobe of the ear. Wounds of the external ear, and otoplasty. Foreign bodies in the external meatus. Polypi of the auditory canal. Absence and obstruction of the auditory canal.	
	<i>Operations upon the internal ear</i>	170

TABLE OF CONTENTS.

	PAGE
PLATE XXXVIII. —Fig. 1, and Plate XLIII., figs. 1 and 4. Perforation of the membrana tympani. Perforation of the mastoid cells. Catheterism of the eustachian tube (Plate XXXVIII., fig. 1, and Plate XLIII., fig. 1.)	
 OPERATIONS UPON THE LIPS.	
<i>Excision of a fold of the mucous membrane of the lip. Swelling of the upper lip,</i>	174
PLATE XLIV. —Hare-lip ; cheiloplasty ; contraction of the orifice of the mouth.	
PLATE XLV. —Hare-lip, etc., continued,	175
Restoration of the orifice of the mouth. Hare-lip.	
Double hare-lip. Complicated hare-lip. Removal of cancers of the lip and cheiloplasty. Cheiloplasty of the lower lip. Genioplasty.	
 OPERATIONS UPON THE NOSE AND NASAL FOSSÆ.	
PLATE XLVI. —Rhinoplasty	186
PLATE XLVII., FIG. 1. —Contraction and occlusion of the nostrils. Foreign bodies in the nostrils. Polypi of the Nasal fossæ. Plugging of the nasal fossæ,	188
 OPERATIONS UPON THE FRONTAL AND MAXILLARY SINUSES.	
Page	194
Perforation of the frontal sinus. Catheterism and perforation of the maxillary sinus.	
PLATE XLVII. —Ligation of a polypus of the nasal fossæ ; removal of the tonsils,	196
PLATE XLVIII. —Cancer of the tongue, and the operation for stammering,	197
 CANCER OF THE TONGUE.	
Modes of operating,	198
 OPERATIONS FOR STAMMERING.	
Page	200

TABLE OF CONTENTS.

	PAGE
DIVISION OF THE FRAENUM. ABNORMAL ADHESIONS OF THE TONGUE. EXCISION OF THE UVULA.	

Page	201
----------------	-----

OPERATIONS UPON THE TONSILS.

Page	203
----------------	-----

Abscess of the tonsils. Excision of the tonsils (Plate XLVII.)

OPERATIONS UPON THE SALIVARY APPARATUS.

PLATE XLIX.—Fistula of the parotid and Steno's duct,	205
Surgical anatomy. Modes of operating. Extirpation of the sub-maxillary gland. Ranula.	

PLATE L.—Staphyloraphy,	211
-----------------------------------	-----

PLATE LI.—Staphyloraphy,	212
------------------------------------	-----

STAPHYLORAPHY, OR CLEFT PALATE.

(*Plates L. and LI.*)

Page	213
Modes of operating.	

CATHETERISM OF THE AIR PASSAGES AND THE AESOPHAGUS.

Page	219
----------------	-----

PLATE LII.—Surgical anatomy. Modes of operating. Stricture of the aesophagus. Extraction of foreign substances.	
---	--

PLATE LIII.—Goitre—ligature,	225
--	-----

PLATE LIV.—Goitre—ligature,	226
Manec's method of operating.	

BRONCHOCELE, OR GOITRE.

Page	227
----------------	-----

CATHETERISM OF THE AIR PASSAGES.

(*Plate LII., Fig. 1.*)

Page	229
----------------	-----

TABLE OF CONTENTS.

	PAGE
ŒSOPHAGOTOMY.	
PLATE LV.—Figs. 1 and 2. Surgical anatomy, Modes of operating.	232
 —	
BRONCHOTOMY.	
PLATE LVI,	235
Surgical anatomy. Indications. Operations. Sub-hyoid Laryngotomy. Thyroid Laryngotomy. Laryngo-Tra- cheotomy. Tracheotomy.	
 —	
EXTIRPATION OF THE BREAST. EMPYEMA.	
PLATE LVII,	249
Surgical anatomy. Extirpation of the breast. Empyema. (figs. 3 and 4). Modes of operating.	
 —	
PARACENTESIS OF THE PERICARDIUM.	
Page	258
 —	
LESIONS OF THE INTERCOSTAL ARTERIES.	
Page	259
 —	
OPERATIONS UPON THE ABDOMEN.	
PLATE LVIII.—Paracentesis abdominis,	260
Surgical anatomy. Gastrotomy. Abscess of the liver, tumours of the gall bladder, hydatid cysts. Ovarian cysts.	
 —	
WOUNDS OF THE ABDOMEN.	
Page	266
Simple penetrating wounds. Wounds of abdomen with strangula- tion of the parts protruded. Wounds of the intestinal canal (Plate LIX.)	
PLATE LIX.—Wounds of the intestines,	275

TABLE OF CONTENTS

	PAGE
HERNIA.	
LX.—Surgical anatomy of the inguinal region,	277
PLATE LXI.—Surgical anatomy of the inguinal region, continued,	278
PLATE LXII.—Surgical anatomy of the scrotum and spermatic cord,	282
PLATE LXIII.—Theoretical explanation of the formation of hernias,	284
PLATE LXIV.—Surgical anatomy of hernia,	285
PLATE LXV.—Radical cure of hernia,	286
Modes of operating. General considerations in regard to hernia. Treatment of hernia. Reduction of hernia.	
PLATE LXVI.—Operation by division of the stricture,	297
Division of the stricture in inguinal hernia. Femoral hernia. Umbilical hernia.	
 — 	
ARTIFICIAL ANUS.	
PLATE LXVII,	307
Pathological anatomy. Modes of operating.	
PLATE LXVIII.—Operation for artificial anus,	315
Surgical anatomy.	
PLATE LXIX.—Operation for artificial anus,	316
Modes of operating.	
 — 	
OPERATIONS UPON THE ANUS AND RECTUM.	
PLATE LXX,	321
Fistula in, and modes of operating. Fissure of the anus.	
PLATE LXXI.—Operations upon the anus and rectum, continued,	329
Hemorrhoidal tumours. Venereal excrescences. Polypi of the rectum. Cancer of the rectum. Modes of operating. Plugging of the rectum. Foreign bodies in the rectum. Stricture of the anus and rectum. Prolapsus ani.	
 — 	
OPERATIONS UPON THE PENIS.	
PLATE LXXVII,	341
Section of the frenum. Phymosis. Paraphymosis.	
Cancer of the Penis.	
PLATE LXXIII.—Operations upon the penis and scrotum, continued,	346
Hydrocele. Sarcocoele. Amputation of the penis.	

TABLE OF CONTENTS.

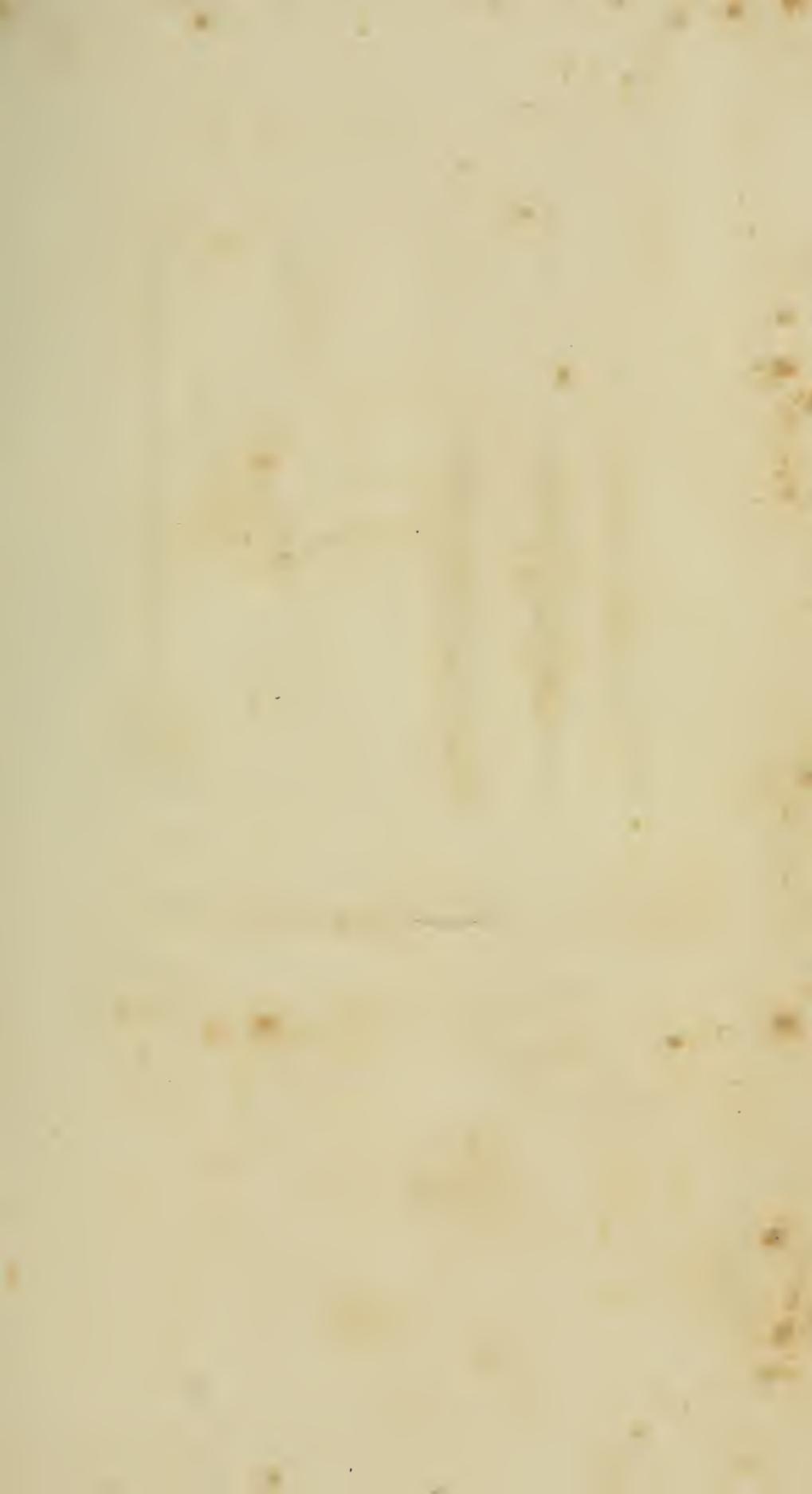
	PAGE
PLATE LXXIV.—Operation for varicocele, Modes of operating.	352
PLATE LXXV.—Operations upon the bladder and urethra, Puncture of the bladder.	356
PLATE LXXVI.—Operations upon the bladder and urethra, continued, Surgical anatomy. Introduction of the catheter into the urethra.	362
PLATE LXXVII.—False passages. Strictures of the urethra. Urethro- raphy and urethroplasty. Enlargement of the meatus. Fastening of catheter	376
PLATE LXXVIII.—Catheterism and lithotrity,	399
PLATE LXXIX.—Surgical anatomy of the perineum. Lithotomy through the perineum and rectum,	410
PLATE LXXX.—Hypogastric lithotomy, Surgical anatomy of the region above the pubes. Modes of operating.	429

OPERATIONS UPON THE GENITAL ORGANS OF THE FEMALE.

PLATE LXXXI.—Lithotomy in the female, Surgical anatomy of the female perineum. Modes of operating. Introduction of the catheter, and litho- tomy in the female. Lithotrity.	438
PLATE LXXXII.—Operations upon the genital apparatus proper, Operations for lacerations and fistulæ of the vagina. Operations upon the vulva. Operations upon the vagina.	451
PLATE LXXXIII.—Operations for uterine polypi, and prolapsus uteri, . Operations upon the uterus. Modes of operating. Operations for prolapsus of the uterus and vagina, cystocele and vaginal rectocele.	466
PLATE LXXXIV.—Operations upon the neck of the uterus and the ova- ries, Exploration of the neck of the uterus. Operations for cancer of the neck of the uterus. Diseases of the ovary. Modes of operating.	474
PLATE LXXXV.—Operations for the induction of premature labour, . Modes of operating.	484
PLATE LXXXVI.—Caesarian operation. Symphysiotomy,	488

TABLE OF CONTENTS.

	PAGE
TENOTOMY.	
PLATE LXXXVII.—Torticollis, or wry neck. Section of the sterno- cleido-mastoid muscle. Distorted hand. Permanent contraction of the fingers,	492
Surgical anatomy. Modes of operating. Permanent contraction of the fingers; section of the bridles, the palmar fascia, and the flexor tendons.	
PLATE LXXXVIII.—Club feet. Section of the tendo achillis, Surgical anatomy. Section of the tendons of the leg and foot.	499



PL. I.

Fig. 3.



Fig. 1.



Fig. 2.



Fig. 4.

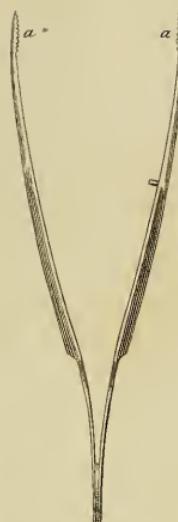


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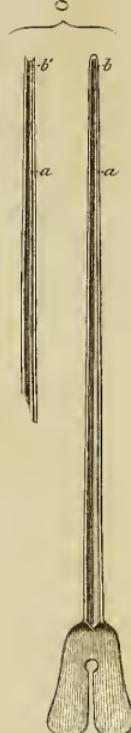


Fig. 6.

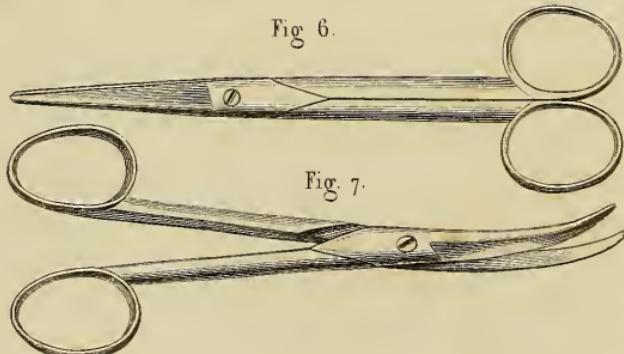
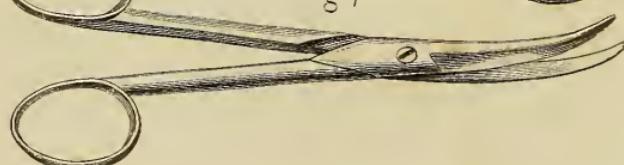


Fig. 7.



MODÈLES CHARRIÈRE.

PLATE I.

INSTRUMENTS REQUIRED FOR MAKING INCISIONS.

Fig. 1. Straight bistoury.

Fig. 2. Convex bistoury.

Fig. 3. Probe-pointed bistoury.

aaa back of the bistoury.

bbb edge of the bistoury.

ccc joint of the handle and blade.

ddd end of the handle.

Fig. 4. Ordinary dissecting forceps.

aa jaws of the forceps.

Fig. 5. Director.

a groove of the director.

b probe-like end of the director.

b' extremity of a director in which the groove is continuous to the end.

Fig. 6. Straight scissors.

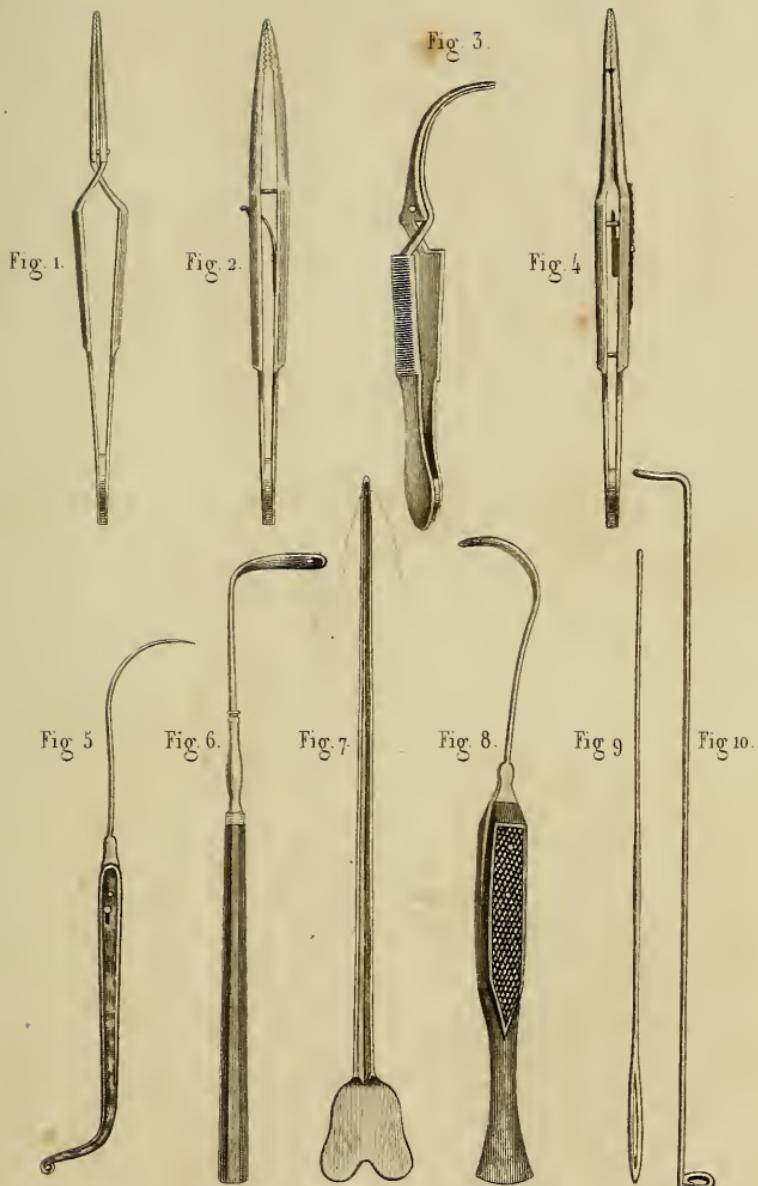
Fig. 7. Scissors curved on their cutting edges.

PLATE II.

INSTRUMENTS REQUIRED FOR LIGATION OF ARTERIES.

- Fig. 1. Charrière's forceps for continued pressure.
- Fig. 2. Graefe's spring artery forceps.
- Fig. 3. Charrière's curved forceps for continued pressure.
- Fig. 4. Amussat's torsion forceps.
- Fig. 5. Tenaculum.
- Fig. 6. Deschamps' artery needle.
- Fig. 7. Director, with an eye in its extremity.
- Fig. 8. Cooper's artery needle.
- Fig. 9. Eyed probe.
- Fig. 10. Sottot's knot-tightener.

Pl. II.

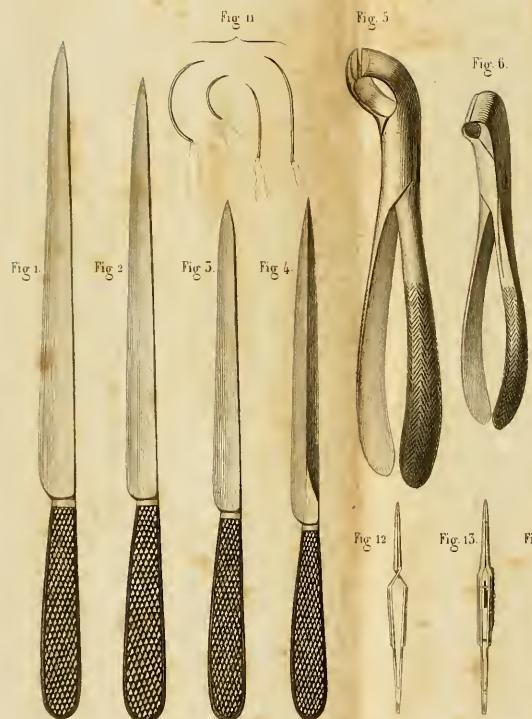


MODÈLES CHARRIÈRE.





PL. III.



PL. IV.

MODELES CHARRIERE



PLATES III. & IV.

INSTRUMENTS REQUIRED FOR AMPUTATIONS.

Figs. 1, 2, 3. Amputating knives of different sizes.

Fig. 4. Interosseous knife, or catlin.

Figs. 5 and 6. Bone forceps.

Fig. 7. Charière's tourniquet.

Fig. 8. Ordinary amputating saw.

a extra blade.

Fig. 9. Small amputating saw.

b extra blade.

Fig. 10. Chain saw.

c needle to conduct it.

d handle to be attached after the introduction of the saw.

Fig. 11. Suture needles.

Fig. 12. Charière's forceps for continued pressure.

Fig. 13. Amussat's torsion forceps.

Fig. 14. Tenaculum.

PLATES V. & VI.

INSTRUMENTS FOR EXSECTION OF BONES.

Fig. 1. Hey's saw.

Fig. 2. Knife-shaped saw.

Fig. 3. Small semicircular saw.—*a*, surface for a point of support to the index finger of the hand, holding the instrument, when it is desired to employ force with precision of motion.

Fig. 4. Larrey's straight saw.

Fig. 5. Martin's saw.—This consists of a rod, *a b*, with a circular saw at its extremity, *c*. A rotary motion is given to the rod, *a b*, and to the saw at its extremity, by another rod, *d e*, which is connected with the first by a universal joint, *f*. This arrangement allows the saw to move freely at any angle which the two rods may form with each other. The extremity, *h*, of the rod, *d e*, fits into the shaft of a trepan (fig. 5, *bis*) which is moved by an assistant, whilst the operator, holding the handle, *i*, which is traversed by the rod, *a b*, directs the action of the saw and graduates its force, using more or less pressure, as may be required. Saws of different diameters, *j*, or shaped like a mushroom, *k*, may be fitted to the rod, *a b*, according to circumstances.

Fig. 6. Charrière's rowel saw.—A crank, *a*, moves the wheel, *b*, the teeth of which, interlocking with those of the wheels, *c d e*, transmit a rotary motion to the saw, *f*. By means of this instrument, which is solid, firm, and of easy application, we can operate on bones which are very deeply seated. Saws of different diameters can be adapted to it.

Fig. 7. Dupuytren's perforator.—An instrument used for breaking up deeply seated *sequestra*, when they cannot be withdrawn whole on account of the narrowness of the external opening. Two serrated jaws, *aa*, which can be opened and closed at will, grasp the bony fragment, which is then acted upon by a central drill, put in motion by a bow, the string of which encircles the grooved wheel, *c*.

Fig. 8. Liston's bone forceps, used for dividing small bones at a single cut.

Fig. 9. Strong forceps, for holding steadily a portion of bone whilst being sawn.

Fig. 10. Forceps for the extraction of *sequestra*.

Figs. 11 and 12. Chisel and gouge.

Fig. 13. Leaden mallet.

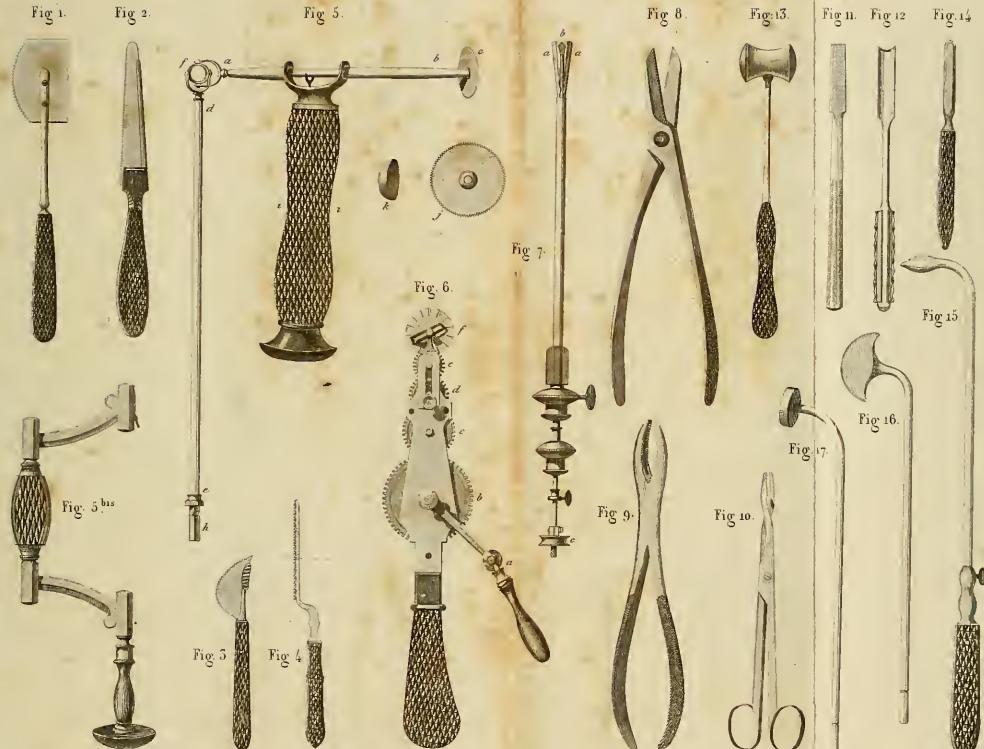
Fig. 14. Rasp.

Fig. 15. Olive-shaped cautery-iron, in its handle.

Fig. 16. Hatchet-shaped cautery-iron.

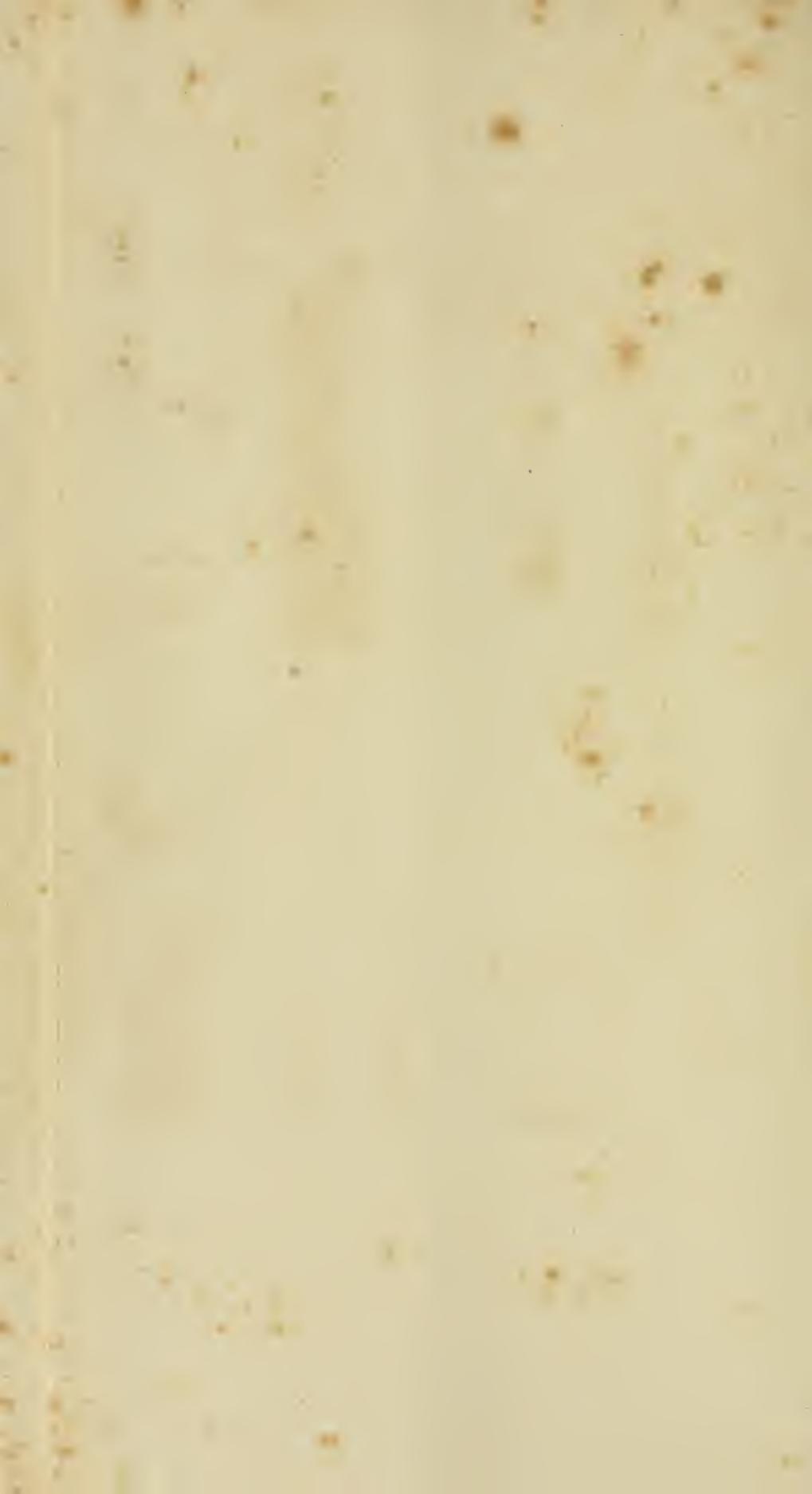
Fig. 17. Nummular cautery.

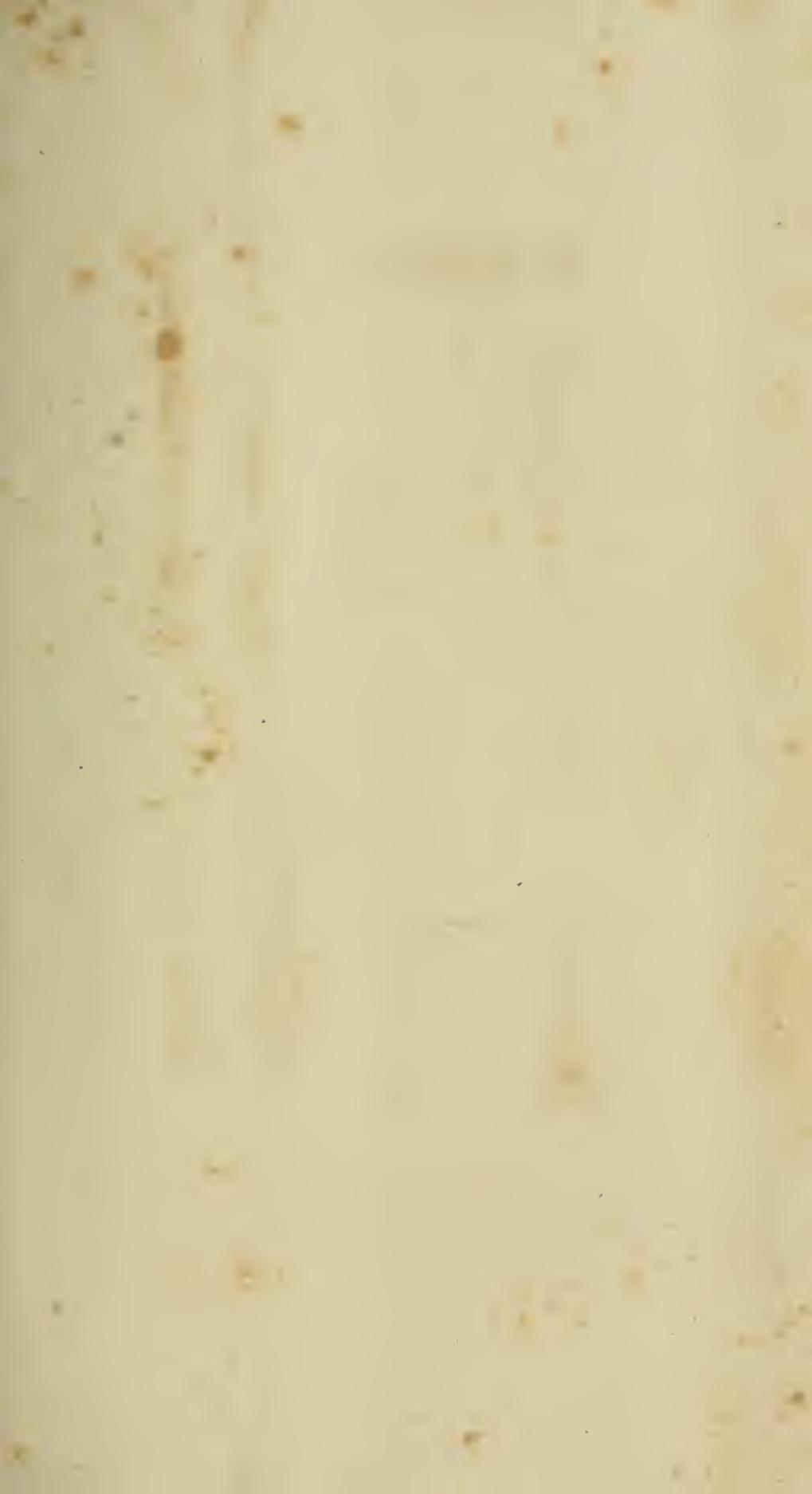
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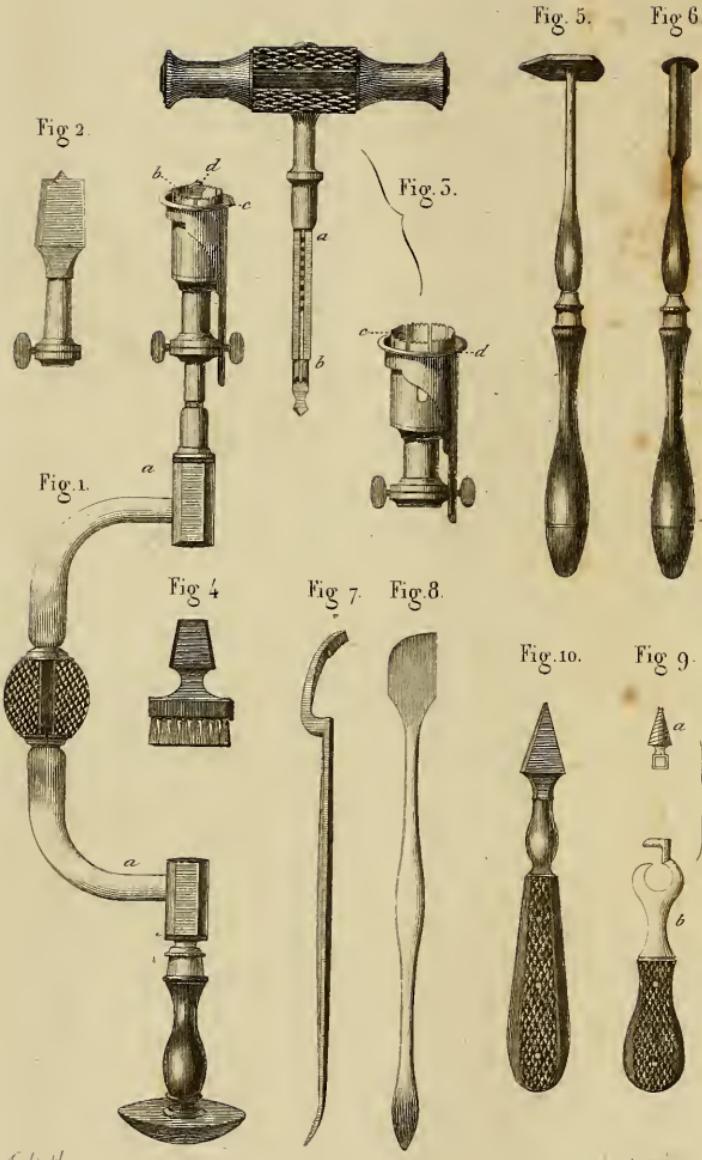
PL VI.

MODELES. CHARRIÈRE





PL. VII.



Fuchs del.

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MODÈLES CHARRIÈRE.

PLATE VII.

TREPHINING INSTRUMENTS.

Fig. 1. *aa*, Shaft of the trepan surmounted by its crown, *b*; *c*, sliding guard for the purpose of limiting the depth to which the crown should penetrate; *d*, pyramidal extremity of the shaft supporting the crown, which serves as a perforator.

Fig. 2. Exfoliator.

Fig. 3. Hand trephine; *a b*, shaft and perforator; *c*, crown; *d*, sliding guard.

Fig. 4. Brush for cleaning the crown of the trephine.

Fig. 5. Raspatory, with five edges.

Fig. 6. Lenticular knife.

Fig. 7. Double elevator.

Fig. 8. Elevator and raspatory.

Fig. 9. Conical screw *a*, for the purpose of extracting a fragment of bone by the aid of its handle, *b*.

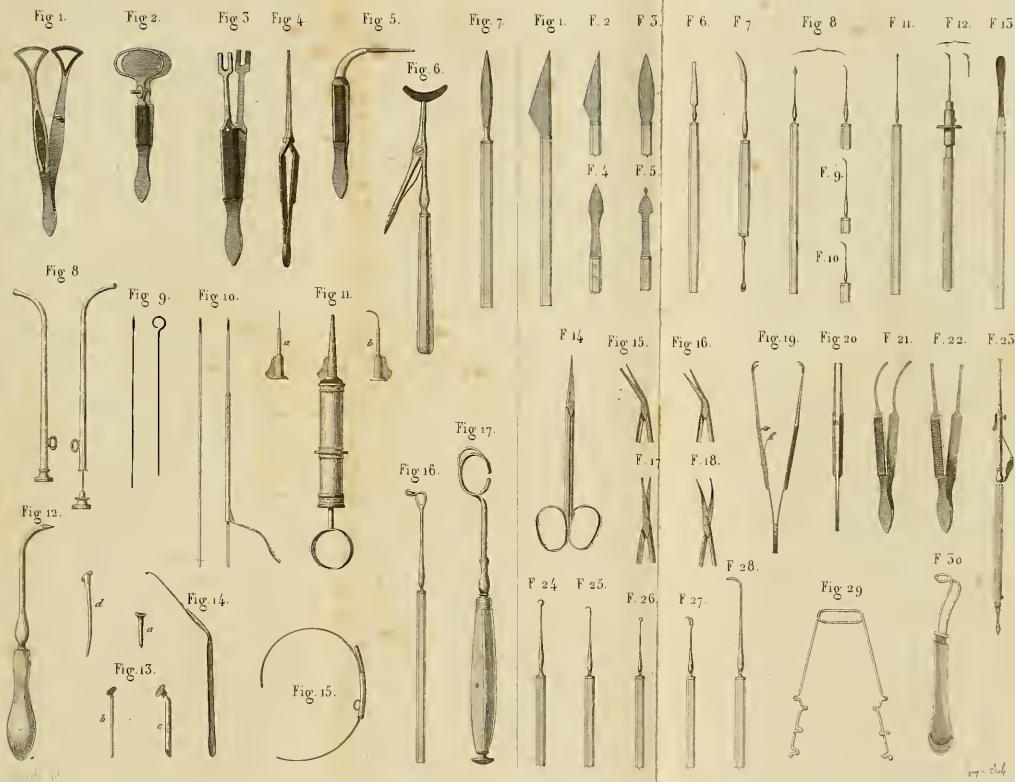
Fig. 10. Perforator, in a handle.

PLATE VIII.

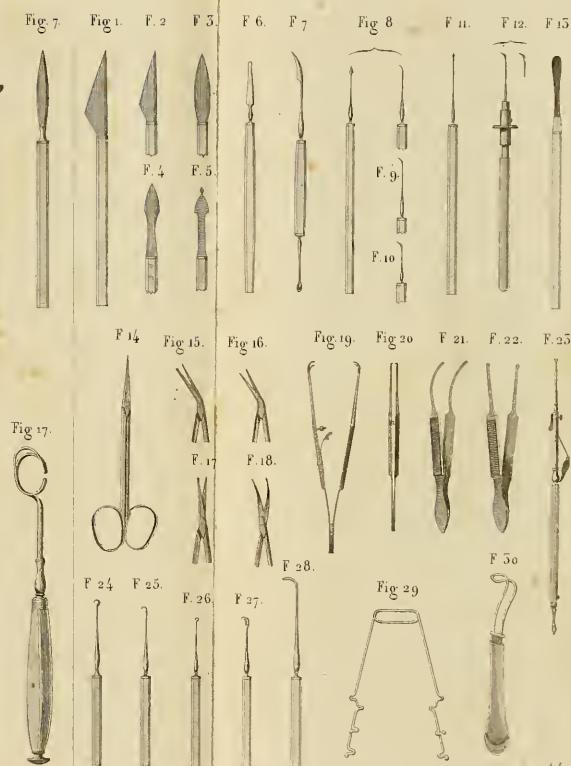
EYE INSTRUMENTS.

- Fig. 1. Adams' forceps, modified by Charrière.
- Fig. 2. Desmarres' ring-forceps for holding the upper eyelid steadily, during the removal of cysts and tumors which require a tedious and minute dissection.
- Fig. 3. Desmarres' forceps with bifurcated extremities, for holding soft parts steadily for the passage of the suture needle.
- Fig. 4. Charrière's straight forceps for continuous pressure. Its branches being delicate and long, grasp and retain readily folds of skin in operating.
- Fig. 5. Another variety of forceps for continued pressure. Its blades, curved and notched externally, answer the double purpose of a stylet on which to introduce a canula into the lachrymal duct, and also for its extraction.
- Fig. 6. Forceps for grasping the free borders of the eyelids.
- Fig. 7. Bistoury for opening lachrymal tumors, the lachrymal sac, and nasal duct.
- Fig. 8. Gensoul's catheters for the lachrymal passages.
- Fig. 9. Silver probes for the *puncta lacrymalia*.—Méjean's probe.
- Fig. 10. Caustic holder, free, and in its canula, for the cauterisation of the lachrymal sac.
- Fig. 11. Anel's syringe; *a* and *b*, additional terminal tubes.
- Fig. 12. Laugier's trocar, for perforating the maxillary sinus.
- Fig. 13. *a*, Dupuytren's canula; *b* and *c*, Scarpa's leaden styles; *d*, Charrière's stylet of prepared ivory.
- M. Charrière renders ivory soft by Hydrochloric Acid, and manufactures stylets of the material thus prepared, which possess the property of swelling when in contact with moist substances, and thus they effect the dilatation of the nasal duct.
- Fig. 14. Cloquet's hooked stylet for extracting canulas from the nasal duct.
- Fig. 15. Desault's canula, with its probe-pointed stylet.
- Fig. 16. Pomperat's instrument for elevating the upper eyelid.
- Fig. 17. Luzardi's speculum.

PL. VIII.



PL. IX.



MODÈLES CHARRIÈRE

370



PLATE IX.

- Fig. 1. Beer's cornea knife.
 Fig. 2. Richter's cornea knife.
 Fig. 3. Wenzel's cornea knife.
 Fig. 4. Beer's lanceet-shaped cornea knife.
 Fig. 5. Furnari's cornea knife.
 Fig. 6. Desmarres' knife for enlarging incisions of the cornea.
 Fig. 7. Cheselden's sickle-shaped knife, modified by Boyer. At the other end of the instrument is a *curette*, *a*.
 Fig. 8. Dupuytren's needle.
 Fig. 9. Scarpa's needle.
 Fig. 10. Walter's needle for keratonyxis.
 Fig. 11. A very delicate needle.
 Fig. 12. Luzardi's hooked needle.
 Fig. 13. Velpeau's ophthalmostat.
 Fig. 14, 15, 16, 17, and 18. Delicate scissors for artificial pupil. Some are curved on their edges, with the extremity of one blade probe-pointed; others are curved flat-wise.
 Fig. 19. Hooked forceps.
 Fig. 20. Eye forceps.
 Fig. 21. Forceps with curved blades.
 Fig. 22. Maunoir's forceps for artificial pupil.
 Fig. 23. Charrière's forceps. At its other end is a small sliding lancet which can be sheathed in the handle of the instrument.
 Fig. 24 and 25. Hooks, sharp-pointed.
 Fig. 26. Beer's hook.
 Fig. 27. Double-hook, sharp-pointed.
 Fig. 28. Blunt hook.
 Fig. 29. Eye speculum.
 Fig. 30. Gellies' instrument for elevating the upper eyelid.

PLATE X.

INSTRUMENTS FOR OPERATIONS ON THE EAR.

- Fig. 1. Itard's speculum.
Fig. 2. Bonnafond's speculum.
Fig. 3. Fabrizi's forceps for the extraction of foreign bodies.
Fig. 4. Dupuytren's forceps for the removal of polypi.
Fig. 5. Curette for the extraction of foreign bodies.
Fig. 6. Deleau's speculum.
Fig. 7. Fabrizi's double catheter.
Fig. 8. Itard's catheter, for injection of the Eustachian tube.
Fig. 9. Blanchet's catheter.
Fig. 10. Blanchet's caustic holder.
Fig. 11. Deleau's flexible catheter and stylet.
Fig. 11 bis. Funnel shaped extremity of Deleau's catheter.
Fig. 12. Fabrizi's trepan for perforating the *membrana tympani*.
Fig. 13. Bonnafond's forceps for carrying lint.
Fig. 14. Bonnafond's instrument for perforating the *membrana tympani*.
Fig. 15. Belloc's instrument for arresting haemorrhage from the nasal fossae.
Fig. 16. Deleau's instrument for perforating the *membrana tympani*.
Fig. 17. Caoutchouc bottle with stop-cock and valve; for injections of air, or sulphuric ether.

Pl. X.

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

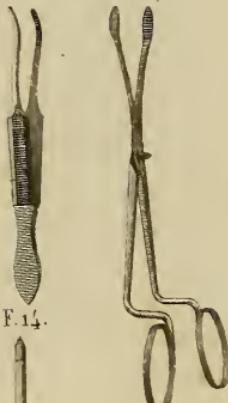


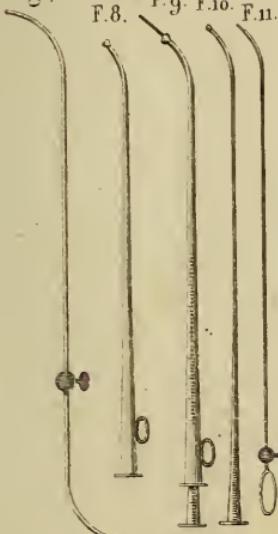
Fig. 5.



Fig. 6.



Fig. 7.



F.12. F.13. F.14.



F.15.

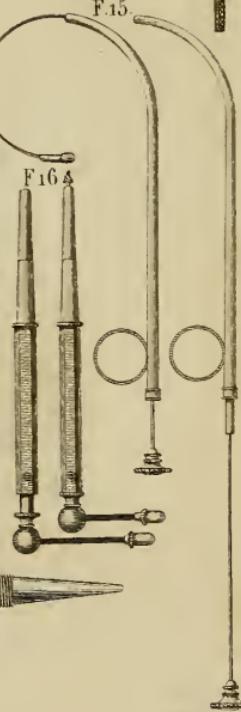


Fig. 17.

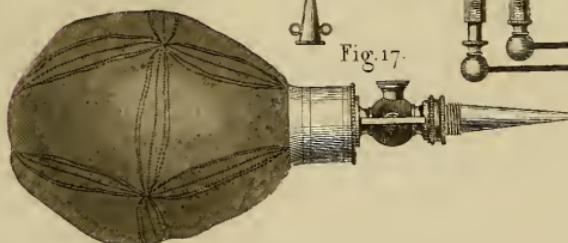
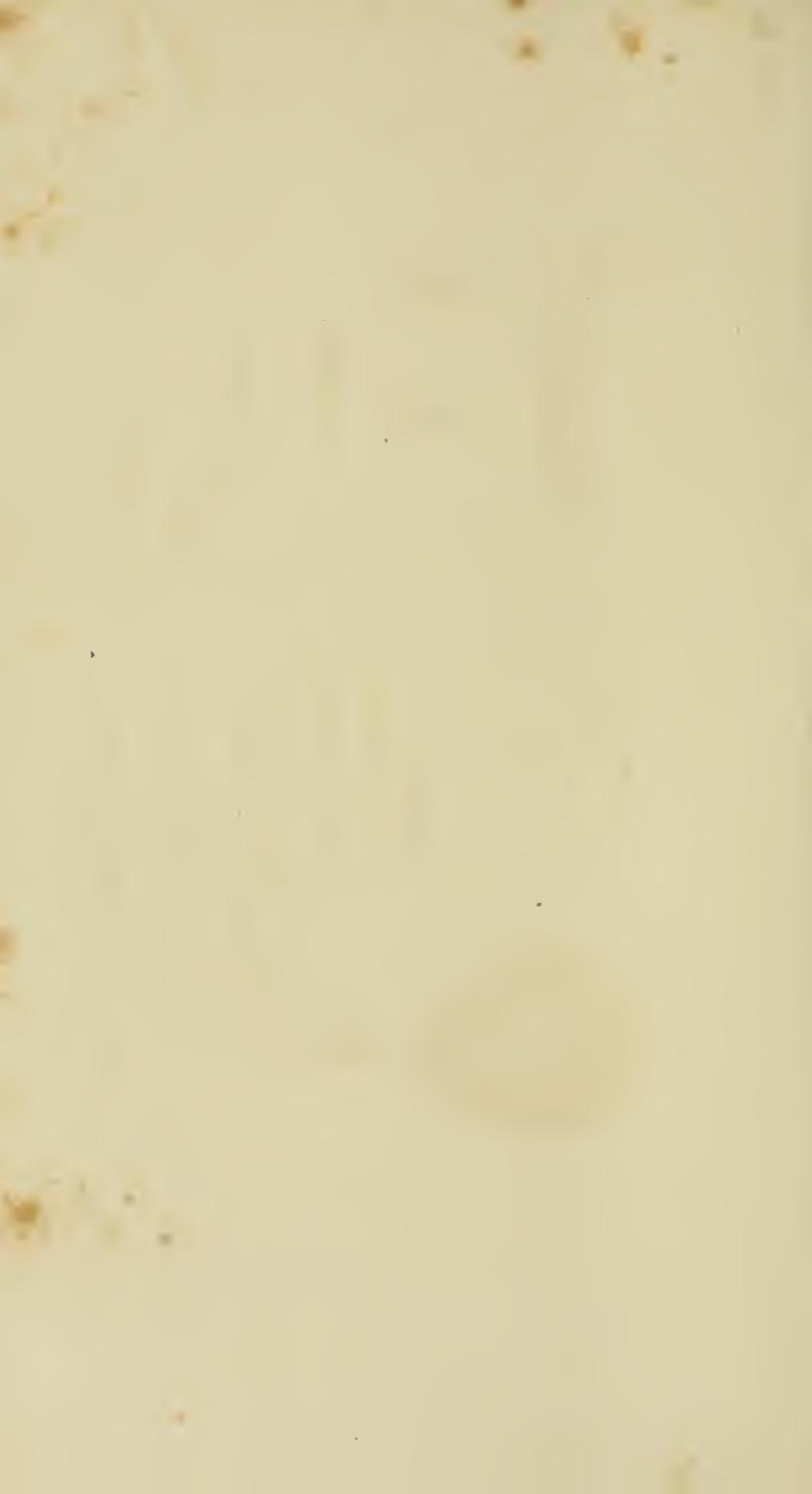
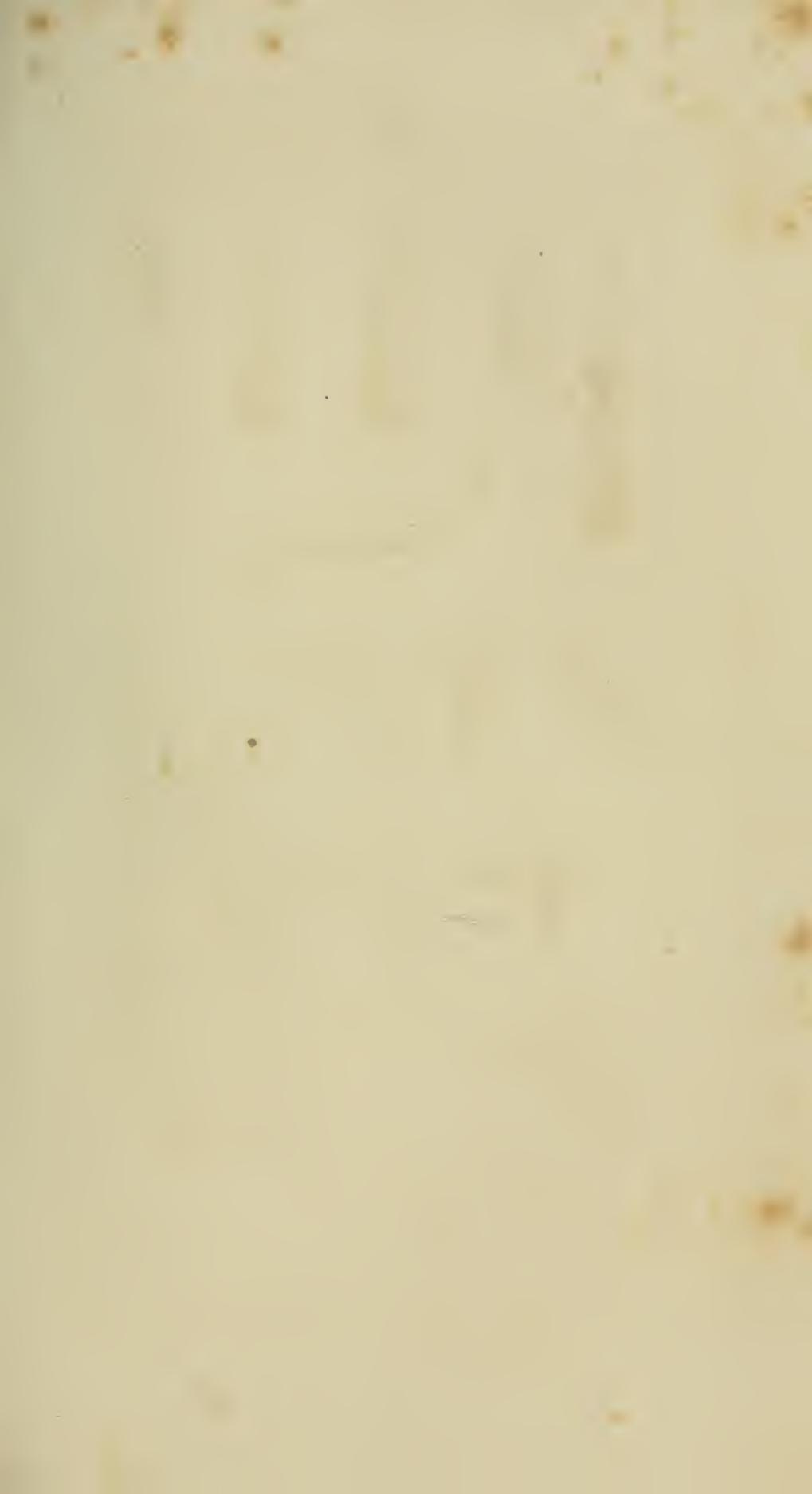


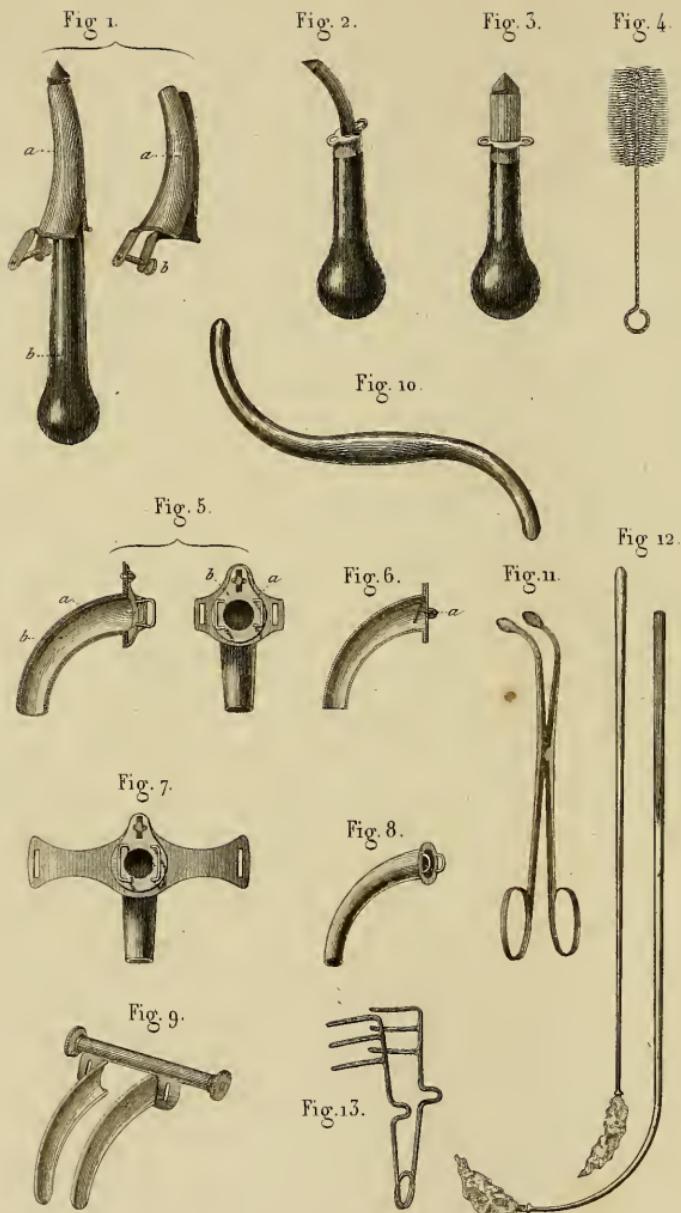
Fig. 18.

MODÈLES CHARRIÈRE.





PLXI.



MODÈLES CHARRIÈRE.

PLATE XI.

INSTRUMENTS FOR LARYNGOTOMY AND TRACHEOTOMY.

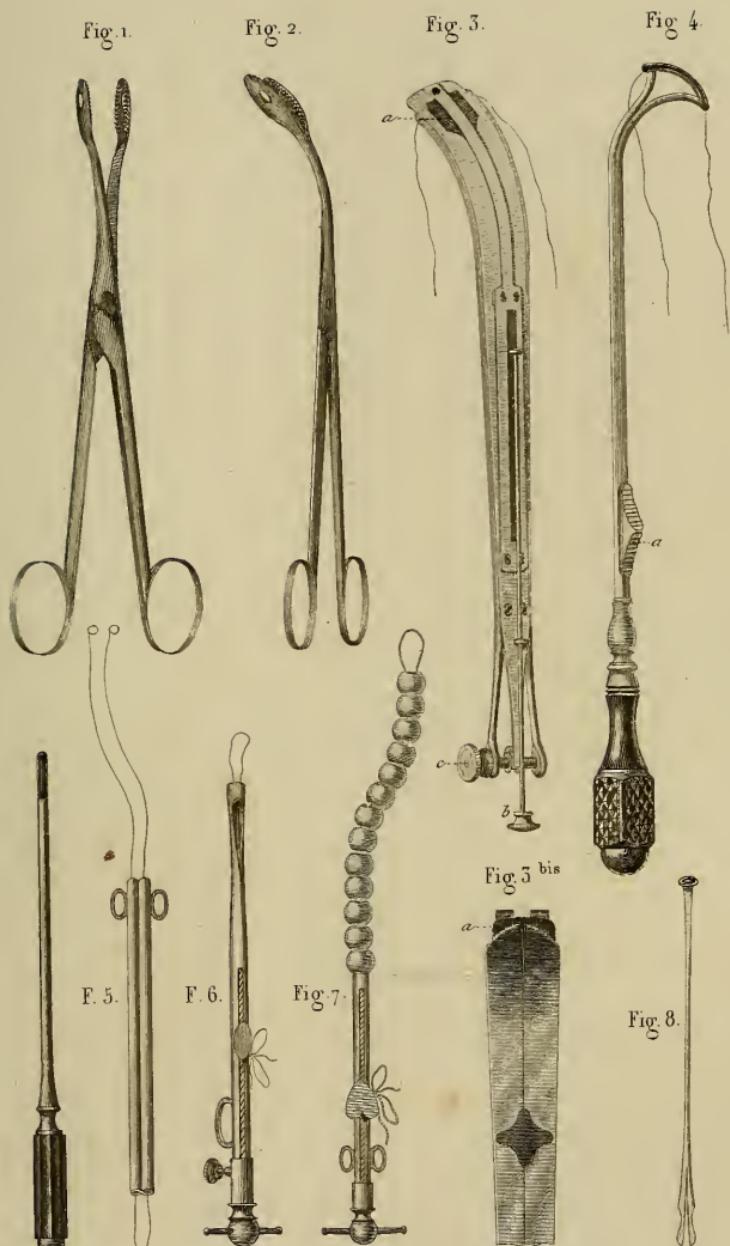
- Fig. 1. Moreau's bivalve canula *aa*, canulas; *b*, trocar.
- Fig. 2. Bauchot's curved trocar, with its canula.
- Fig. 3. Straight trocar and canula.
- Fig. 4. Mop, or brush, for cleaning canulas, *in situ*.
- Fig. 5. Borgelat's double canula, *a*, external canula; *b*, internal canula.
- Fig. 6. Charrière's canula with a valve.
- Fig. 7. Guersent's canula.
- Fig. 8. Brettoneau's canula.
- Fig. 9. Gendron's split canula.
- Fig. 10. Guersent's whalebone handle for the introduction of canulas.
- Fig. 11. Trousseau's dilating forceps.
- Fig. 12. Sponges mounted upon whalebone handles for the purpose of cleansing canulas, *in situ*.
- Fig. 13. Maslieurat-Lagemar's dilator.

PLATE XII.

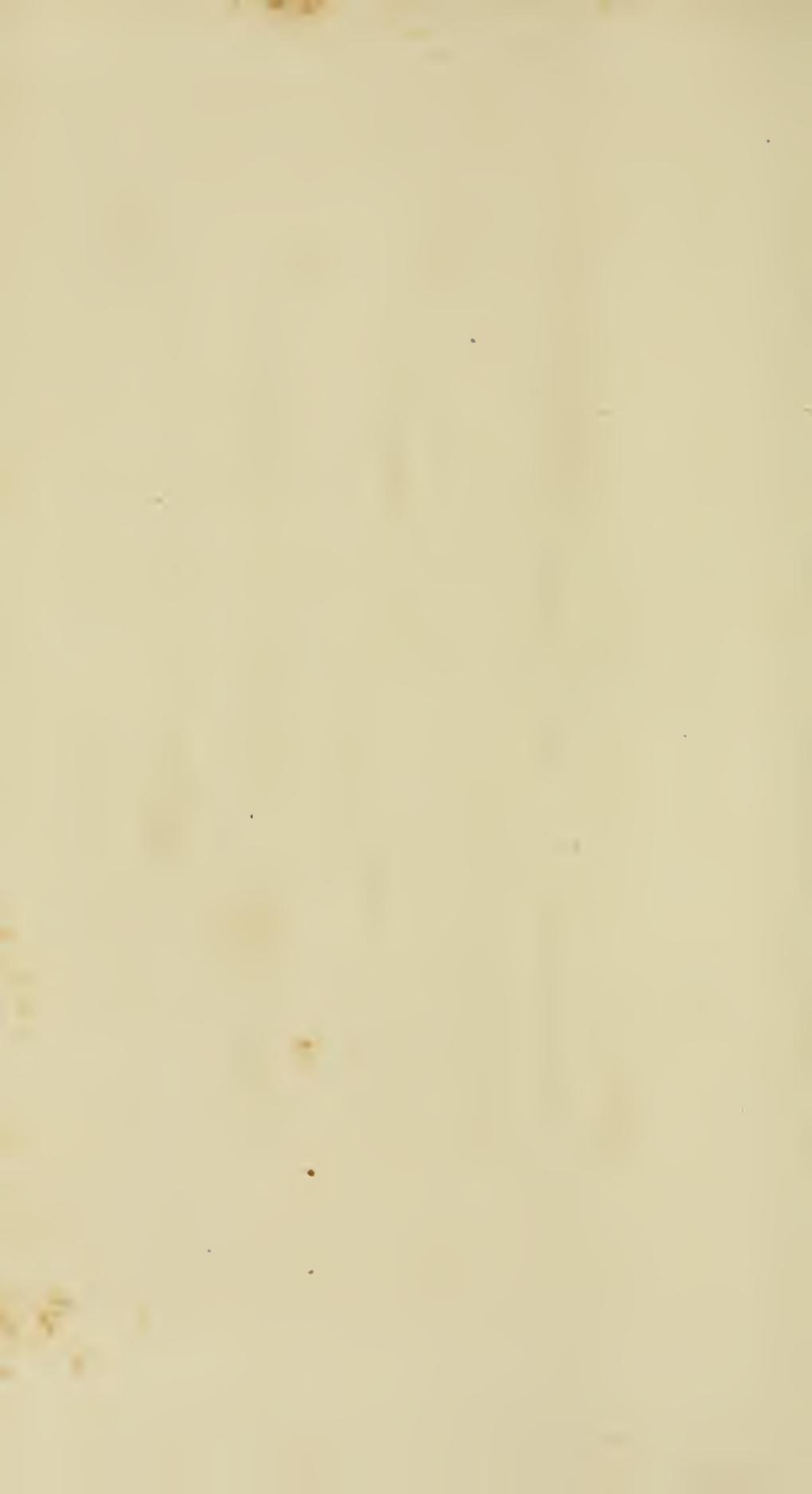
INSTRUMENTS FOR LIGATION, ETC., OF NASAL POLYPI.

- Fig. 1. Straight polypus forceps, with a movable pivot, and blades which can be taken apart.
- Fig. 2. Curved polypus forceps.
- Fig. 3. Felix Haten's ligature carrier; convex aspect, *a*, movable plate carrying the ligature; *b*, screw-rod acting upon the ligature and disengaging it by elevating the plate *a*; *c*, screw for separating, or bringing together, the two handles which open the instrument.
- Fig. 3 bis. Concave aspect of same instrument, *a*, the movable plate and hooks, projected above the blades.
- Fig. 4. Charrière's ligature carrier, *a*, a thumb-piece to act upon two movable rods by which the ligature passing through the groove at the top of the instrument can be disengaged, or retained at will.
- Fig. 5. Double canula.
- Fig. 6. Graefe's knot-tyer modified by Dupuytren; the ligature is tightened by means of a double-screw contained within the canula.
- Fig. 7. Mayor's beaded knot-tyer; the mechanism is the same. The beads allow the ligature to be applied in cavities, where a straight instrument could not be carried.
- Fig. 8. Dessault's knot-tyer.

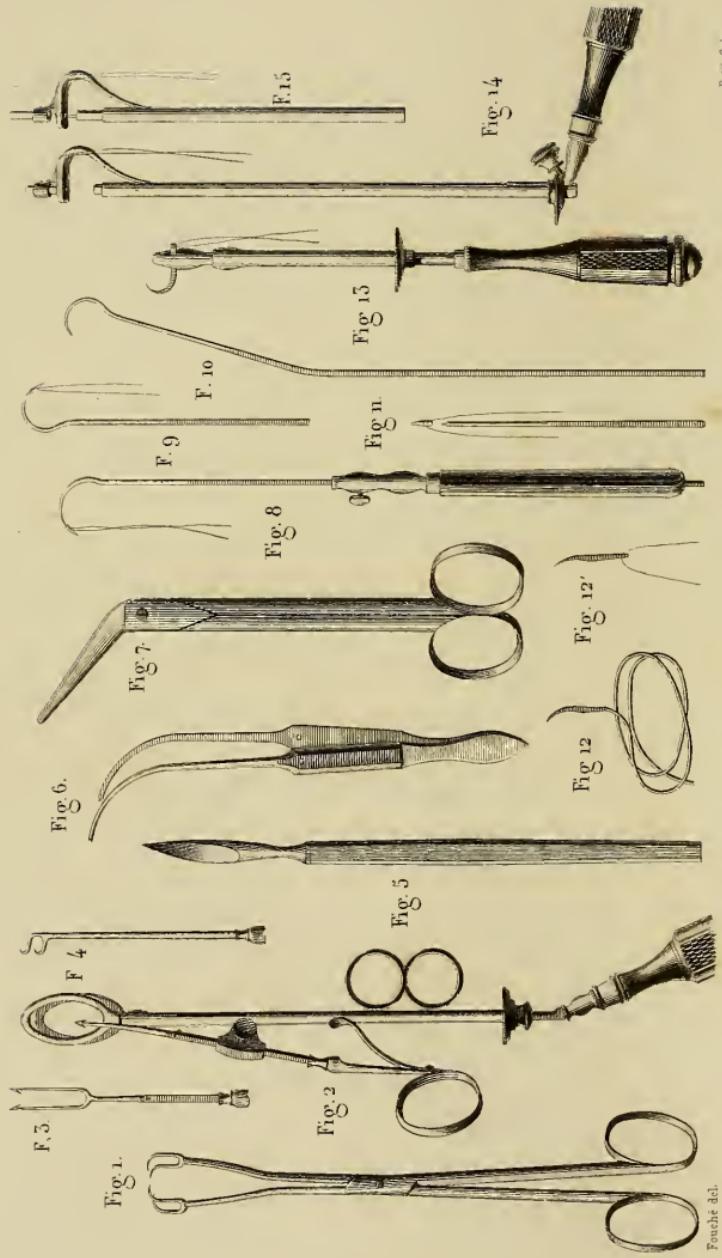
Pl. XII.



MODÈLES CHARRIÈRE.







Petit Coint ac

MODÈLES CHARRIÈRE

Poche dcl.

PLATE XIII.

INSTRUMENTS REQUIRED IN OPERATIONS UPON THE
TONSILS AND SOFT PALATE.

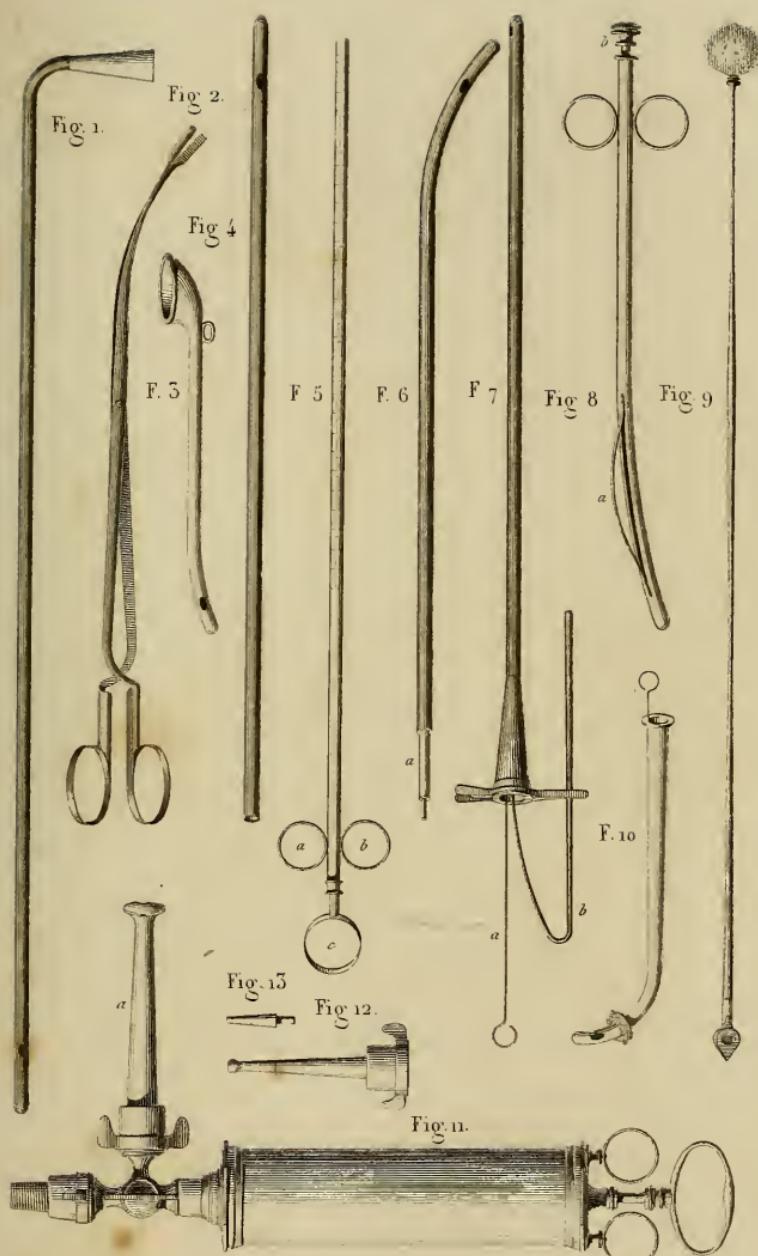
- Fig. 1. Musœux's forceps.
- Fig. 2. Fahnestock's tonsil instrument, modified by Velpeau.
- Fig. 3. Guersent's double barb, for transfixing the tonsil, which can be substituted at will for the single barb.
- Fig. 4. The spiral hooks of Leroy d' Etiolles, for seizing the tonsil.
- Fig. 5. Bistoury with long handle.
- Fig. 6. Græfe's forceps.
- Fig. 7. Roux's angular scissors for staphyloraphy.
- Fig. 8, 9, 10, and 11. Bourgougnon's needle, and needle carrier, for carrying sutures through the soft palate.
- Fig. 12. Dieffenbach's needle, with leaden wire as ligature.
- Fig. 12 bis. Græfe's needle.
- Fig. 13. Roux's needle, and needle holder.
- Fig. 14 and 15. Depierris' instrument for carrying sutures through the soft palate.

PLATE XIV.

INSTRUMENTS REQUIRED IN OPERATIONS UPON THE PHARYNX AND LARYNX.

- Fig. 1. Oesophagus catheter, for administering nourishment artificially, and other purposes.
- Fig. 2. Oesophagus forceps for extraction of foreign bodies.
- Fig. 3. Fabret's catheter.
- Fig. 4, 5, and 6. Blanche's catheter with a jointed stylet.
- Fig. 7. Baillarger's catheter; *a*, stylet of iron wire; *b*, whalebone stylet.
- Fig. 8. Vacca's instrument for facilitating the incision of the oesophagus, modified.
- Fig. 9. Double movable hook of Gräfe and Dupuytren, for the removal of foreign bodies; it is attached to the free extremity of an ordinary sponge and whalebone probang.
- Fig. 10. Chaussier's catheter for artificial respiration in newly-born infants.
- Fig. 11. Charrière's syringe, with a stop-cock working in both directions, for the purpose of introducing fluids into the stomach, as well as of removing them, without detaching the syringe. *a*, tube to be immersed in the fluid; *b*, conical attachment for the oesophageal catheter.
- Fig. 12 and 13. Nozzles of the syringe, adapted to catheters of different calibre.

PL.XIV.

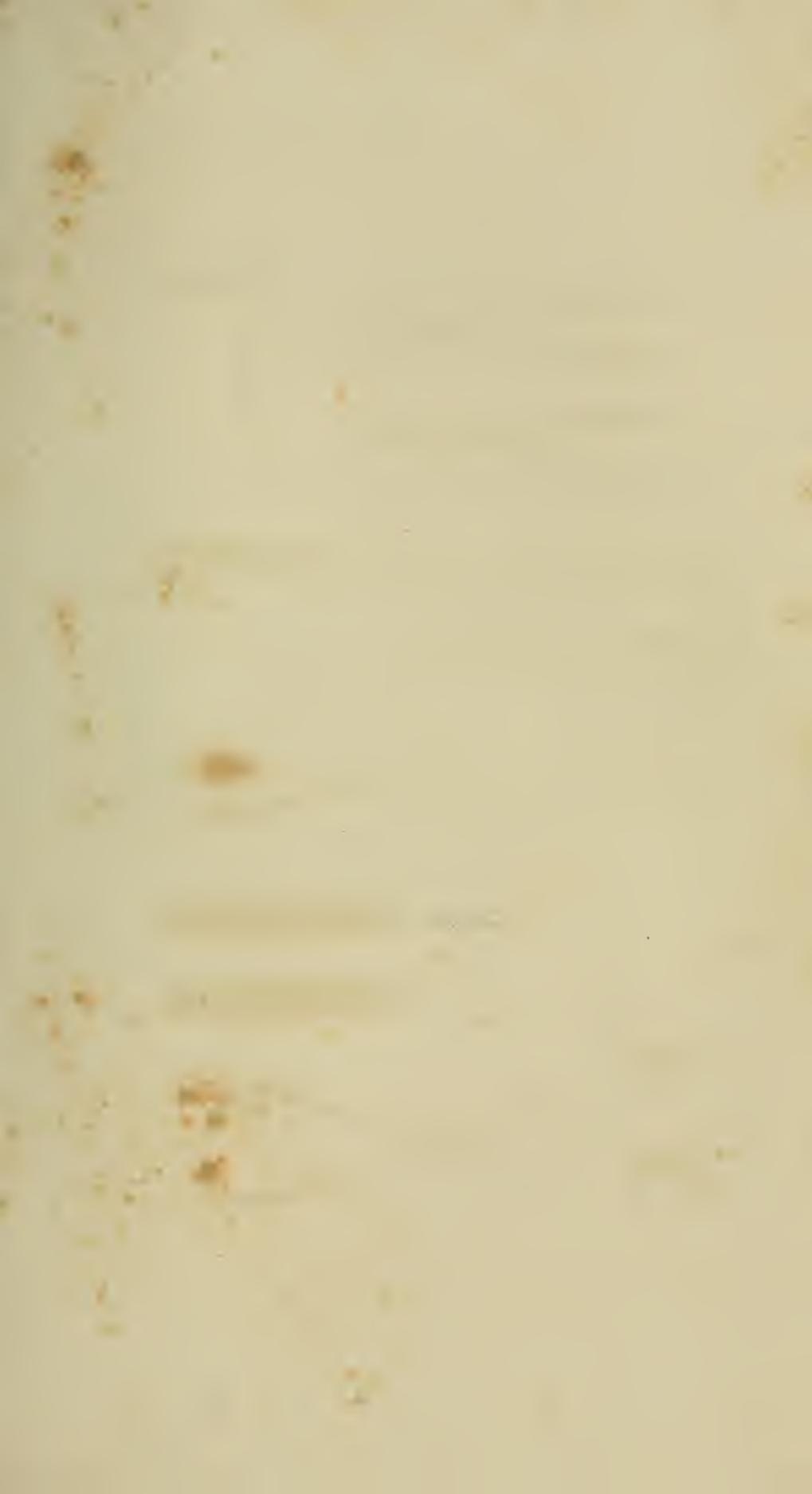


Fouche del.

MODÈLES CHARRIÈRE

Peut Cohn sc





Pl. XV.

Fig. 1 et 2



Fig. 3.

Fig. 3.

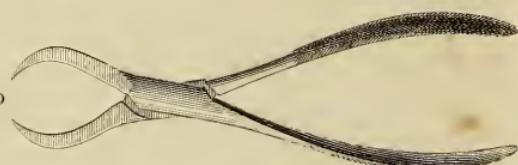


Fig. 4.

Fig. 4

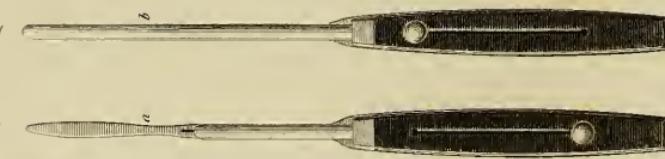


Fig. 5.

Fig. 5.

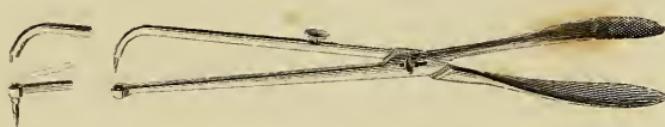


Fig. 6.

Fig. 6.

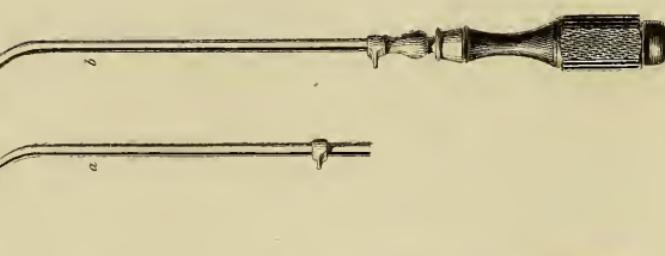


Fig. 7.

Fig. 8.



Petit Caimac

MODÈLES CHARRIÈRE
Touche de l.

PLATE XV.

INSTRUMENTS FOR OPERATIONS UPON THE INTESTINES;
WOUNDS OF THE INTESTINES; HERNIA; ARTIFICIAL
ANUS.

Figs. 1 and 2. Denan's ferrule. Figure represents a section of the silver ferrules to show the arrangement of the steel ferrule *a*.

Fig. 3. A pair of pincers for grasping the steel ferrule *a* and lessening its diameter by pressure to facilitate its introduction into the two silver ferrules *b* and *c*.

Fig. 4. Blandin's bistoury, modified by Guerin for the radical cure of hernia; *a*, the blade disengaged from its sheath; *b*, the bistoury covered by the sheath.

Fig. 5. Boyer's needle-holder for inserting points of suture in abnormal anus.

Fig. 6. Gerdy's needle for the radical cure of hernia; *a*, the needle thrust out of its grooved sheath; *b*, the needle covered by the grooved sheath.

Fig. 7. Dupuytren's Enterotome.

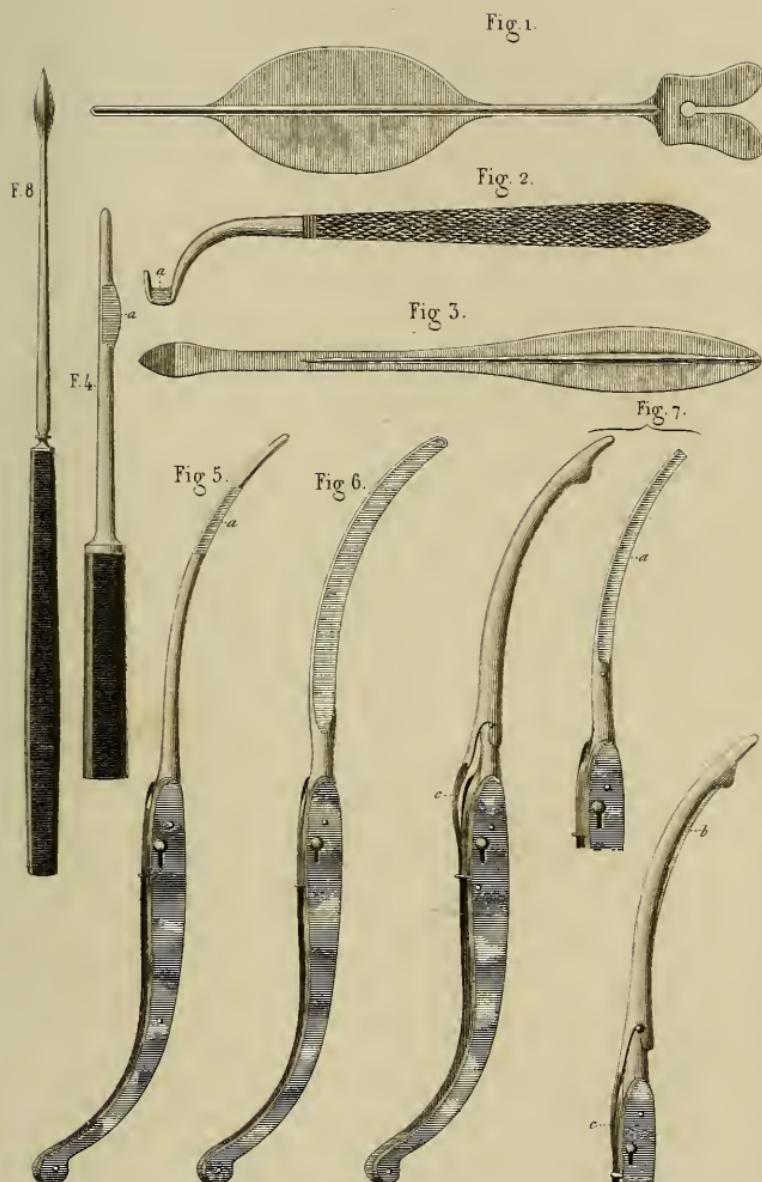
Fig. 8. Blandin's Enterotome.

PLATE XVI.

CONTINUATION OF INSTRUMENTS FOR OPERATIONS UPON
THE INTESTINES, ETC.

- Fig. 1. Boyer's director with lateral extensions.
- Fig. 2. Thompson's bistoury; *a*, the cutting edge.
- Fig. 3. Vidal de Cassis grooved spatula.
- Fig. 4. Tesse's bistoury; *a*, the edge.
- Fig. 5. Astley Cooper's bistoury; *a*, the edge.
- Fig. 6. Pott's bistoury.
- Fig. 7. Grimala's sheathed bistoury; *a*, the blade; *b*, the blade disengaged from the sheath by pressure upon the spring *a*.
- Fig. 8. Velpeau's lance-shaped needle for the radical cure of hernia.

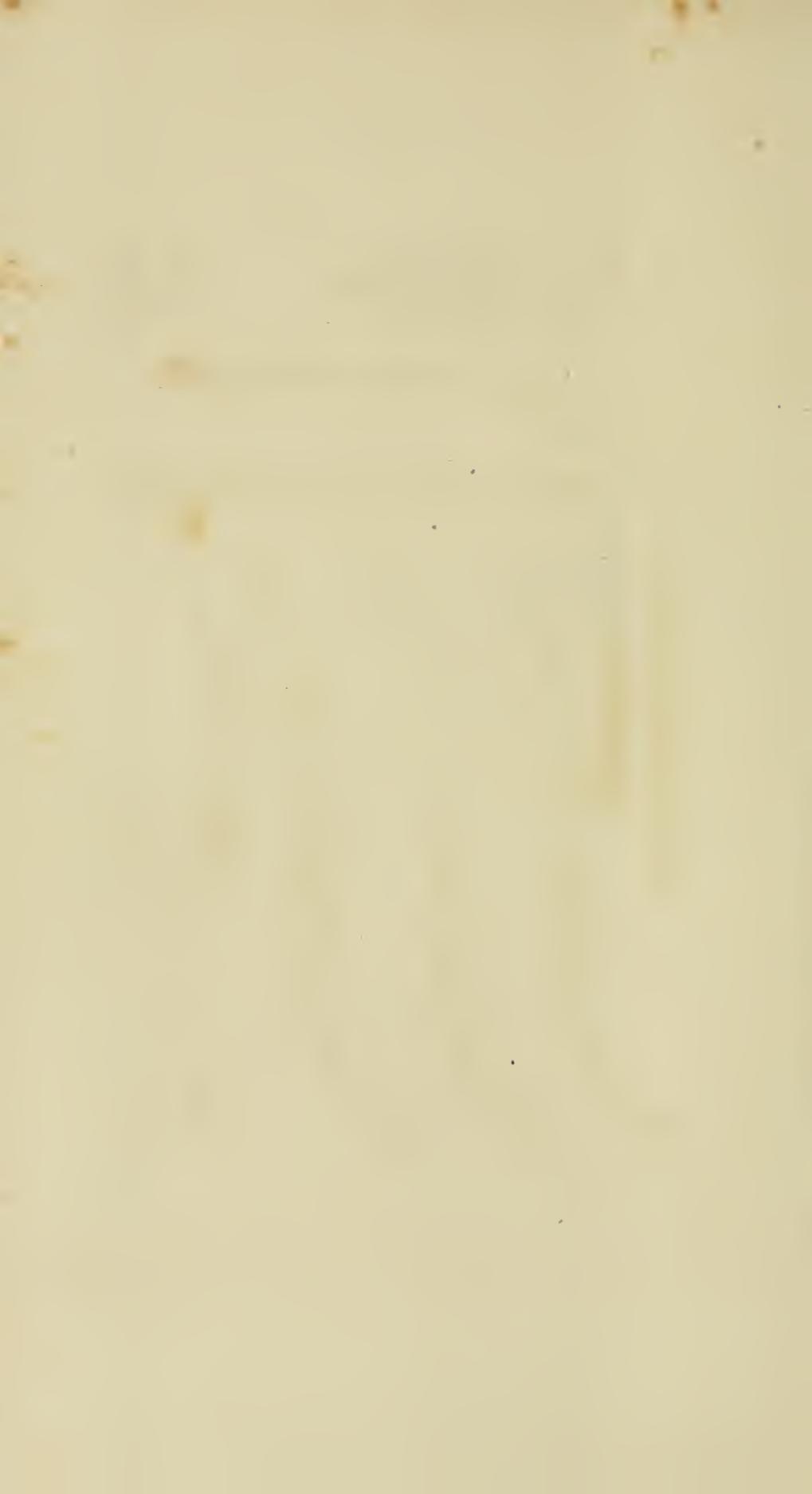
Pl. XVI.

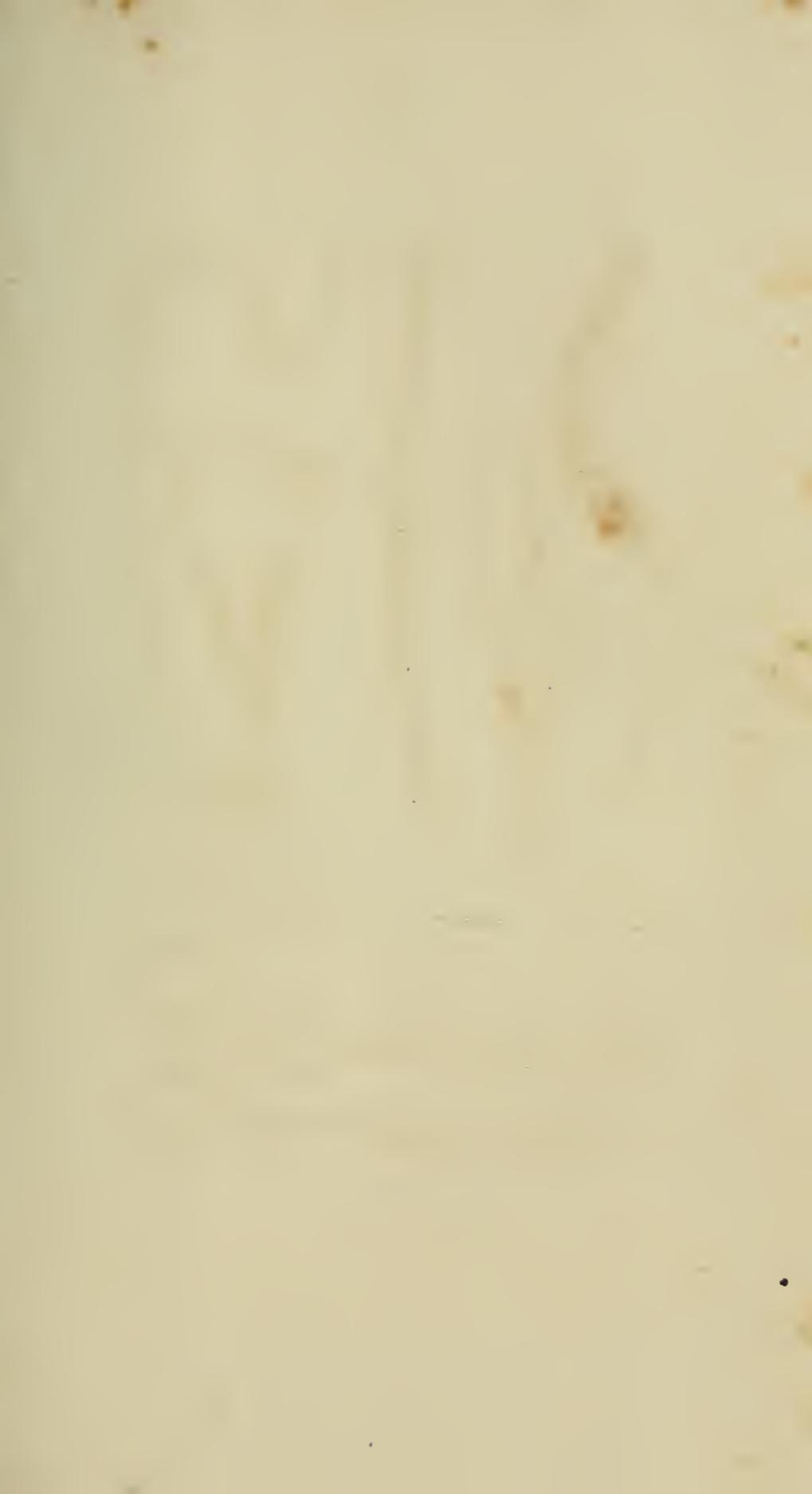


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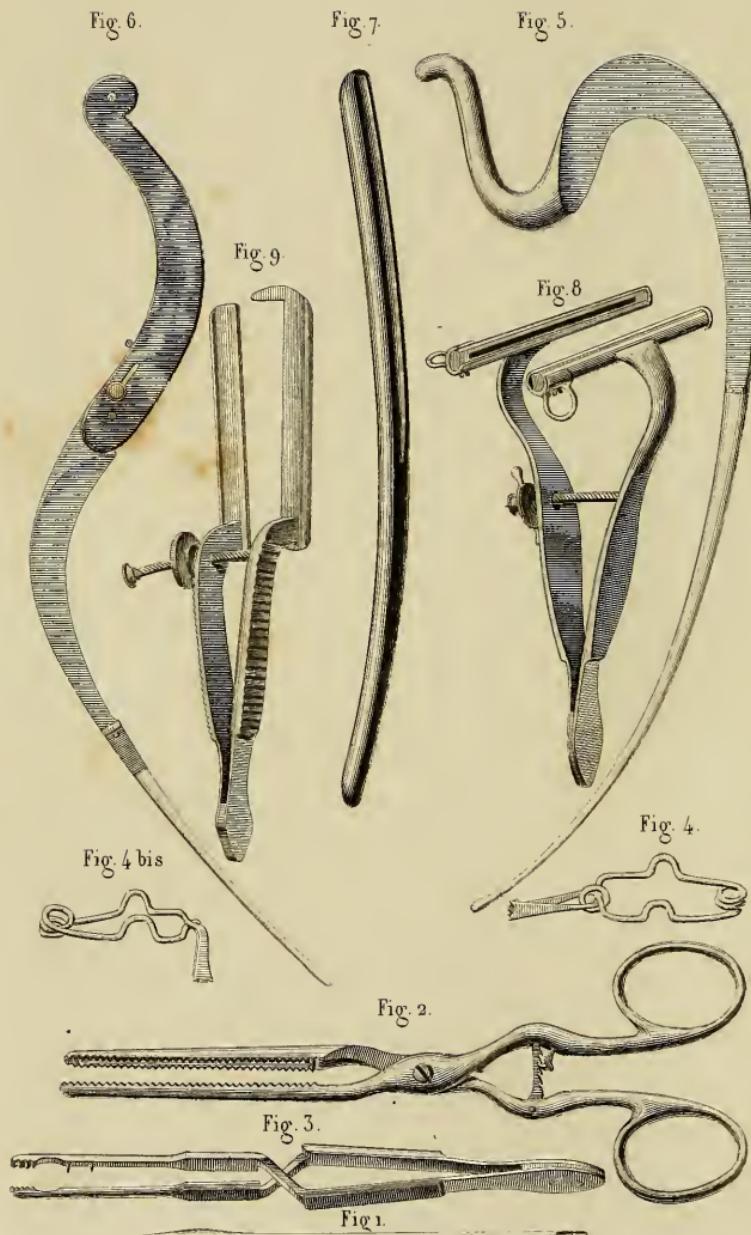
Peut Colin sc.

MODÈLES CHARRIÈRE





Pl. XVII.



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Petit Collin sc.

MODÈLES CHARRIÈRE

PLATE XVII.

INSTRUMENTS FOR THE OPERATIONS OF PHYMOSIS,
FISTULA IN ANO, AND HEMORRHOIDS.

- Fig. 1. A lance-shaped needle for the operation of phymosis.
- Fig. 2. Ricord's pincers for phymosis.
- Fig. 3. Vidal's pincers for phymosis.
- Fig. 4 and 4 bis. Vidal's small self-acting pincers.
- Fig. 5. A bistoury for fistula in ano with a probe attached.
- Fig. 6. Marx and Brechet's bistoury with a probe attached.
- Fig. 7. Desault's wooden gorget for fistula in ano.
- Fig. 8 and 9. Amussat's caustic-holding forceps and protecting forceps for operating upon hemorrhoids.

PLATE XVIII.

TRUSSES AND PESSARIES.

- Fig. 1. Double truss for inguinal hernia.
Fig. 2. Double truss with a dorsal pad.
Fig. 3. Another form of double truss for femoral hernia.
Fig. 4. A truss with a conical pad for umbilical hernia.
Fig. 5. A simple truss.
Fig. 6. A simple truss from left to right.
Fig. 6. *bis.* A very strong inguinal pad.
Fig. 7. Hervez de Chegoin's pessary for anteversion of the uterus.
Fig. 8. Annular pessary with a stem and central perforation.
Fig. 9. An ivory pessary in the shape of the cup and ball toy.
Fig. 10. A funnel shaped pessary oblique and provided with a stem.
Fig. 11. A simple funnel-shaped pessary.
Fig. 12. A round funnel-shaped pessary with the central perforation.
Fig. 13. An oval funnel-shaped pessary with the central perforation.
Fig. 14. A pessary, shaped like the bung of a barrel.
Fig. 15. Jules Cloquet's pessary.
Fig. 16. Kilian's pessary.
Fig. 17. A figure of eight pessary.
Fig. 18. Malgaigne's hourglass pessary.

Pl. XVIII.

Fig. 1.

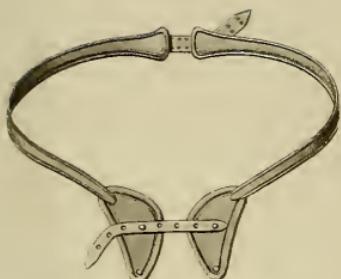


Fig. 2.

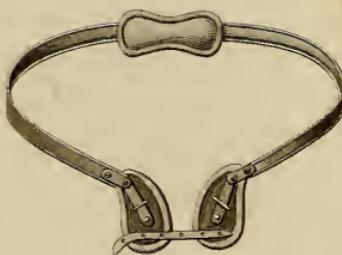


Fig. 3.

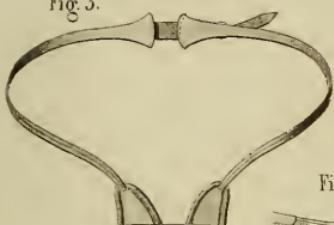


Fig. 4

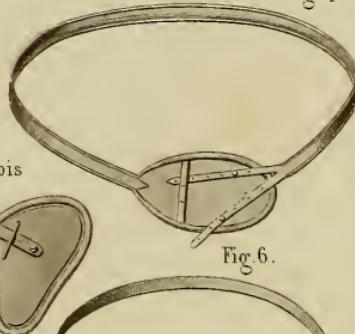


Fig. 6 bis



Fig. 5

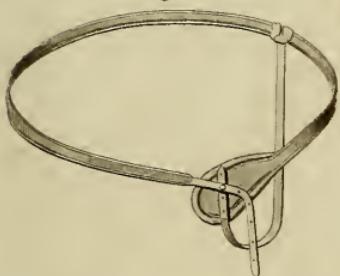


Fig. 6.



Fig. 7.



Fig. 11.



Fig. 12.



Fig. 16.



Fig. 8



F. 13



Fig. 9



Fig. 14



Fig. 10



Fig. 15

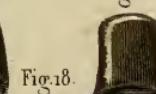


Fig. 17.

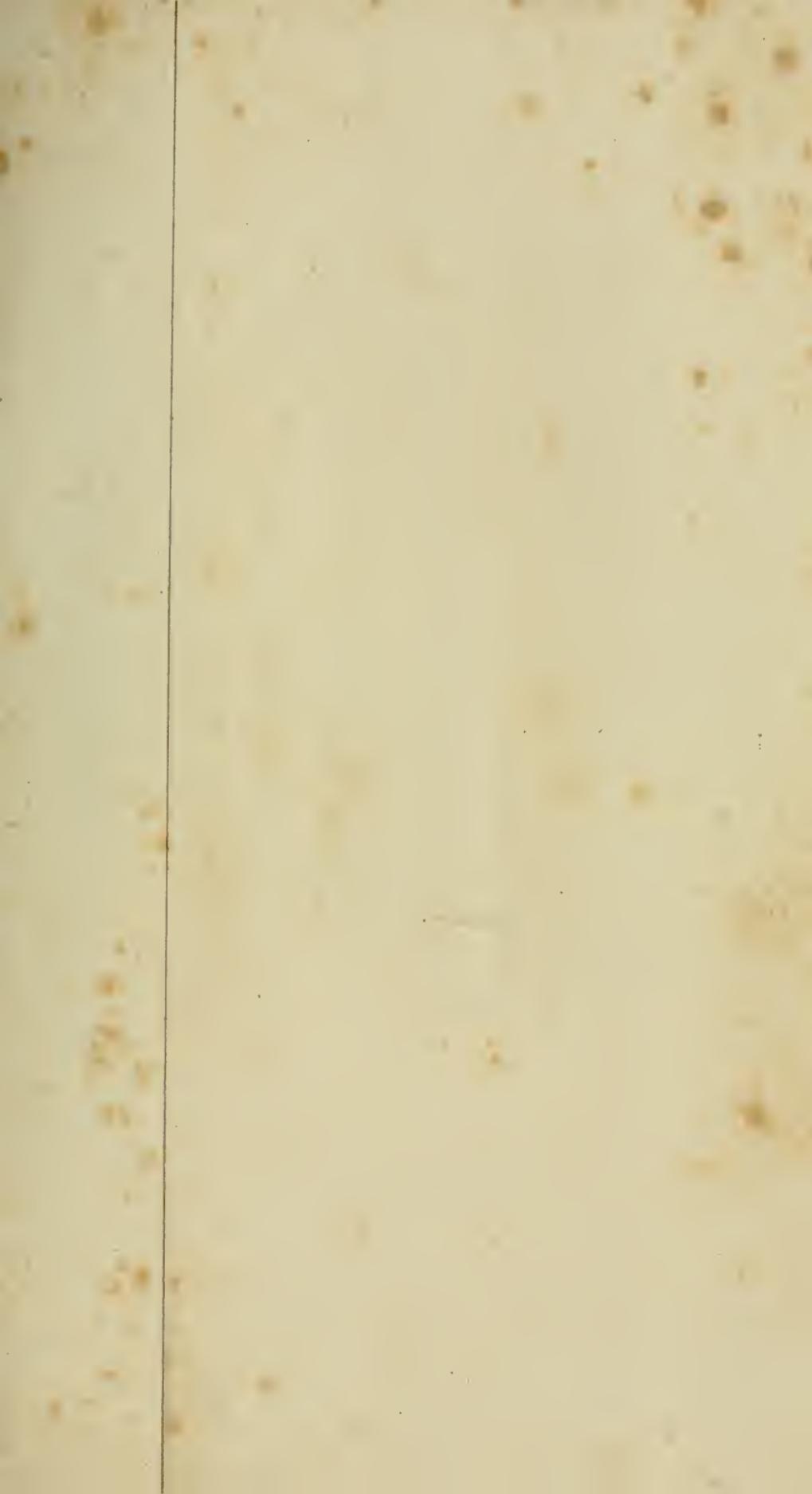


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MODÈLES CHARRIÈRE

Petit Collin sc.





F.1 F.2 F.3 F.4

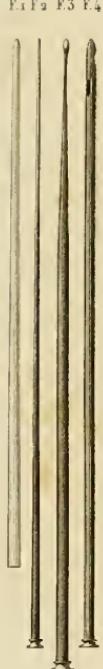


Fig. 5

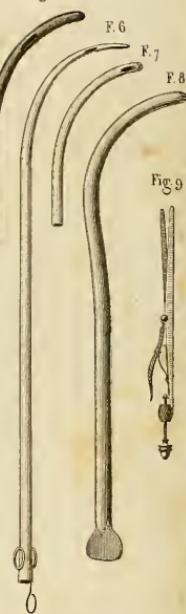


Fig. 9



Fig. 10 F.12



Fig. 13 Fig. 15



Fig. 14



Fig. 16



Fig. 17



Fig. 19



Fig. 21



F.22



Fig. 23 Fig. 24



Fig. 25



Fig. 27



Fig. 28



PLATE XIX. AND XX.

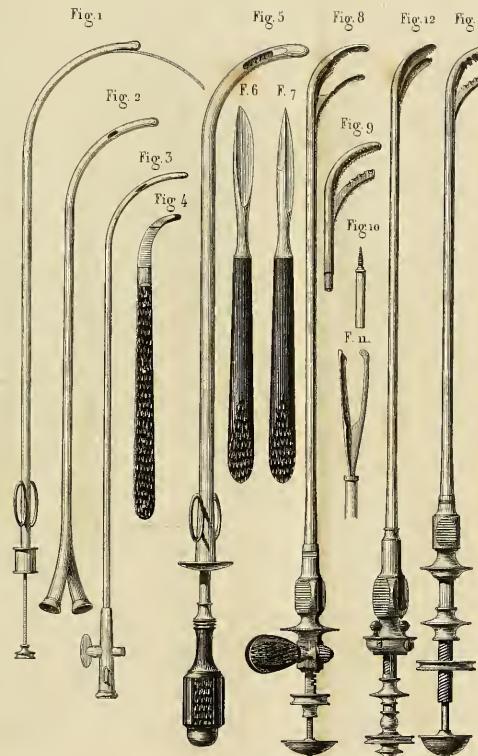
INSTRUMENTS FOR TREATING DISEASES OF THE URETHRA
AND PROSTATE GLANDS.

- Fig. 1. A wax exploring bougie.
Fig. 2. A conical gum-elastic bougie.
Fig. 3. A conical gum-elastic bougie with an olive-shaped point.
Fig. 4. A straight gum-elastic catheter.
Fig. 5. A curved gum-elastic catheter.
Fig. 6. A conical silver catheter.
Fig. 7. A curved silver catheter.
Fig. 8. A pewter bougie.
Fig. 9. Civiale's instrument for incising the urethra.
Fig. 10. Mercier's instruments for applying caustic to the prostate gland.
Fig. 11. Lallemand's instrument for cauterising the urethra.
Fig. 12. Civiale's instrument for cauterising the urethra and prostate gland.
Fig. 13. Lallemand's instrument for canterising the prostate gland for involuntary seminal emissions.
Fig. 14. Barré de Rouen's instrument for cauterising the urethra from before backward.
Fig. 15. Ducamp's instrument for cauterising the urethra from before backward.
Fig. 16. Leroy d'Etiolles instrument for cauterising the urethra from before backward.
Fig. 17. Ricord's curved scarificator.
Fig. 18. Ricord's straight scarificator.
Fig. 19. Begin and Robert's sheathed scarificator.
Fig. 20. An extra blade to a scarificator.
Fig. 21. Mercier prostatic scarificator.
Fig. 22. Civiale's urethral scarificator.
Fig. 23. Civiale's instrument for exploring strictures.
Fig. 24. Hunter's double branched forceps.
Fig. 25. Mercier's prostatic sound.
Fig. 26. Leroy d'Etiolles jointed curette.
Fig. 27. An instrnment for crushing stones in the urethra.
Fig. 28. A straight urethral dilator.

PLATE XXI.

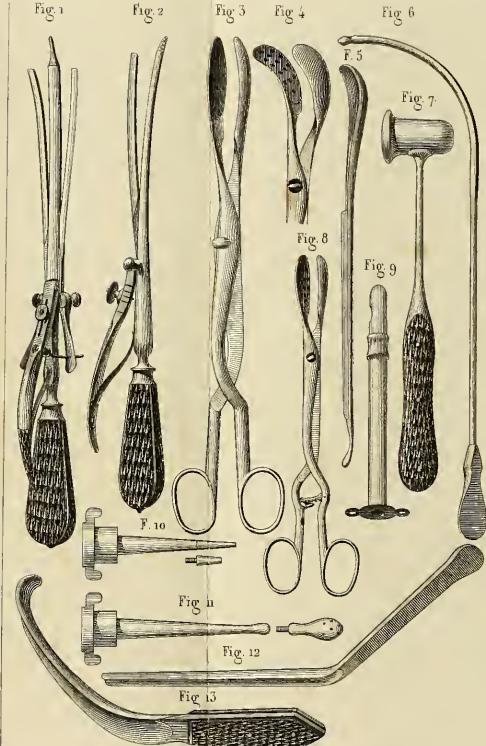
INSTRUMENTS FOR THE OPERATIONS OF LITHOTRITY AND LITHOTOMY.

- Fig. 1. Frère Côme's dart catheter, modified by Civiale.
Fig. 2. Jules Cloquet's metallic double catheter.
Fig. 3. A catheter with a stop-cock, with Pasquier's curve.
Fig. 4. Belmas' bistoury for incising fascia.
Fig. 5. Pasquier's evacuating catheter.
Fig. 6. A convex bistoury fastened firmly to its handle.
Fig. 7. A double-edged bistoury for perineal lithotomy, also fastened firmly to its handle.
Fig. 8. Mercier and Charrière's rack and pinion lithotrite, whose jaws are spoon-shaped, with fenestræ.
Fig. 9. Heurteloup's rack and pinion lithotrite, with fenestræ in the jaws.
Fig. 10. An instrument for extracting a bougie in the bladder.
Fig. 11. An instrument for extracting foreign bodies from the bladder.
Fig. 12. Amussat's, Civiale's and Charrière's severed lithotrite, with flat jaws.
Fig. 13. Segala's and Charrière's screw lithotrite, with open jaws.



Pouché del

MODÈLES CHARRIÈRE



Pouché del



PLATE XXII.

OTHER INSTRUMENTS FOR THE OPERATIONS OF LITHOTRITY AND LITHOTOMY.

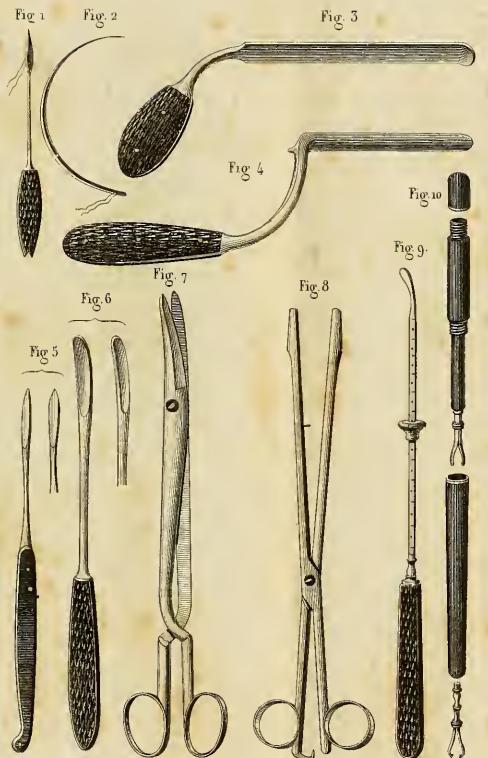
- Fig. 1. Dupuytren's double lithotome, Charrière's model.
- Fig. 2. Frère Côme's simple lithotome, modified by Charrière.
- Fig. 3. Straight lithotomy forceps, whose branches cross and recross near the handles.
- Fig. 4. Curved lithotomy forceps.
- Fig. 5. A curette with a probe at one extremity, and a groove along which the forceps can be slid.
- Fig. 6. A staff with the edges of the groove rounded.
- Fig. 7. A hammer for striking the lithotrite when the calculus is broken by percussion.
- Fig. 8. A pair of straight lithotomy forceps, whose handles cross and recross, with a rack attached, which is both voluntary and self-acting, the branches being united and disjointed by a novel arrangement of the pivot..
- Fig. 9. Dupuytren's canula used in plugging the wound.
- Fig. 10. A canula with three different sized tips, to be applied to Charrière's syringe (plate XIV, fig. 11, 12 and 13).
- Fig. 11. A canula which can be used as a single jet, or to which an additional piece with numerous perforations can be attached for injecting the bladder.
- Fig. 12. A blunt gorget which can be used as a guide for the forceps.
- Fig. 13. Belmas' and Civiale's blunt gorget with a hook-like extremity.

PLATE XXIII.

INSTRUMENTS FOR THE TREATMENT OF THE DISEASES OF FEMALES.

- Fig. 1. Vidal (de Cassis) needle for suture of the perineum.
- Fig. 2. Roux' needle for the same purpose.
- Fig. 3. Jobert's flat blade for depressing the lateral walls of the vagina.
- Fig. 4. A depressor with an elbowed valve for the posterior part of the vagina.
- Fig. 5. Two convex sharp-pointed bistouries for paring off the edges of a fistula.
- Fig. 6. Two knives, a right and left, for dividing the neck of the uterus.
- Fig. 7. A pair of long scissors curved on their flat surface.
- Fig. 8. Jules Cloquet's forceps for holding a ligature.
- Fig. 9. An uterine sound, modified by Valleix.
- Fig. 10. A long caustic-holder for three distinct purposes: 1st. a pair of forceps with two branches; 2d. a pair of forceps for holding the nitrate of silver; 3d. a reservoir caustic-holder (which is not shown in the plate).

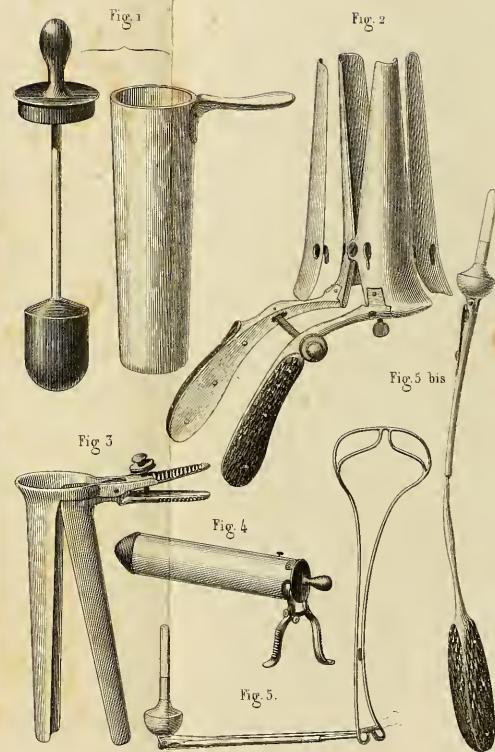
PL. XXIII



Pouché del

MODÈLES CHARRIÈRE

PL. XXIV



Petitotin ex.



PLATE XXIV.

OTHER INSTRUMENTS FOR THE TREATMENT OF THE
DISEASES OF FEMALES.

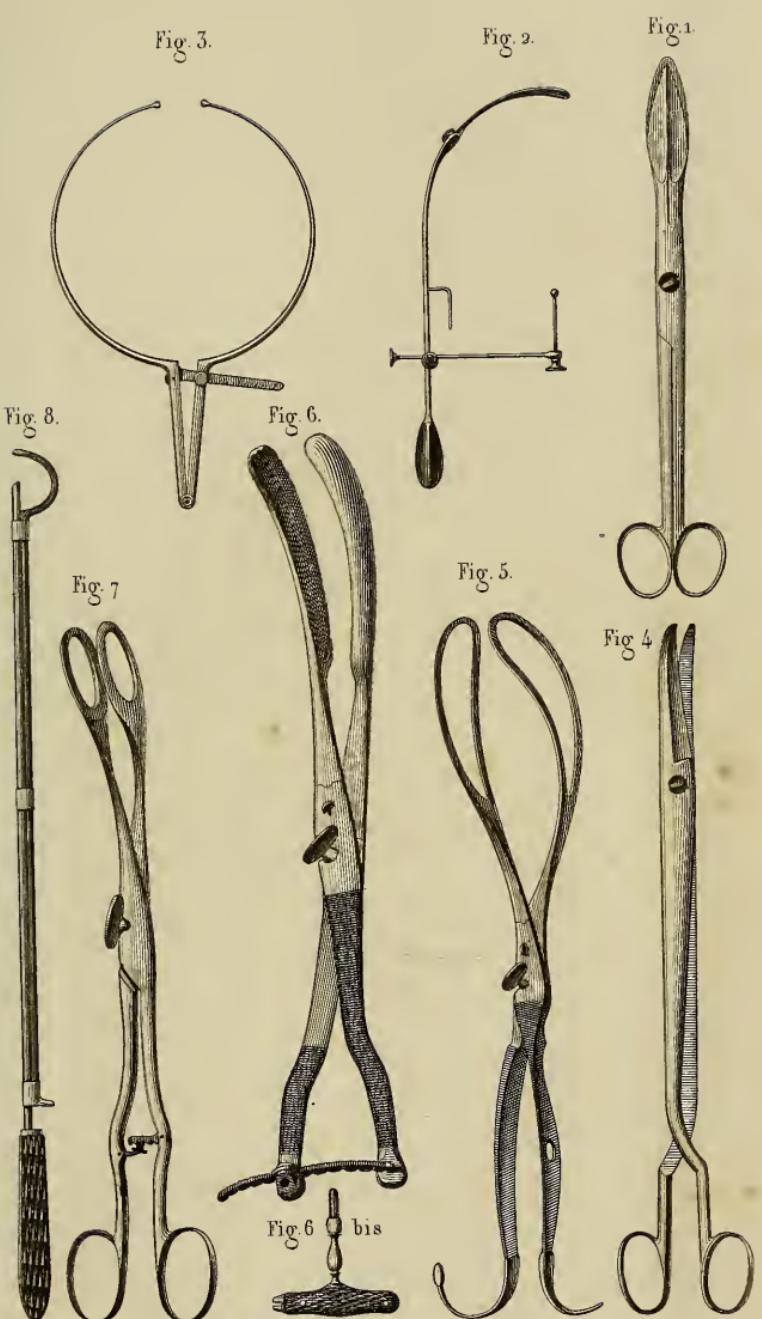
- Fig. 1. Jobert's ivory speculum.
- Fig. 2. Ricord and Charrière's speculum with four valves.
- Fig. 3. Bennet's bivalve speculum.
- Fig. 4. A speculum with three valves.
- Fig. 5. Valleix' instrument for rectifying the position of the uterus.
- Fig. 5, *bis.* the same instrument attached to a handle for the purpose of introducing it.

PLATE XXV.

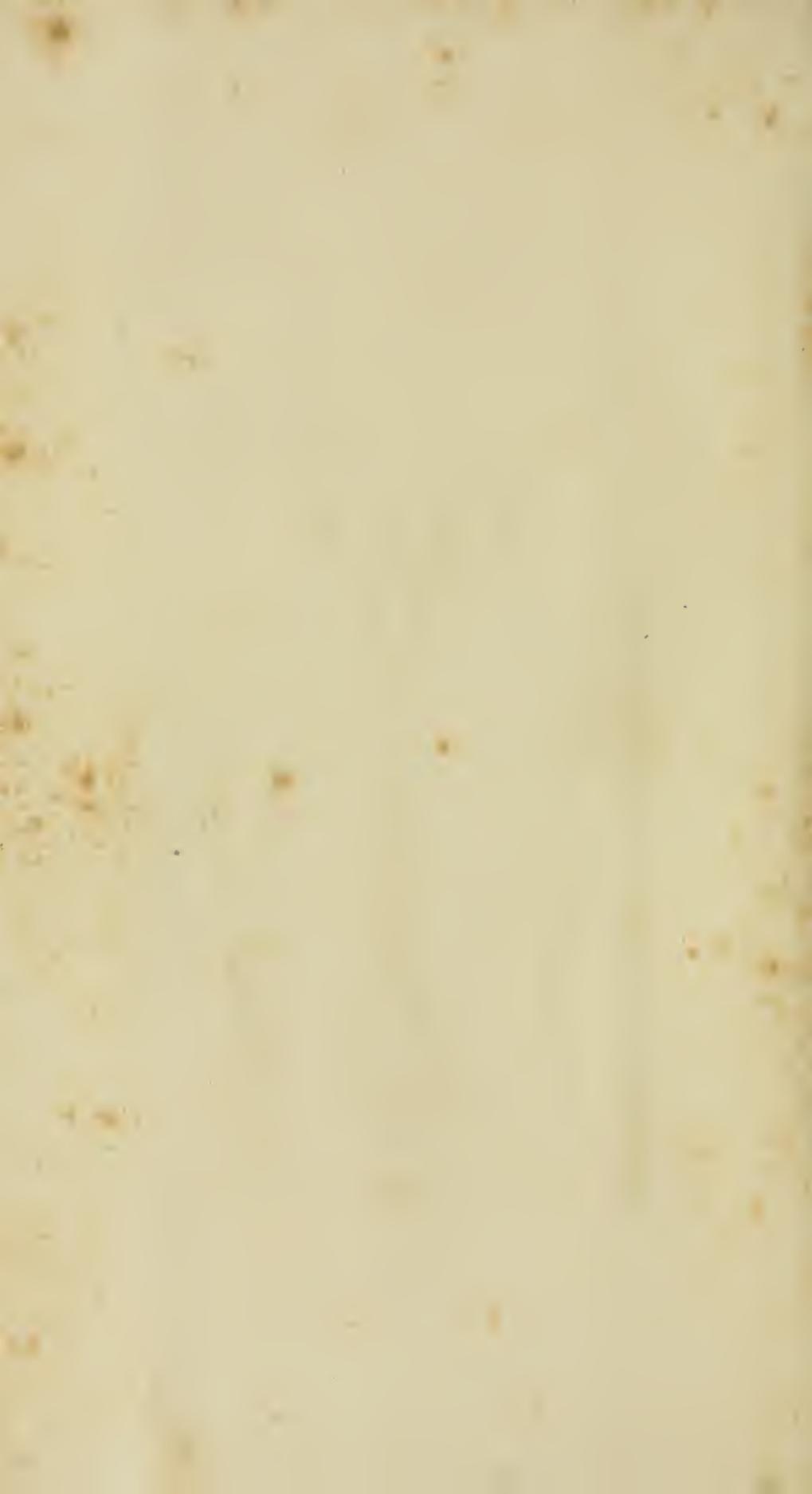
INSTRUMENTS FOR OBSTETRICAL OPERATIONS.

- Fig. 1. Smellie's perforator with a protecting sheath.
- Fig. 2. Van Huewel's pelvimeter.
- Fig. 3. Baudelocque's pelvimeter.
- Fig. 4. Dubois' scissors for cutting open the head, the branches being crossed and recrossed near the handles.
- Fig. 5. A pair of forceps with a spring temper.
- Fig. 6. Baudelocque's cephalotribe, with Depaul and Charrière's articulated rack.
- Fig. 6. *bis.* The key of the cephalotribe for turning the rack.
- Fig. 7. A pair of abortion forceps.
- Fig. 8. Scholler's whalebone instrument for holding or changing the position of the umbilical cord.

Pl. XXV



MODÈLES CHARRIÈRE





Pl. I

Fig. 1.



Fig. 3.



Fig. 4.

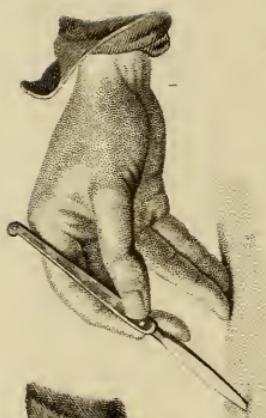


Fig. 5.



Fig. 6.



Fig. 2.

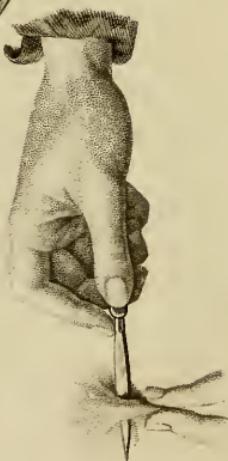


PLATE I.

METHODS OF HOLDING THE BISTOURY.

THE positions in which the bistoury may be held are liable to infinite variety; nevertheless, for the purposes of operative surgery, these positions may be reduced to three, and each of them subdivided into two varieties.

First Position (fig. 1 and 2). The handle of the bistoury is held firmly in the whole hand, like a table knife. In this position, the end of the handle of the instrument always rests in the palm of the hand, whilst the cutting edge may be turned either downwards (as in fig. 1), when the index finger is extended upon the back of the blade; or upwards (as in fig. 2), when the index is placed near the junction of the blade with the handle, and on its side. The first position is the best, whenever great firmness or force is required in the use of the instrument.

Second Position (fig. 3 and 4). The bistoury is held like a pen in writing, the cutting edge being turned either downwards (fig. 3), or upwards (fig. 4). This position of the instrument is suitable when we desire its movements to be at the same time delicate and precise.

Third Position (fig. 5 and 6). The bistoury is held like the bow of a violin. In one of the varieties of this position, the point of the instrument is carried forward with its edge downwards (fig. 6); in the other the point is carried backwards, with the edge upwards (fig. 5). This position is employed when we wish to use the knife with the utmost delicacy and prudence.*

* In this country, as in England, the ordinary scalpel is most generally employed by surgeons in operations upon the living body, in preference to the French bistoury, as well as in dissections of the dead. And there is a manifest advantage in the employment of a similarly shaped instrument for both purposes, as that instrument which the operator is most in the habit of using will always serve his purpose best under circumstances of difficulty. The shape of the scalpel undergoes slight variations, according to the fancy of individuals, and the above rules with regard to position are entirely applicable to it.—EDS.

INCISIONS.

In cutting the integuments with the bistoury, or scissors, the object ordinarily in view is to open a passage towards deeper seated tissues, either for their simple exposure, or their removal. Under different circumstances, then, the incision may be made either *from without inwards*, or *from within outwards*.

In cutting from *without inwards*, the skin should always be previously put upon the stretch, in order to avoid its wrinkling, and to facilitate its division under the edge of the bistoury, which should always cut by being drawn across the tissues with a suitable amount of pressure, applied so as to leave the cut surfaces perfectly perpendicular.

1st. *Simple Incisions.* The skin being firmly drawn and stretched over the deeper parts by the left hand of the surgeon, or by his assistants, the operator takes a straight bistoury in the first or second position (fig. 1 or 3), plunges it at first perpendicularly to a sufficient depth, and afterwards inclines it to an angle of about 45° , until the incision has reached the desired length, when he brings it out again perpendicularly, in order to avoid making an oblique section of the skin at the end of the cut. The same rules are followed in making all simple incisions, whether straight or curved.

Sometimes it is necessary to avoid with especial care the parts immediately beneath the skin. In such a case the incision should be made with a convex bistoury, held in the third position (fig. 6), dividing the tissues carefully, layer by layer. Or, by pinching up a fold of skin, one end of which is held by an assistant, the bistoury being held in the first position, the fold may be divided by cutting it downwards perpendicularly, or by transfixing its base and cutting outwards in the same direction, a simple straight incision being the result in either case (fig. 2).

2d. *Compound Incisions.* These are formed by the meeting, or intersection, of two or more simple incisions. The principal varieties are : 1st, the incision resembling the letter V, where two simple incisions meet at an acute angle ; if they meet at a right angle, it is said to resemble the letter L. 2d, the T incision, where one incision falls perpendicularly upon the centre of another ; when they intersect each other at a right angle, a crucial incision is the result ; when several incisions converge towards a common centre, they form a star. When several incisions are to be made intersecting each other, it can be done

to the best advantage, especially where the skin is loose and yielding, by making a long straight cut in the first place, and then, whilst firmly stretching its borders by a hand at either end, making the others rapidly across it.

3d. *Incisions from within outwards.* These are effected either with, or without, the assistance of a director. By one method, the bistoury, held in the second or third position, is inserted obliquely beneath the skin, or aponeurosis, or into the sinus which is to be laid open, and then brought up into a perpendicular position, by which movement the parts covering its edge are freely divided, the knife cutting from its heel towards its point. In a second method the instrument, in its first position, is introduced under the skin, with or without a director, to the point where the incision is to be terminated ; then thrusting its point through the integuments, from within outwards, the incision is completed by lowering the wrist and cutting out, from the point towards the heel of the knife.

PLATE II.

UNION OF WOUNDS.

THE different methods of promoting the union of wounds vary according to the nature and condition of the solution of continuity, and the ultimate object which the surgeon has in view. When a wound has commenced to suppurate, we simply, by means of different modes of dressing, endeavor to prevent the gaping of its edges, and the unnecessary retention of the purulent discharge, whilst watching the process of cicatrization. But when immediate union of the wound is sought after, union by the first intention, as it is called, it is necessary that its edges should be retained very accurately in contact, in order that the adhesive inflammation about to develop itself shall effect their permanent agglutination. When wounds are not very irregular in their form, or when they are situated on the extremities, or on a convenient part of the body, it is sometimes possible to keep their edges in accurate apposition by means of position, and the judicious use of adhesive plasters and bandages; but in a great many instances it becomes absolutely necessary to resort to a regular operative procedure, viz.: the application of sutures.

FIG. 2, 3, 4, 5, 6. SUTURES.

The object of the application of sutures is to retain in accurate contact the lips of a wound, when, from its form or position, plasters or bandages will not answer the purpose.

The instruments required for the introduction of sutures are needles and ligatures. The flattened needle of Boyer, curved in the form of an arc of a circle, *a a*, and that of Velpeau, with its eye on the side, curved, but flattened only on its anterior half, *b b*, are in most general use; for particular operations, needles of other shapes are employed—these will be described in their proper connection.* The needle-carrier (fig. 7) is

* The straight round needle with a triangular point, of different sizes, is much used in this city. It answers fully as well in the great majority of wounds as the old-fashioned curved needles, and is unquestionably managed with more facility.—EDS.

PL. 2.

Fig. 9

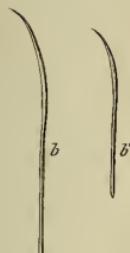


Fig. 1.

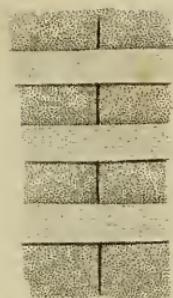


Fig. 2.

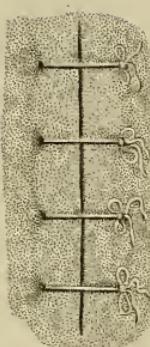


Fig. 3.

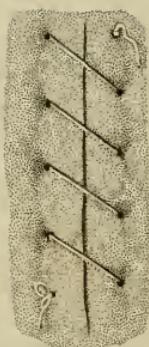


Fig. 7.

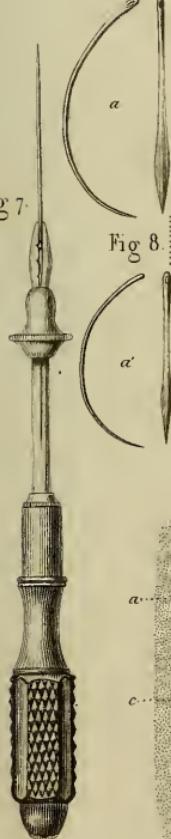


Fig. 8.

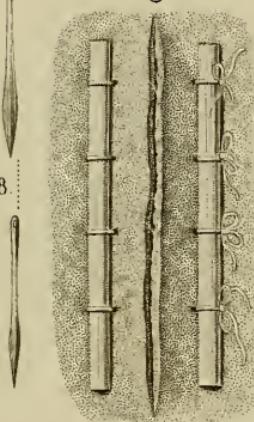


Fig. 4.

Fig. 5.

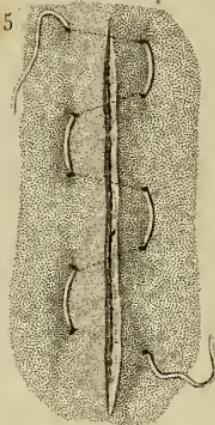
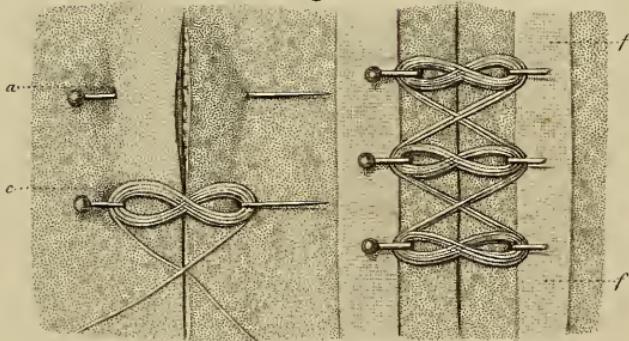


Fig. 6.





only used when the nature of the tissues requires the employment of much force in the introduction of the needle.

In regard to their mode of application, and the manner in which their purpose is effected, sutures are divided into three species. 1st, *The simple, or Pelletier's suture* (fig. 2 and 3), which approximates the lips of the wound, edge to edge; 2d, *The zig-zag, or basting suture* (fig. 5), by which the deeper portions of the cut surfaces are brought in contact; 3d, *The twisted suture* (fig. 6), which effects both of these objects, keeping the deeper portions of the wound together, whilst its cutaneous edges are also maintained in accurate apposition.

1st. *Simple suture* (fig. 3) is effected by passing a needle with its ligature through both of the lips of the wound which are to be kept in contact. To do this the operator passes the needle from without inwards through the right border of the wound at a distance of two to three lines from its edge; its point is then pushed forward in such a manner as to perforate from below upwards the left border of the wound at the same distance from its edge; the convexity of the needle always presenting towards the bottom of the wound. Sometimes the irregular shape of the wound, or the separation of its lips from each other, renders it impossible for both of them to be perforated at the same time by the same needle; in this case a ligature armed with two needles may be employed, each of which is passed through a lip of the wound, from within outwards.

The first point of suture being thus effected, the rest are applied in like manner, until the edges of the solution of continuity are in contact throughout. When several sutures are thus introduced without cutting the thread, the *continued, or glover's suture* is the result (fig. 3). On the contrary, when the thread is cut and tied over the wound between each point of suture, it is then known as the *interrupted suture* (fig. 2). Finally when, in place of tying together the ends of each of the threads, they are all brought together in a single bundle, and fastened at a distance, so as to keep up their tension, we have Ledranc's, or the *looped suture*, sometimes applied to wounds of the intestines (v. *Enteroraphy*).

2d. *Zig-zag, or basting suture* (fig. 3). This is commenced exactly in the same manner as the simple suture, that is to say, a single needle is inserted through both lips of the wound, but its thread, instead of passing back again across the wound, is carried along, and parallel with, its border, until the next point is reached, from which it is passed again through both of its lips to the side from which it was at first introduced.

The needle being thus inserted alternately from either side of the wound, without the thread being cut, a species of zig-zag is described by it from which the suture takes its name (fig. 5). *The quilled suture* (fig. 4) is evidently a variety of this latter; it tends also to bring together the deeper portions of a wound, only the loops of the ligature which produce this result in the zig-zag suture are here replaced by a piece of a gum elastic catheter, or the barrel of a quill. The manner in which it is done is by passing, in the first place, through the lips of the wound, as many double ligatures as it is wished to make points of suture; the quill or bougie is then introduced, parallel to the edge of the wound, through the loops formed by the doubling of the ligatures, whilst their free ends are tied, with the necessary degree of tightness, over another quill at the opposite side of the wound.

3d. *Twisted suture.* This species of suture combines the results of both of those previously described, only it is done in a different manner; instead of an ordinary ligature, a metallic pin or needle is passed through the lips of the wound—either an ordinary pin, *a*, or the insect pins, which Dieffenbach prefers. By the first step the deeper portions of the cut surfaces are brought in contact, and to produce the same effect upon the cutaneous edges of the wound, a ligature is applied around each pin in the form of the figure 8, its ends being crossed in passing to the next pin, where the process is repeated. The operation is finished by cutting off the points of the pins, and placing a longitudinal strip of adhesive plaster between their extremities and the skin, to prevent the latter from being irritated by the cut ends, *ff*.



Pl. 3.

Fig. 1.

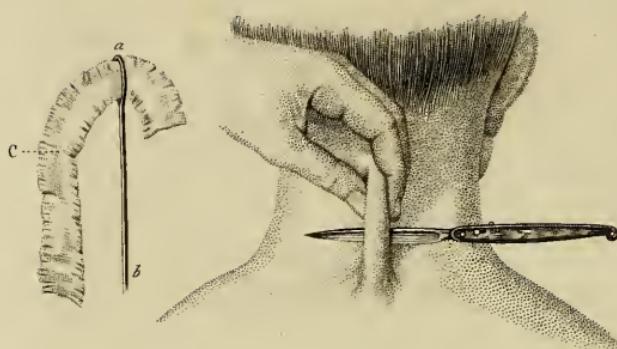


Fig. 1.



Fig. 3.

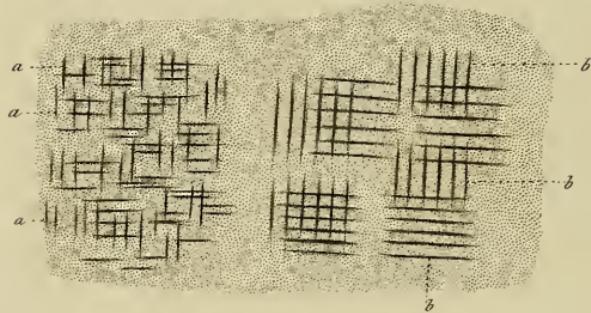


Fig. 4

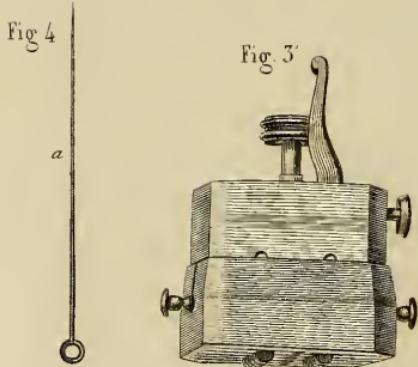


Fig. 2.

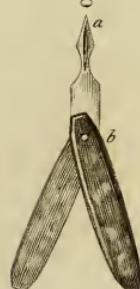


PLATE III.

OF THE SETON.

THE object of the seton is to establish and keep up a drain, or issue, by means of a strip of cotton, or linen tape, introduced beneath the skin. It is most frequently made use of in the nape of the neck, but may be applied with advantage in many other localities.

FIG. 1. SETON IN THE NAPE OF THE NECK.

Having pinched up the skin of the back of the neck in a vertical fold, one end of which is held by an assistant, the operator transfixes the base of the fold by a straight bistoury held in the first position, and enlarges the incisions thus made to the requisite extent; then by means of the eyed-probe, *a b*, the strip of linen, *c*, previously greased with cerate, is passed through the wound made by the bistoury, and the fold of skin is allowed to resume its natural position.

The dressing consists of a piece of linen in which a number of small holes have been cut, spread with cerate and placed upon the wound; over this is a small wad of lint for the purpose of absorbing the discharge which escapes through the holes in the linen, covered by a compress, in the folds of which the excess of the seton is coiled. A circular turn of a bandage around the neck retains the dressing in position, and it should not be renewed until the fourth or fifth day, by which time suppuration will have been established. At each dressing a new portion of the seton, well greased, is drawn into the wound, and the soiled end cut off; when the seton is exhausted a new one is sewed to its extremity.

Boyer's suture needle (fig. 1 *bis*), which carries the seton through at the same time that it makes the wound, may be substituted for the bistoury and eyed-probe. This instrument, however, is not much used.*

* The English seton needle, which differs slightly from Boyer's, is a convenient instrument, and very generally employed in this country; it can be introduced more rapidly and with less pain than the bistoury and eyed-probe.

The substitution of a strip of india-rubber cloth for linen or cotton, is also an im-

FIG. 2. VACCINATION.

Ordinarily the upper and outer part of the arm is selected for the insertion of the vaccine virus. There are four methods of doing this : 1st, *by friction* ; 2d, *by a blister* ; 3d, *by scarification* ; 4th, *by puncture*. We will describe the latter only, which is the mode most in use.

To vaccinate by puncture the ordinary lancet, or what is better, the vaccinating lancet, *a b*, is the instrument generally preferred. This is previously charged with the virus, either by inserting it into a mature vesicle, when we vaccinate directly from arm to arm, or by making use of preserved matter. The lancet is then introduced almost horizontally beneath the surface of the skin to the distance of about a line, the operator endeavoring to make the instrument pass as it were between the epidermis and the true skin ; it is allowed to remain for a few seconds and then withdrawn in such a manner as to wipe off the virus from the point of the instrument, the withdrawal of which is generally followed by a small drop of blood. In this manner three or four punctures are made in each arm, which must be allowed to dry perfectly before the infant is dressed.

FIG. 3. SCARIFICATIONS.

The term *bird-peck punctures*, *aaa*, is applied to a number of superficial punctures rapidly made with a lancet-shaped needle, or a well-pointed lancet, with the view of depleting inflamed or edematous tissues.

Scarifications are small superficial incisions, made close to each other for the purpose of causing a flow of blood ; it is a very ancient method of effecting depletion of the capillaries. They may be made with a lancet, a razor, or even a bistoury, held in the third position. With a view of lessening the pain when made in this manner, the Germans have invented a scarificator (fig. 3 *bis*), in which, by means of a spring, some fifteen or twenty small blades are made to cut at one stroke ; thus the duration of the operation is much diminished.

FIG. 4. ACUPUNCTURE.

The operation of *Acupuncture* consists in the introduction of needles made for the purpose, *a, b, c*, into different parts of the body. When

provement, as it does not absorb the discharge from the wound ; nor does it require constant renewal and methodical dressing, but may be tied in a loop and allowed to remain, which, with children, is an advantage.—EDS.

the needles are placed in communication with the poles of a machine, with the object of passing a current of electricity through a limb or a diseased part, the operation takes the name of *electro-puncture*. Of late electro-puncture has been employed, and in several instances with success, to produce the coagulation of the blood in arteries, and in this manner to effect a cure of aneurism.

There are different modes of introducing the needles—either suddenly by a single thrust, or in a more gradual manner, by rolling the handle of the needle between the thumb and index finger, whilst pressing it gently onwards. Sometimes also it is driven forwards by a series of gentle taps upon its head. The pain is but trifling by either method.

PLATE IV.

1ST. BLEEDING FROM THE ARM.

FIG. 1. ANATOMY OF THE PART.

THE skin and adipose tissue which cover the veins at the bend of the arm have been removed by dissection, as well as the subjacent brachial aponeurosis, 2, in order to demonstrate the relation of the deeply seated parts with the superficial veins.

These are, reckoning from without towards the inner border of the arm :

A. *The radial vein*, accompanied by some small branches, *a*, of the musculo-cutaneous nerve.

B. *The median cephalic*, crossed by the internal branch, *b*, of the musculo-cutaneous nerve.

C. *The cephalic vein*, formed by the union of the two preceding ; the main trunk of the musculo-cutaneous nerve, *c*, lies along its inner border.

D. *The common median vein*, with branches from the musculo-cutaneous and internal cutaneous nerves.

E. *The median basilic*, accompanied by the anterior branch, *e*, of the internal cutaneous nerve. Larger and more superficial than the preceding, the median basilic vein runs parallel, in its external half, with the brachial artery, from which it is separated by the aponeurotic expansion given off by the tendon of the biceps, *G*. The median nerve, *H*, also lies behind it.

I. *Ulnar veins*. M, *basilic vein*, formed by the union of the median basilic with the ulnar veins. N, Internal cutaneous nerve.

FIG. 2. METHOD OF PERFORMING THE OPERATION.

The patient being either seated, or lying down, the operator having provided himself with a short bandage, places the centre of it upon the forepart of his arm, about three or four fingers' breadths above the bend of the elbow, and bringing its two ends to the outer side of the arm,

PI. 4

Fig. 2.

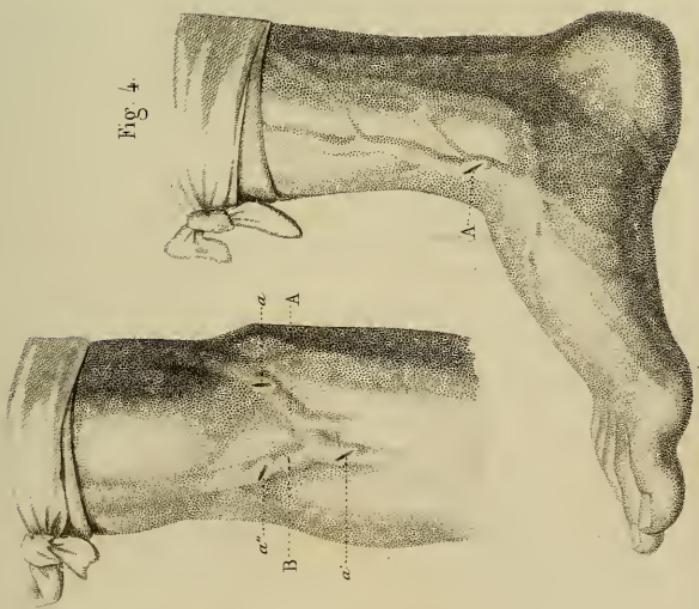


Fig. 1.
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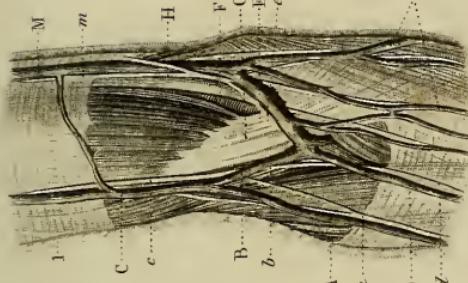


Fig. 4

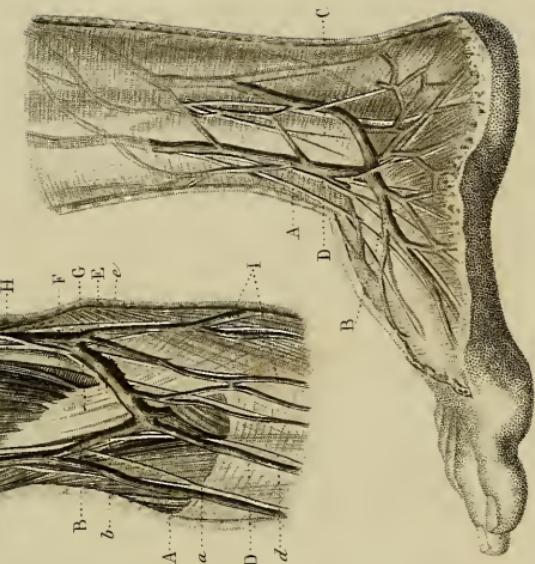
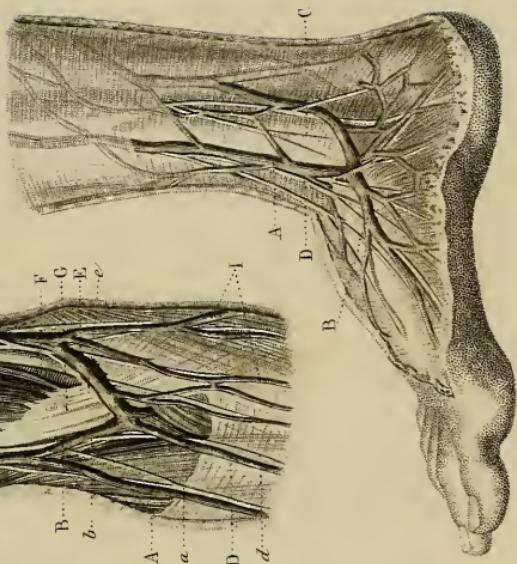
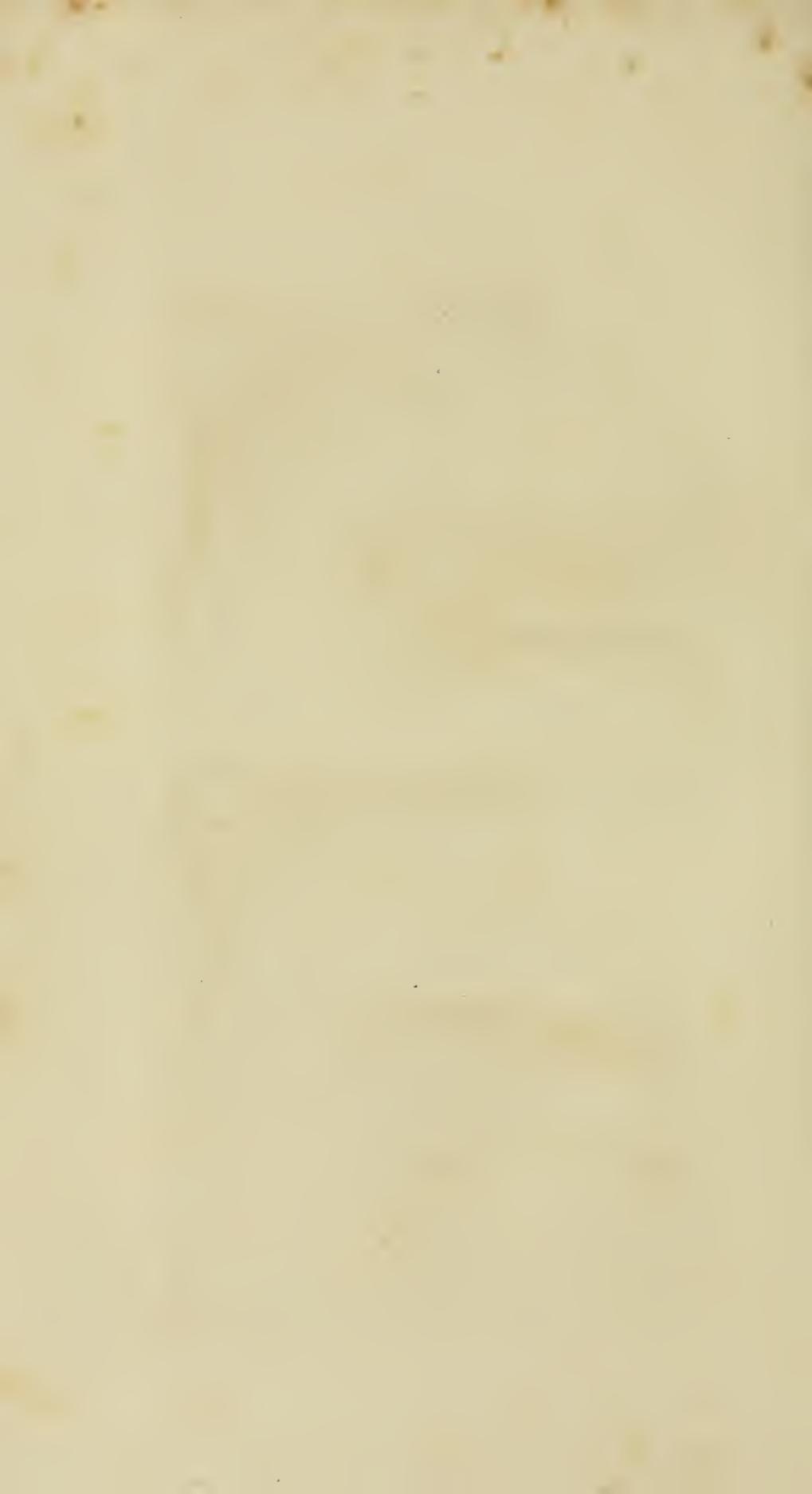


Fig. 3





ties them in a bow-knot. Whilst the veins are swelling under the influence of this constriction, which, however, should never be carried so far as to control the beating of the pulse at the wrist, the surgeon prepares a small compress, folded in four, for the dressing, and makes ready his lancet, which is done by opening the blade until it forms a slightly obtuse angle with its handles; this he places within his reach, or between the teeth, so that it can be seized at any moment by the heel of the blade.

Then taking the patient's arm, he rotates it outwards, and places its hand beneath his own left arm (if it is upon the right arm that he is about to operate, and *vice versa*, if on the left); he now by means of gentle friction pushes along the blood so as to distend the portion of the vein which he is about to pierce, to the utmost, and confines it there by the thumb of his left hand across the vein, whilst the four fingers of the same hand encircle the back part of the patient's arm and their ends put the skin upon the stretch in front. This done, the surgeon takes the blade of the lancet between his thumb and index finger, and makes use of the other fingers as a point of support at the moment of piercing the vein, resting them upon the patient's forearm. The opening of the vein should be made, in most instances, by a simple puncture, obliquely to the general direction of the vein, a, a', a'' . Immediately on the puncture being made, the stream of blood jets out with more or less force, and its force can be increased by causing the patient to grasp or squeeze in his hand a cane, lancet-case, or roll of bandage. When the requisite amount of blood has been obtained, it is arrested by applying the thumb of the left hand upon the opening in the vein, whilst removing the bandage from the arm. After having wiped away the blood from the arm, the small compress already prepared is placed upon the wound in the vein, under the thumb, and retained in its situation by a bandage applied around the arm in the form of the figure 8, the ends of which are tied in a knot over the wound, or fastened with a pin.

In bleeding from the arm there are several points worthy of notice, both with regard to the selection of a vein, and the shape of the lancet. Blood can be obtained from any of the veins at the bend of the arm when they can be recognized beneath the skin. The *median basilic*, A, or *cephalic*, B, are, however, for the most part preferred. What has been said above, applies particularly to the median cephalic; but when the median basilic is the only vein to be found, it is necessary for

the operator to ascertain accurately the position of the artery before opening the vein. It is better, as a rule, to make the puncture as low down in the vein as practicable, because, in this position, the aponeurotic expansion from the tendon of the biceps lies between the two vessels. If at the moment of puncturing the vein, the patient should throw his biceps muscle into a state of strong contraction, as he would, for example, in drawing the operator towards him with the arm, this, by throwing a stronger tension upon the aponeurotic expansion, would raise the median basilic vein, and separate it still farther from the artery which lies beneath it.

The lancet which makes an obtuse angle at its point, called *à grain d'orge*, from its resemblance in shape to a grain of barley, makes a large wound, and suits the great majority of cases (pl. 5, fig. 1); the more pointed pattern, known as the lancet *à grain d'avoine*, from its shape being like that of an oat-grain (fig. 2), and that with a very acute point, called *à langue de serpent* (fig. 3), from its likeness to a snake's tongue, are used when the vein lies very deep and is covered with a thick layer of fat; when using these it is recommended to enlarge the opening in the integuments by making the point of the instrument cut its way out by a lever-like movement succeeding the puncture. In this way a free flow of blood is secured, and the infiltration of the cellular tissue, known as *thrombus*, is prevented.

2D. BLEEDING FROM THE FOOT.

FIG. 3. ANATOMY OF THE PART.

The internal saphenous vein, A, which takes its origin on the dorsum of the foot, B, passes from below upwards in front of the internal malleolus, C, upon the inner side of the tibia, accompanied by the saphenous nerve, D. A thin layer of fascia separates it from the skin.

FIG. 4. MODE OF OPERATING.

The venous circulation in the foot is arrested, as in the arm, by means of a bandage placed around the ankle, about two fingers' breadths above the malleoli; after this it is placed in a warm foot-bath, whilst the lancet and dressing are being made ready. When prepared, the surgeon, seated in front of the patient, takes the foot from the water, and having wiped it places it upon his knee; he then secures

the vein, A, in its place with the thumb, as it is very apt to roll in this locality, and proceeds to open it precisely as in bleeding from the arm. It is rarely the case that the blood flows from the foot in a jet, and the custom is to replace the foot in the vessel of warm water until its deepened color, or the length of time of immersion, indicates that a sufficient quantity of blood has been lost.

The dressing consists of a small square compress over the wound, kept in place by a bandage in the form of the figure 8, around the foot and ankle.

PLATE V.

FIG. I. LANCETS.—1, À GRAIN D'ORGE; 2, À GRAIN D'AVOINE; 3, À LANGUE DE SERPENT.

a, blade of the lancet; *e*, heel of the blade; *g*, sheath of the lancet; *h*, *h'*, the two portions of the sheath; *f*, joint of the blade and its sheath.

FIG. II. Bleeding from the external jugular vein, B; arteriotomy in the temporal artery, A.

BLEEDING FROM THE JUGULAR.

FIG. 2. ANATOMY OF THE PART.

The external jugular vein, which is sometimes solitary, and at others double in its origin, in the latter case commencing by two branches which unite in a common trunk about the middle of the neck, takes its course normally from the angle of the lower jaw to the middle of the clavicle. Passing obliquely backwards from its point of origin, it crosses the course of the sterno-cleido-mastoid muscle, and lies upon it, covered throughout by the platsma myoides and the skin. In the upper part of its course it has near it some small nervous filaments.

MODE OF OPERATING.

The patient being seated, or, still better, in reclining position, the circulation is arrested by a compress placed upon the vessel a short distance above the clavicle. The compress, which should be somewhat thick, is kept in its place by a bandage, A, which is tied in the arm-pit of the opposite side. A simple piece of cord, rather tightly tied, might readily take the place of the compress and bandage, for the cord buries itself in the skin and compresses the vein very accurately at the point where it is crossed. The vein being by this means sufficiently distended, the surgeon steadies it with his index finger, and makes the puncture, B. The opening in the vein in this region of the neck should be full

Pl. 5.

Fig. 1

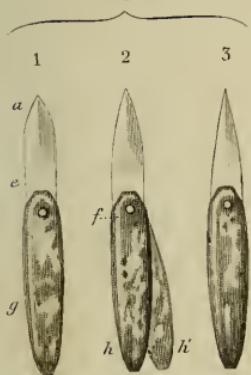
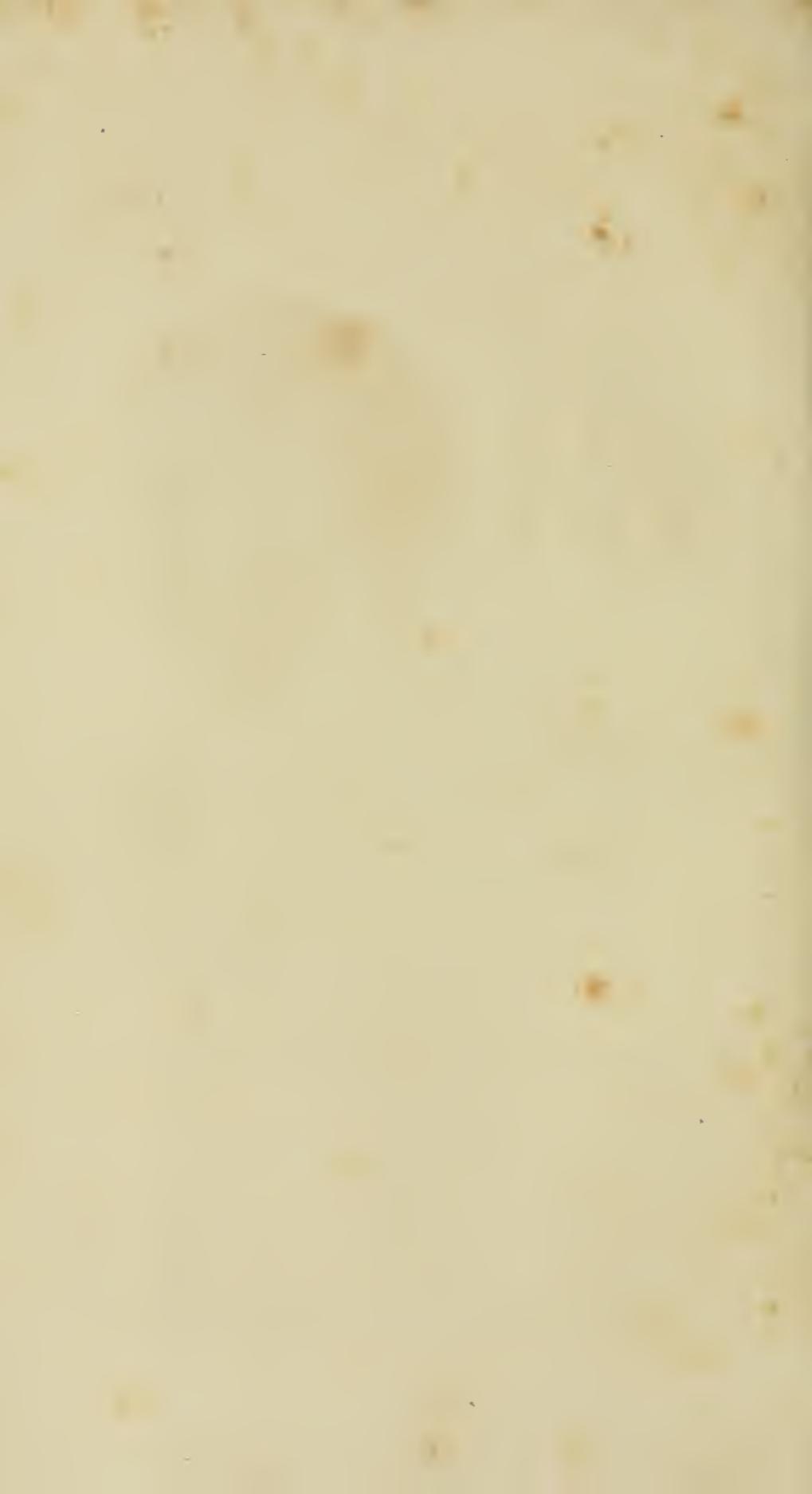


Fig. 2





large, and directed obliquely across the fibres of the platysma muscle, for being thus divided the muscular fibres retract and keep the wound gaping. It happens very often that the blood will not flow in a jet, but trickles down the neck ; in this case a common card should be folded longitudinally, so as to form a gutter, by which the blood can be guided into a proper vessel.

The flow of blood is stopped by removing the compression, and at the same time a finger should be placed upon the wound to prevent the entrance of air into the vein. The wound is dressed by bringing its edges together and applying a piece of adhesive plaster, or the common court plaster. Sometimes this dressing, and even the addition of a circular bandage, does not succeed in stopping the flow of blood entirely ; in such a case M. Magistel suggests the introduction of a point of suture.

ARTERIOTOMY.

S U R G I C A L A N A T O M Y.

A' represents the course of the temporal artery ; *b'*, the section of the skin ; *c'*, pyramidal compresses for compression of the artery.

The temporal artery, a branch of the external carotid, when opposite to the condyle of the lower jaw, runs directly upwards behind the arch of the zygoma. About the middle of the temporal region it divides into two branches : the posterior, which passes backwards, and the anterior, or frontal, which runs upwards and forwards upon the forehead, where it lies upon the epicranial aponeurosis, and immediately beneath the skin.

M O D E O F O P E R A T I N G.

The patient being properly placed, either sitting or lying, the exact position of the artery is ascertained by its pulsations, and it is steadied by the thumb and index finger of the operator, the skin covering it being rendered tense at the same time. He then, with a straight bistoury, held in the third position, makes a short incision directly across the course of the artery, by which it is divided. The blood issues sometimes in a jet, though more frequently it only trickles ; in order to stop it, when necessary, compression is made on either side of the wound by means of the pyramidal compresses, *c*, *c'*, which are retained in their places by a circular bandage around the head, knotted over the temples.

PLATE VI.

LIGATION OF ARTERIES.

1ST. ON THE EFFECTS PRODUCED BY THE LIGATION UPON AN ARTERY.

Fig. 1. Arteries are composed of at least three membranes placed one upon the other, called *coats*: *a*, the external coat, possesses the most vitality, is tough and very resisting; *b*, the middle coat, is yellow, elastic, composed of circular fibres, possesses very little power of resisting force applied in the direction of the course of the vessel, and a low degree of vitality; *c*, the internal coat, thin, smooth, transparent, endowed with little strength and no vitality, is regarded as an analogue of the epidermoid tissues.

Fig. 2. When a ligature, *a*, is applied to an artery, the internal and middle coats, *b*, *c*, are divided by the thread, and pushed aside, so that the internal surfaces, *c*, *d*, of the outer coat, the only one which resists the action of the ligature, are brought into forcible contact.

Fig. 3. After the application of a ligature to an artery, the first collateral branch, *a*, above the ligature becomes dilated; in the space between the ligature and this first collateral branch the blood stagnates, and shortly forms a clot, *b*, the office of which is to plug up the artery after the ligature has come away.

Fig. 4 and 5. The process of torsion, *a*, produces an effect upon the arterial coats analogous to the ligature, that is to say, it effects a division of the internal and middle coats, *b*, *b*, which are forced to either side, whilst the external coat, *c*, alone offers resistance, and becoming twisted, serves to obliterate the calibre of the artery.

Fig. 6. After the circulation of the blood through an artery has been interrupted, by a ligature or any other means, it becomes re-established beyond the obstruction by the dilatation of the anastomoses between the collateral branches above and below the ligature. Fig. 6, taken from Dupuytren's Museum, represents an aneurism, *a*, of the popliteal artery which was cured by the application of ice. We can readily recognize the very considerable dilatation of the articular arteries,

Pl. 6.

Fig. 1

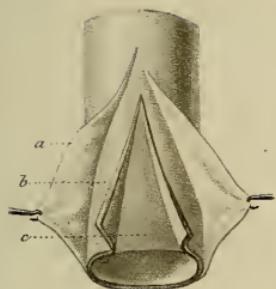


Fig. 2.

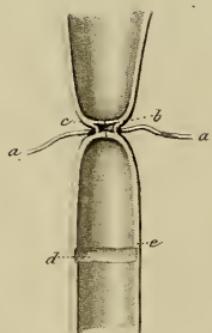


Fig. 3.

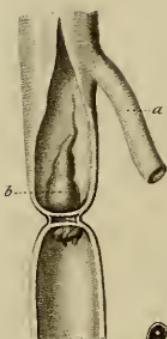


Fig. 7.

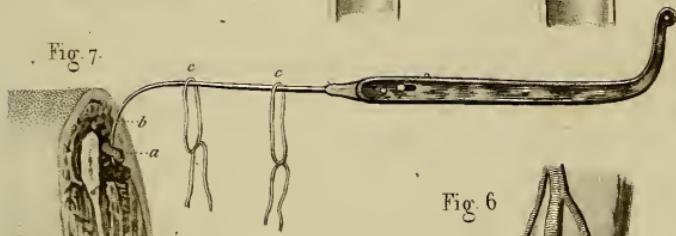


Fig. 5.

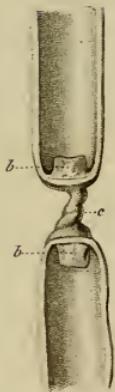
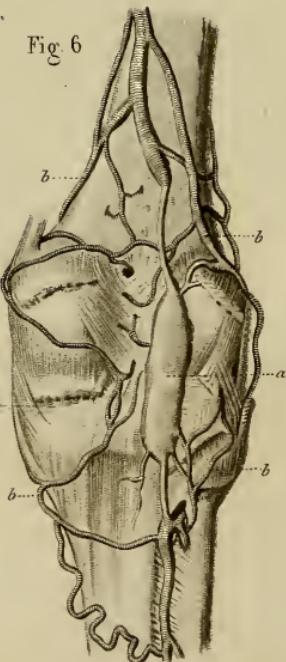
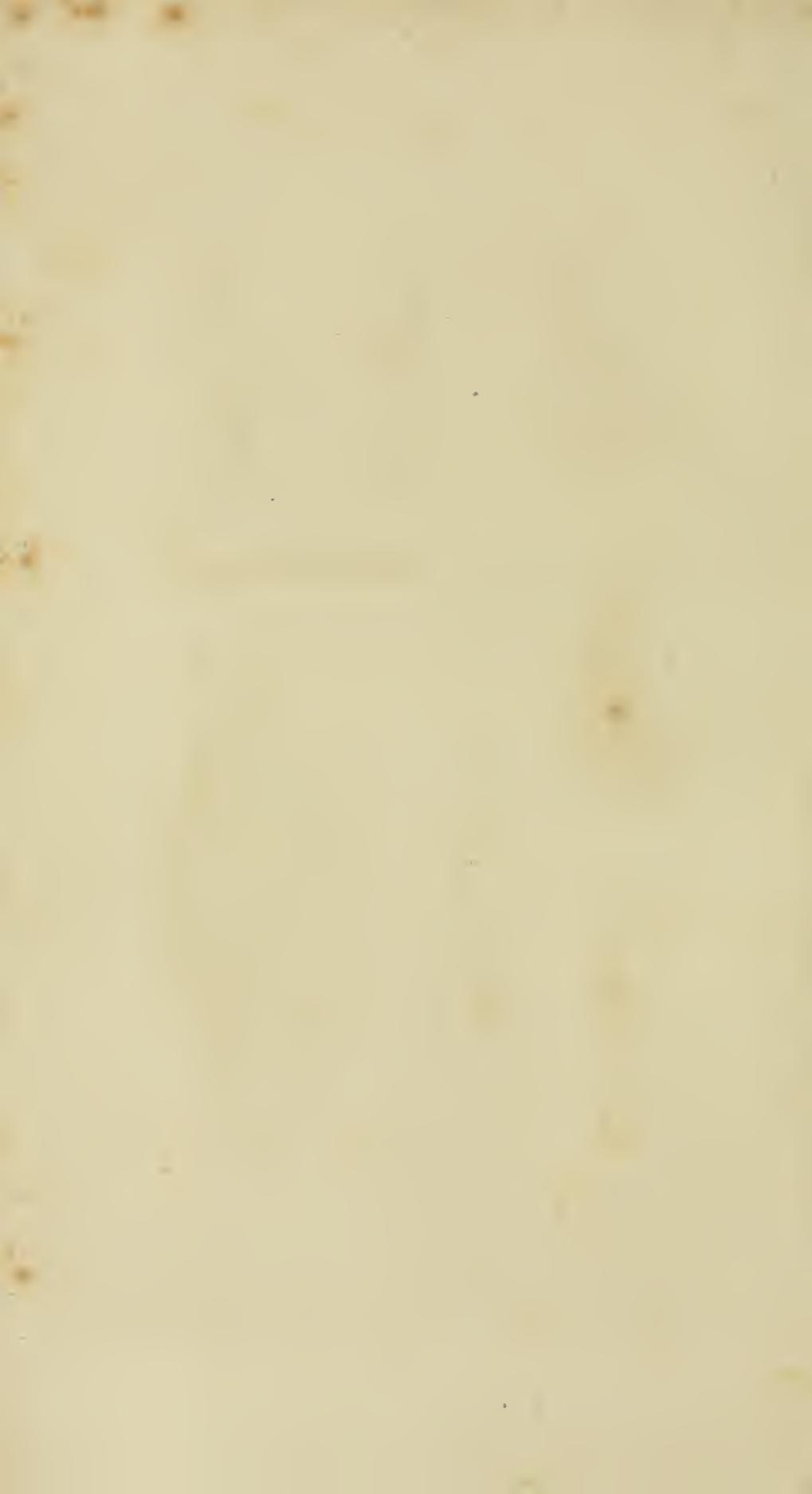


Fig. 4.



Fig. 6





b, b, b, b, through which the circulation in the limb below has been preserved.

Fig. 7. *a*, an artery in a stump, transfixed by the point, *b*, of the tenaculum ; *c, c'*, ligatures to be applied to the artery.

2D. GENERAL RULES FOR THE LIGATION OF ARTERIES.

To lay bare an artery for the purpose of placing a ligature upon it it is necessary :

1st. To determine the position of the vessel, by the requisite familiarity with its anatomical relations, assisted by the arterial pulsations—if the operation is performed upon the living body.

2d. The skin being placed upon the stretch, an incision is made upon the vessel with a convex bistoury held in the third position ; this incision, parallel with the course of the artery, should always divide both the skin and the subcutaneous cellular layer, and its length should be proportioned to the depth at which the vessel lies.

3d. The aponeurotic layer which binds down the muscles is to be divided to the same extent, on a director, and the muscles beneath pushed to either side to expose the sheath of the vessel, which contains the artery, in company with its corresponding veins and nerves.

4th. After raising a fold of the sheath of the vessel with the dissecting forceps, it is to be opened with great care, the edge of the bistoury being kept parallel to the artery, and never turned towards it.

5th. The bistoury is then relinquished, and the surgeon makes use of the director, held as a writing pen, to isolate the artery on either side, and endeavors with its point to tear through the loose cellular tissue which surrounds it, so as to pass the instrument behind the vessel. In this stage of the operation there are two important precautions to be observed ; in the first place, to lay bare the artery to as trifling an extent as possible, and secondly, to introduce the director between the artery and the vein, so that the latter shall not be exposed to injury from the point of the director as it passes beneath the artery.

6th. When the artery is well exposed and the director lodged beneath it, the operator satisfies himself of its identity by recognizing its pulsations, and then passes along the groove of the director an eyed-probe, armed with the ligature. When the vessel is deeply situated, Deschamps' or Cooper's artery-needle is substituted for the eyed-probe.*

* The highest American authority in regard to the mode of tying arteries, Prof. Mott, does not make use of the director as described above, but employs in its

Finally, being assured of the identity of the artery, the first knot in the ligature is tied. If the vessel is deeply placed, the knot should be tightened by means of the two index fingers inserted into the wound, one of them pressing upon each end of the ligature, in order that the artery should not be too much dragged from its bed. The second knot is then tied, one of the ends of the ligature cut off, and the remaining one brought out at the most depending angle of the wound.

place the smooth round point of the artery-needle which bears his name, and which is also known as the American needle. After opening the sheath of the vessels, and separating it from the artery with the handle of the scalpel, he insinuates the point of this needle, which he considers by far the best instrument of its kind, gently between the vein and artery, and passes it beneath the latter, always keeping the point *from the vein*, and disturbing the connections of the artery as little as possible. As there is probably no surgeon living who has operated upon the arteries more extensively, or more successfully, than Prof. Mott, we can do no better than to follow his method in this respect.—EDS.



Pl. 7.

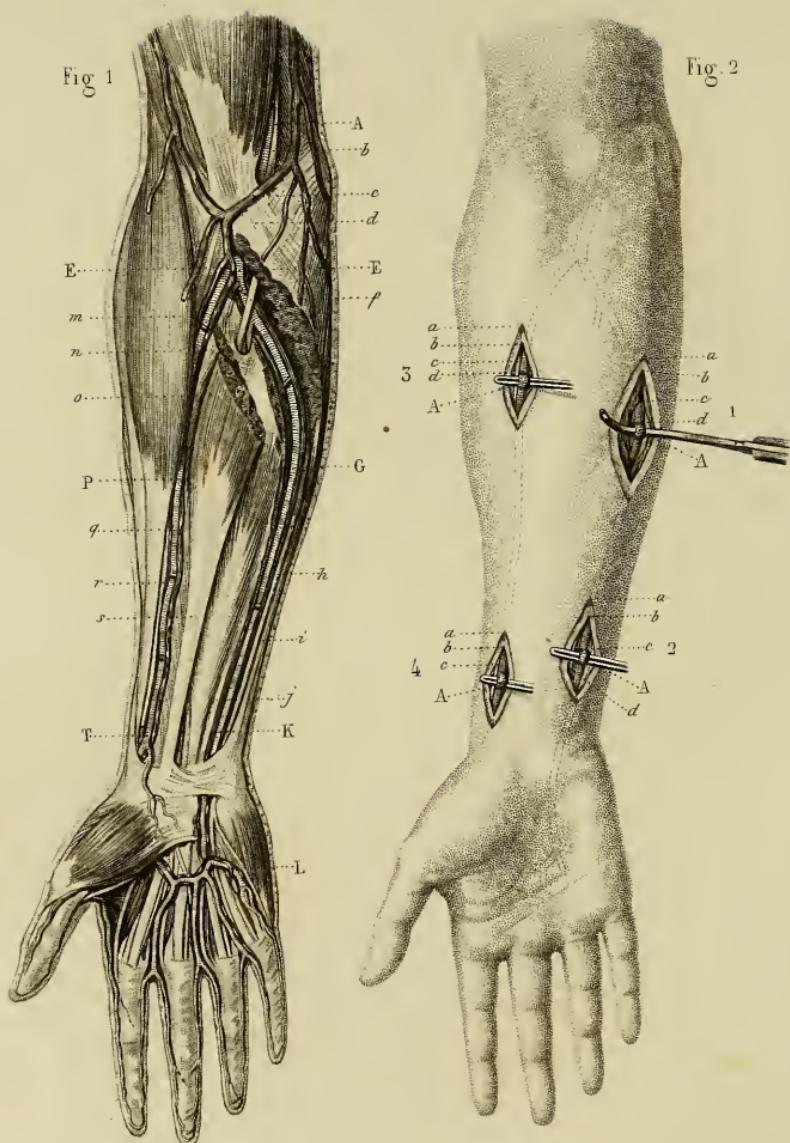


PLATE VII.

LIGATURE OF THE ULMAR AND RADIAL ARTERIES.

FIG. 1. SURGICAL ANATOMY.

A, Brachial artery, accompanied on its inner side by the median nerve, b.

c, median basilic vein, crossing the course of the brachial artery and median nerve, from which it is separated by the aponeurotic expansion, d, given off by the tendon of the biceps.

Incision No. 2 represents the *ligature of the ulnar artery in its lower third*, a, incision in the skin; b, edges of the divided aponeurosis; c, ulnar nerve; d, tendons of flexor *sublimes*; A, radial artery with the director beneath it.

Incision No. 3. *Ligature of the radial artery in its upper third*. a, wound in the skin; b, edges of the aponeurosis; c, radial nerve; d, internal border of the *supinator longus*; A, radial artery with the director beneath it.

Incision No. 4. *Ligature of the radial artery at the wrist*. a, wound in the skin; b, aponeurosis; c, radial nerve; A, radial artery with the director.

MODE OF OPERATING.

§ 1. *Ligature of the radial artery at the wrist* (see incision No. 4).
1st, Along the external border of the tendon of the *flexor carpi radialis*, which is always easily recognized, make an incision from one and a half to two inches in length through the skin and sub-cutaneous cellular tissue. 2d, Divide the aponeurosis of the fore-arm upon a director; recognize, isolate, and place a ligature beneath the artery, which is situated just external to the tendon of the *flexor carpi radialis*, always easily known by its pearly color.

§ 2. *Ligature of the radial artery in the upper third of the fore-arm*—(see incision No. 3).

Upon the internal border of the *supinator longus* muscle, if it can be recognized, and if not, along a line, representing the course of the

artery, and drawn from the middle of the bend of the elbow, to the inner side of the styloid process of the radius, let an incision be made from two and a half to three inches in length, taking care to avoid the superficial veins. The deep fascia being laid open on the director, the inner edge of the supinator ongus muscle is to be sought for beneath it. This landmark being determined, on drawing the muscle a little outwards with a spatula or blunt hook, the artery will be discovered enclosed in its sheath with its two *venae comites*, from which it is to be isolated and tied.

§ 3. *Ligature of the ulnar artery in the lower third of the forearm* (see incision No. 2). 1st. Along the external border of the tendon of the *flexor carpi ulnaris*, or if it is preferred, in the course of a line drawn from the internal condyle of the humerus to the prominence of the pisiform bone, let fall an incision from one and a half to two inches in length, dividing the skin and subcutaneous cellular tissue; 2d. The deep fascia being then laid open upon the director, the tendon of the *flexor ulnaris* will be seen, and it must be pushed towards the inner side; 3d. The artery, which is beneath it, between its two accompanying veins in their common sheath, is then to be isolated, and the ligature inserted beneath it.

§ 4. *Ligature of the ulnar artery in the middle of the forearm* (see incision No. 1). 1st, Upon the imaginary line just indicated make an incision three inches in length through the skin and cellular tissue; 2d, endeavour to find the first intermuscular septum which can be detected, going from within outwards; 3d, divide it upon the director, and push the fibres of the *flexor sublimis* towards the outer side of the limb, when the artery will be discovered immediately beneath it, with its veins. After having laid open the sheath of the artery, it will be found most convenient to make use of Cooper's or Deschamps' needle, on account of the depth of the wound.



Pl. 8.

Fig 1.

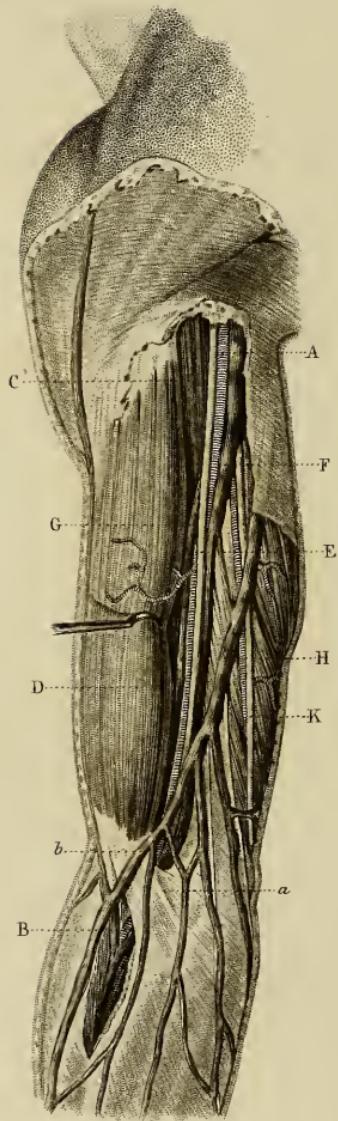


Fig 2.

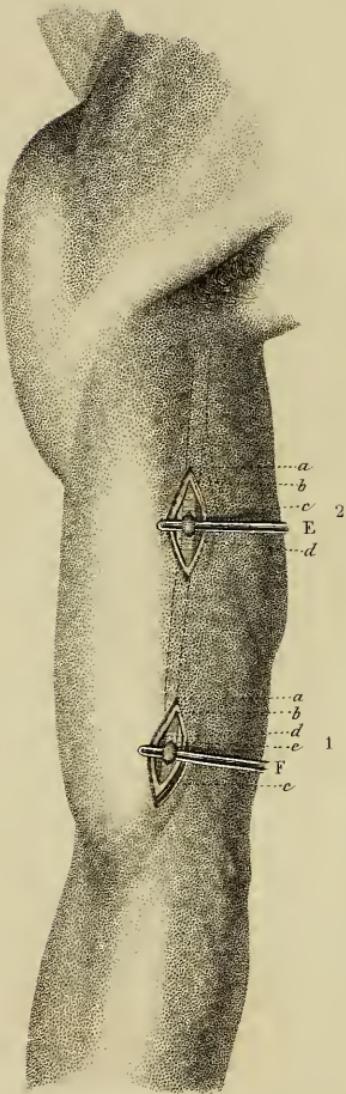


PLATE VIII.

LIGATION OF THE BRACHIAL ARTERY.

FIG. 1. SURGICAL ANATOMY.

AB, *Brachial artery*.—It extends from the inferior limit of the axilla to about an inch below the articulation of the humerus with the ulna. Situated on the inner side of the humerus above, it inclines gradually outwards in descending the arm, and at its lower part lies in front of the bone.

In its upper fourth the artery is in relation with the inner edge of the *coraco-brachialis* muscle C; below, it corresponds with the internal border of the biceps, D, which slightly overlies it in its two inferior thirds. In emaciated subjects it is covered only by the integuments and deep fascia of the arm. Towards its termination, it lies along the inner edge of the tendon of the *biceps*, whilst about to pass beneath the aponeurotic expansion, a, given off by the latter, which separates it from the median basilic vein, b.

E, *The median nerve*, which accompanies the artery throughout its course, enclosed with it in a common aponeurotic sheath. Above, the nerve is external to the artery; towards the middle of its course, it passes in front, and below, in its inferior third, it lies internal to it. The *radial and ulnar nerves* lie behind, and to the inner side of the artery, but only at its upper part.

FG, *Humeral veins*.—The vein on the inner side of the artery is larger than that on the outer side; in their course down the arm, they form frequent anastomoses with each other.

H, *The inferior profunda*, branch of the brachial artery which passes backwards in company with the ulnar nerve, K.

FIG 2. OPERATION.

Incision No. 1. *Ligation of the brachial artery near the bend of the elbow.* a, incision involving the skin and cellular tissue; b, edges of the divided aponeurosis of the arm; c, median basilic vein, situated between the skin and aponeurosis, and pushed out of its place towards

the inner condyle; *d*, inner edge of the *biceps* muscle; *e*, median nerve on the inner side of the artery; *F*, artery isolated from its sheath, with the director beneath it.

Incision No. 2. *Ligature of the brachial artery at the upper part of the arm.*—*a*, incision through the integuments; *b*, incision of the deep fascia; *c*, brachial vein; *d*, median nerve, external to the artery; *E*, artery isolated, and raised upon the director.

MODE OF OPERATING.

§ 1. *Ligature of the brachial artery at the bend of the elbow* (see incision No. 1). 1st, Make out distinctly the tendon of the *biceps*, and the internal border of this muscle.

2. Make an incision at least two inches long, following the curve of the inner edge of the *biceps*. In this incision through the integuments, the precaution must be taken to push the basilic vein on one side, in order that it may not be wounded.

3. The deep fascia, in this situation, is the aponeurotic expansion given off by the tendon of the *biceps*; it is to be laid open on the director.

4. Beneath it is seen the artery with its veins, and on its inner side, the median nerve; the sheath is to be opened by cutting upon it obliquely, and the artery carefully isolated and tied.

§ 2. *Ligature of the brachial artery in the upper part of the arm* (see incision No. 2). 1st, after having distinctly recognized the internal border of the *biceps* muscle, make an incision parallel to it about two inches and a half in length, through the skin and cellular tissue.

2d. Lay open the deep fascia on a director.

3d. Look for the nervous trunk which lies nearest the inner edge of the *biceps*; it is the median nerve, beneath and to the inner side of which the artery will be found.

4th. Open the common sheath of the vessels, by lifting a fold of it with the forceps and holding the knife horizontally; then push the median nerve outwards, isolate the artery, and pass the director beneath it from without inwards.

Pl. 9.

Fig. 1.

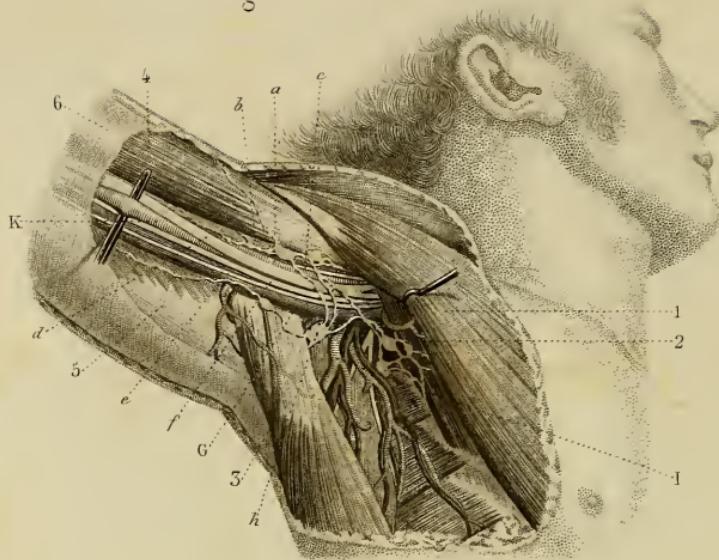


PLATE IX.

LIGATION OF THE AXILLARY ARTERY.

FIG. I. SURGICAL ANATOMY.

1, *Pectoralis major* muscle drawn upwards ; 2, *pectoralis minor* ; 3, *Latissimus dorsi* and *teres major* muscles ; 4, *biceps* muscle ; 5, *triceps extensor cubiti* ; 6, deep fascia of the arm.

a, Axillary artery. A continuation of the subclavian artery, it commences at the lower border of the first rib, and ends at the inferior boundary of the axilla (the lower border of the *latissimus dorsi* muscle) ; its course corresponds with a line dividing the anterior from the middle third of the axilla. In its inferior half it is in relation externally with the inner side of the humerus, against which it may be readily compressed ; internally it is covered only by the integuments and deep fascia, and its pulsations can be easily felt.

b, coraco-brachialis muscle, in contact with the artery throughout its course. The artery is always to be found at the internal and posterior border of this muscle, which serves as a reliable landmark.

c, d, e, f, branches of the brachial plexus of nerves. They surround the artery very closely below the *pectoralis minor* muscle ; *c*, the *musculo-cutaneous* nerve lies along the outer side of the artery ; *d*, the median, the largest branch of the plexus, takes its origin by two roots, which meet in front of the artery, opposite the lower border of the *pectoralis minor* muscle ; this nerve, skirting along the inner border of the *coraco-brachialis* muscle, lies in front and a little to the outer side of the artery ; *e, internal cutaneous* nerve, a small branch which takes its origin from the innermost root of the median, lies in front and to its inner side. Finally, the *ulnar* nerve, *f*, and the *radial*, which is concealed by the axillary vein, are situated still farther within and behind.

G, the axillary vein, is situated in front of the artery and nerves, which it partly conceals.

The axillary vessels and nerves are surrounded and held together by

a loose cellular tissue, which is interspersed with numerous lymphatic vessels and glands, h.

I, the subscapular, and inferior thoracic arteries and veins.

K, brachial artery, continuation of the axillary, isolated from the nerves and veins which surround it.

FIG. 2. OPERATION.

a, incision of the skin, cellular and adipose tissues; *b*, deep fascia; *c*, median nerve, pushed upward; *d*, axillary vein, depressed by a blunt hook; *e*, internal cutaneous nerve; *f*, sheath of the axillary vessels; *G*, axillary artery upon the director, which has been passed from within outwards, and from below upwards.

MODE OF OPERATING.

The operation of tying the axillary artery in the axilla, below the *pectoralis minor* muscle, is described as Lisfranc's method; it is as follows: 1st, determine the position of the artery by drawing a straight line corresponding with the union of the anterior third with the posterior two-thirds of the axilla, or by feeling, if possible, for the internal edge of the *coraco-brachialis* muscle, the guide for the artery. 2d, carefully divide the skin and cellular tissue on this line to the extent of two inches and a half. 3d, as soon as the fasciculus of vessels and nerves is in sight, lay aside the bistoury, and relax the parts by slightly lowering the arm. 4th, endeavor then to recognize the *coraco-brachialis* muscle, and make use of it as a guide to the position of the artery. 5th, by the aid of the director, starting from the *coraco-brachialis* muscle, first push the median and internal cutaneous nerves in front, and then the ulnar and musculo-spiral towards the posterior border of the wound; in the interval between them the artery and vein will be found. 6th, separate with care the artery from the vein, and pass the needle beneath it, from behind forwards, in order not to injure the vein, which in this locality requires more care than the nerves.



Pl. 10.

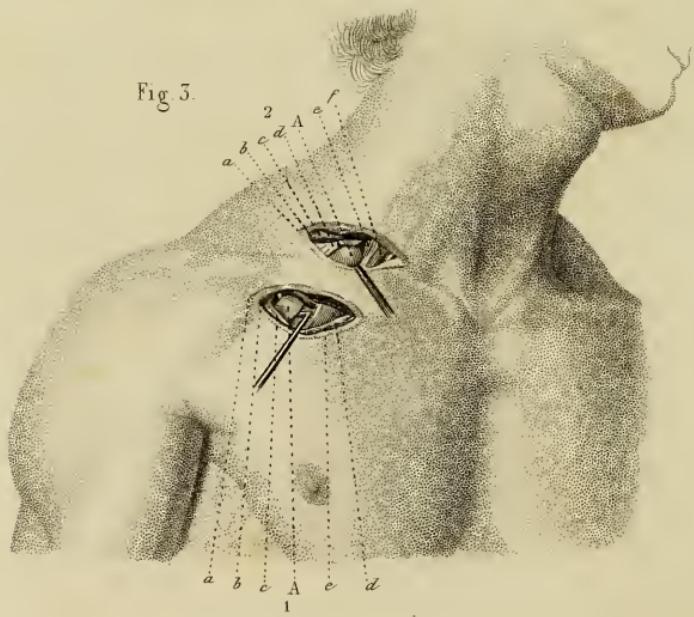
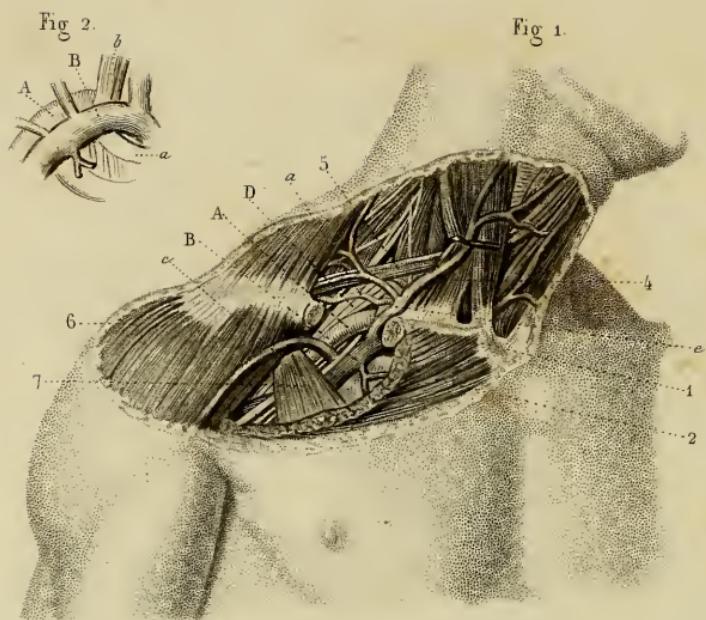


PLATE X.

LIGATION OF THE AXILLARY AND SUBCLAVIAN ARTERIES.

(*For the origin and collateral branches of the subclavian arteries, see pl. 11.*)

FIG. 1 AND 2. SURGICAL ANATOMY.

FIG. 1. 1, the clavicle and *pectoralis major* muscle, cut away partially, 2, in order to expose the axillary vessels; 3, the *trapezius* muscle; 4, sterno-mastoid; 5, omo-hyoid; 6, deltoid; 7, *pectoralis minor*.

A, the axillary artery; in its upper half, it is covered successively by the insertion of the *pectoralis minor*, 7, higher up by the *pectoralis major* muscle, from which it is separated by a layer of adipose tissue, containing numerous small veins and arteries; and finally by the fascia and the skin. *a*, The supra-scapular artery which crosses the base of the neck just above the clavicle.

B, the *axillary vein*, situated in front and to the inner side of the artery, is not in immediate contact with it. The *cephalic vein*, *c*, passes upward in the interspace between the deltoid and *pectoralis major* muscles, crosses the axillary artery above the superior border of the *pectoralis minor*, and empties into the axillary vein.

D, the *nerves of the brachial flexus*, lie behind and above. A thoracic branch often crosses the course of the artery, sometimes in front, and sometimes behind it.

FIG. 1 and 2. A, the *subclavian artery*, taking its origin from the innominata on the right side, and from the arch of the aorta on the left, passes upwards, curves in the form of an arch over the first rib, *a*, and runs downwards and outwards to the first intercostal space, where it takes the name of *axillary artery*. On account of the difference in their origin it will be seen that the first, or ascending portion of the left subclavian, is somewhat longer than the corresponding division of the right. (See pl. 11, fig. 1.)

The *subclavian artery*, after passing between the scaleni muscles, runs downwards upon the first rib, *a* (fig. 2), in a groove situated just

outside of the tubercle into which the *scalenus anticus* muscle, *b*, (fig. 2,) is inserted, which tubercle Malgaigne pointed out as an excellent landmark in searching for the artery. Beyond the *scaleni* the artery lies in the supra-clavicular triangle, which is bounded below by the clavicle and the *subclavius* muscle ; within, by the sterno-mastoid, *4*, which often overlies it slightly with its external border ; and on the outside by the *omo-hyoideus*. Here the artery is covered only by the deep cervical fascia, the *platysma myoides* muscle, and the skin ; still lower in its course it is covered by the clavicle and *subclavius* muscle. In persons with long necks the first rib rises above the clavicle, and in this case the artery may be readily compressed directly against it by pushing the clavicle slightly downwards.

B, the *subclavian vein*, situated somewhat lower down and in front of the artery, is separated from it by the insertion of the *scalenus anticus* muscle, *b*, fig. 2. The external jugular vein, *e*, may cross in front of the artery whilst passing down to empty into the *subclavian vein*.

D, the *nerves of the brachial plexus*, lie above and behind the artery ; they are only in relation with it below and posteriorly.

FIG. 3. OPERATIONS.

Incision No. 1. *Ligature of the axillary artery*.—*a*, incision of the skin ; *b*, deep fascia ; *c*, upper border of the *pectoralis minor* ; *e*, fibres of the *pectoralis major* cut across ; *d*, axillary vein ; *A*, axillary artery, below the point where the cephalic vein empties into the *subclavian*, with an artery needle passed beneath it.

Incision No. 2. *Ligature of the subclavian artery outside of the scaleni*.—*a*, incision in the skin ; *b*, deep fascia ; *c*, omohyoid muscle ; *d*, nerves of the brachial plexus ; *e*, *scalenus anticus* muscle ; *f*, *subclavian vein* ; *A*, *subclavian artery*.

MODES OF OPERATING.

§ 1. *Ligature of the axillary artery below the clavicle.*

1. *Ordinary method*.—The muscles of the shoulder being perfectly at rest, the elbow slightly separated from the trunk, and the head inclined to the opposite side, the surgeon makes, from eight to ten lines below the clavicle, and parallel with it, an incision involving the skin, *platysma* and subcutaneous cellular tissue, and extending from the septum between the *pectoralis major* and deltoid muscles, to a point two

fingers'-breadth outside of the sterno-clavicular articulation. The muscular fibres of the *pectoralis major* being successively divided and pushed aside, the posterior fascial investment of this muscle (the coraco-clavicular aponeurosis) is brought into view. Then, to favor the separation of the edges of the wound, the shoulder should be depressed, and the fascia torn through with the point of a director. The finger being introduced into the wound to press downwards and outwards the *pectoralis minor* muscle, the following parts can be recognized: 1st the vein, distended with blood; 2d, the axillary artery, farther on the outside and behind it; 3d, the nerves of the brachial plexus, situated still higher up and farther behind. Whilst passing the ligature beneath the artery, it is important that the vein should be pressed to the inner side by the finger, in order that it may be protected from injury from the point of the director, or needle, as it is introduced between the vessels.

By this method, the artery is tied in a triangular space which is bounded above by the clavicle, below and on the outer side by the *pectoralis minor* muscle, and below and on the inner side by the sternal portion of the *pectoralis major*.

II. *Desault's method*.—This consists in making an oblique incision, about three inches in length, following the interspace separating the deltoid and *pectoralis major* muscle, which contains some cellular tissue and fat, as well as the cephalic vein, which must be carefully avoided. The object in this operation is to reach the axillary artery below the *pectoralis minor* muscle.

III. *Chamberlayne's method*.—Make an incision three inches in length below the clavicle, and join it by another of the same extent, corresponding to the interspace between the deltoid and *pectoralis major* muscle. This method, as is seen, unites the incision employed by Desault, with that of the ordinary method. The result is a triangular flap which is to be turned downwards in proceeding with the operation. The ligature of the axillary artery above the *pectoralis minor* muscle can be effected with much more facility by the double incision of Chamberlayne, than by the ordinary method, and is therefore preferable to it.

§ 2. *Ligature of the subclavian artery*.—A ligature may be applied to the subclavian artery at three different points in its course: 1st, on the *outside* of the *scaleni* muscles, upon the first rib; 2d, *between* the *scaleni*, behind the insertion of the *scalenus anticus*; 3d, *within* the

scaleni. In the first two of these operations the artery is sought for in the supra-clavicular triangle already described.

I. *On the outside of the scaleni.—Velpeau's method.*—1st, The patient being situated conveniently, a transverse incision is to be made above the clavicle, and parallel with its posterior border, extending from the sterno-mastoid muscle to the anterior edge of the trapezius. The skin, platisma, and cellular tissue are to be divided, layer by layer, and the external jugular vein, if it cannot be avoided, must also be cut across, after being tied above and below; 2d, the cellular and fatty tissue is now to be torn and pushed aside with the point of the director, until the finger can detect, at the bottom of the wound, the *tubercle on the first rib*, into which the *scalenus anticus* is inserted; 3d, this landmark being well recognized, introduce upon the finger the point of an artery needle, from before backwards, and slightly from without inwards, so that it may pass beneath the artery, preventing, at the same time, with the point of the finger, the artery from being pushed by the needle towards the first trunk of the brachial plexus. In order to facilitate this manœuvre, the shoulder should be depressed as much as possible.*

II. *Between the scaleni;—Dupuytren's method.*—This operation differs from the latter only in the situation of the ligature, which is to be placed on that portion of the artery which lies between the two *scaleni* muscles. To accomplish this, after the operator has recognized the situation of the tubercle on the first rib, and has felt distinctly the insertion of the muscle into it, he passes a director beneath the latter, between it and the artery, and on the director divides the muscle across. Thus, by the retraction of its muscular fibres, the artery is exposed, and a ligature is readily carried around it. The objections are urged against Dupuytren's operation: that in it the phrenic nerve, which lies along the inner margin of the *scalenus anticus*, is exposed to injury, as well as the subclavian vein, and the origin of the internal mammary artery, which lie in its immediate vicinity.†

* This operation was first performed by Mr. Ramsden, of St. Bartholomew's Hospital, London, in 1809; his patient died on the fifth day. It was first successfully performed by Prof. Wright Post, in this city, in 1817.

† The successful termination of this operation in Dupuytren's case, as well as more recently in the hands of Dr. J. C. Warren, of Boston, renders it desirable to obviate these objections if possible, especially as in some cases it may be substituted for the ligature of the artery within the *scaleni*, which is such a desperate resource. Prof. Mott proposes to avoid some of the dangers enumerated above, which, by the

III. *Within the scaleni.*—Colles, Mott, and Liston have each placed a ligature upon the artery in this situation, but thus far it has not been followed by success. The operation presents so many serious difficulties, on account of the great depth of the artery, its numerous branches, and the importance of the parts by which it is surrounded, that it is at present hardly considered a justifiable undertaking.*

way, are not alluded to by any of the surgeons who have successfully performed the operation, by cutting through the *scalenus anticus* muscle vertically, in the direction of its fibres, to a sufficient extent, and passing a ligature around the artery through the opening thus made.—EDS.

* The mode of operating adopted for the ligature of the *right* subclavian artery within the *scaleni*, is very much the same as that for the ligature of the *arteria innominata*, to be shortly described. A similar method was also employed by Dr. J. Kearny Rodgers, for the ligature of the *left* subclavian within the *scaleni*, an operation never before attempted until performed by him at the New-York Hospital in 1846. The result of the case was unsuccessful.—EDS.

PLATE XI.

LIGATION OF THE PRIMITIVE CAROTID, LINGUAL AND
FACIAL ARTERIES.

FIG. 1, 2 AND 3. SURGICAL ANATOMY.

FIG. 1. *Origin of the carotid and subclavian arteries; branches of the subclavians.*—*a, a*, arch of the aorta; *b, innominata*; *d, c*, right subclavian and carotid, arising from the *innominata*; *e, f*, left subclavian and carotid. On the inner side of the *scalenus* muscle, *g*, on either side, the subclavians give off the following branches: the vertebral arteries, *h, h*; the inferior thyroid and supra-scapular, arising generally from a common trunk, the thyroid axis, *i, i*; the internal mammary arteries, *j, j*. Beyond the *scalenus* arise: the posterior scapular branches, *k, k*; and the acromio-thoracic artery, which, however, is more frequently given off by the axillary artery, just above the *pectoralis minor* muscle.

FIG. 2. *Relations of the arterial with the venous trunks.*—*a, a*, internal jugular veins, somewhat in front of and external to the carotids; *b, b*, the subclavian veins, in front of, running parallel with, and somewhat lower down than their corresponding arteries; *c*, the *vena innominata* in front, and a little on the outside of the artery of the same name; *d*, the left brachio-cephalic venous trunk, or *vena innominata*, crosses in front of the origins of the left subclavian and carotid, and the arch of the aorta; *e*, inferior thyroid vein; *f*, external jugular.

FIG. 3. 1, sterno-thyroid muscle; 2, omo-hyoid; 3, 3, extremities of the sterno-mastoid muscle, which has been cut across; 4, masseter.

A, *right primitive carotid.* Extending from the bifurcation of the *innominata* to the upper border of the thyroid cartilage, it ascends the neck somewhat obliquely from before backwards, and from within outwards, skirting along the outer side of the trachea and larynx, and lying upon the *longus colli* and *rectus anticus major* muscles. In its lower half it is covered in front by the sterno-hyoid and sterno-thyroid muscles, 1; near its middle it is crossed by the omo-hyoid muscle, 2; and below this point it is also overlaid by the sternal portion of the

Pl. 11.

Fig. 5.

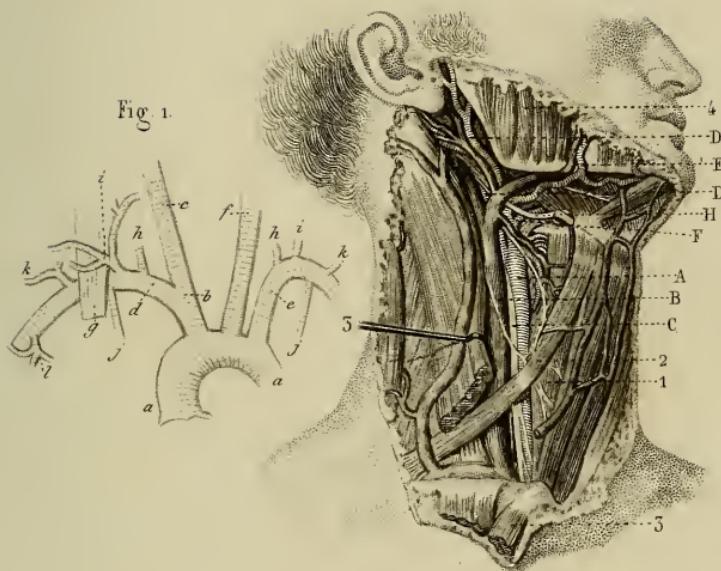
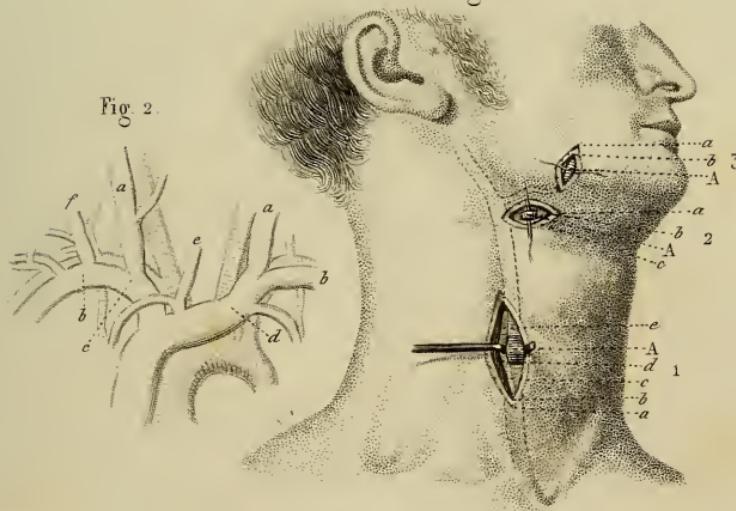


Fig. 4



sterno-mastoid, by which it is separated from the platsma and integuments, the platsma covering the artery only in its upper half.

B, the *internal jugular vein*, which lies on the outside of the artery, and over-lays it slightly.

C, the pneumogastric nerve, which lies behind the vein and artery and between them, in the same sheath; below, it passes between the subclavian artery and vein to enter the thorax. Several cardiac branches arise from it, which cross in front of the artery in its lower fourth.

The *great sympathetic* nerve lies still further behind the vessels, in the loose cellular tissue between their sheath and the provertebral muscles, in company with some lymphatic vessels and glands.

D, the *internal carotid*, and D' the *external carotid*, are the terminal branches of the primitive trunk. The external carotid, lying in front of the internal, terminates opposite the articulation of the lower jaw, where it takes the name of *temporal*. Almost superficial at its origin, it is immediately afterwards crossed by the *great hypoglossal nerve H*, and stylo-hyoid and digastric muscles, when it enters the substance of the parotid gland.

E, the *facial artery*, arising from the external carotid, a little above the *cornu* of the *os hyoides*, passes beneath the stylo-hyoid and digastric muscles, through the submaxillary gland, and by a flexuous course reaches the base of the lower jaw, over which it mounts, lying in the interspace between the *triangularis oris* muscle, and the anterior border of the masseter, whence it passes on to supply the face.

F, the *lingual artery*, arising from the external carotid below the facial, and opposite to the *os hyoides*, over which it winds to bury itself in the tongue. At its origin it is crossed by the *great hypoglossal nerve H*.

FIG. 4. OPERATIONS.

Incision No. 1. *Ligature of the facial artery*.—a, incision in the skin; b, edges of the platsma and deep fascia; A, facial artery, beneath which a ligature has been passed.

Incision No. 2. *Ligature of the lingual artery*.—a, incision through the platsma and deep fascia; c, incision in the genio-hyo-glossus muscle; A, lingual artery with the ligature beneath it.

Incision No. 3. *Ligature of the carotid in its middle portion*.—a, incision of the skin; b, deep cervical fascia; A carotid artery, with the director beneath it.

MODES OF OPERATING.

§ 1. *Ligature of the innominata.* This artery takes its origin from the most anterior point of the arch of the aorta, and after ascending obliquely from an inch to an inch and a half, terminates opposite to the right sterno-clavicular articulation. Although so short and deeply situated, this artery has nevertheless been tied in the living body, without excessive difficulty, by Mott, who employed the following steps in the operation.

Mott's method. 1st, The patient lying conveniently, with his head thrown backwards, an L shaped incision is made, the horizontal portion of which extends parallel with the clavicle, and about half an inch above it, from the median line of the neck three inches outwards, whilst the vertical portion follows the internal edge of the right sterno-mastoid muscle to the same extent.

2d. The whole of the sternal portion, and the greater part of the clavicular insertion of the sterno-mastoid muscle, is then cut across and turned over the flap, and the sterno-hyoid and sterno-thyroid muscles thus brought into view, are divided in the same manner, and turned over upon the trachea; 3d, the carotid being now recognized, is followed down to its origin; 4th, the *innominata* being laid bare to the necessary extent, carefully avoiding the pneumogastric and phrenic nerves, as well as the internal jugular vein and the pleura, pass the ligature in an appropriate artery needle, from below upwards, and from without inwards.

§ 2. *Ligature of the primitive carotid artery at the middle of the neck.* (Pl. 16, fig. 2). 1st, The patient being placed in a recumbent position, and the head turned to the opposite side, an incision three inches in length is to be made along the inner border of the sterno-mastoid muscle, and carried through the skin, subcutaneous cellular tissue, and *platysma myoides*. 2d, Divide upon a director that portion of the deep cervical fascia, which unites the edges of the sterno-hyoid and sterno-thyroid muscles, with the sterno-mastoid; 3d, flexing the patient's head forward, and separating the muscles just named, the omo-hyoid is brought into view crossing the wound obliquely, this may be pushed upwards, or downwards, or cut across, if in the way; 4th, the sheath of the vessel is now visible, this is to be opened with care, upon a director, whilst an assistant presses upon the vein at the upper angle of the wound, to prevent its extreme distention from interfering with the

operator; 5th, the cellular tissue connecting the vessels is then to be gently torn with the point of the needle, in order that it may be passed beneath the vessel, from without inwards.

Ligature of the primitive carotid at the base of the neck.—Malgaigue's method.—1st, Make an incision from two and a half to three inches in length, extending from a point one-third of an inch above the sterno-clavicular articulation, upwards in the direction of a line which, if produced, would meet the symphysis of the chin; 2d, the skin, cellular tissue, and deep cervical fascia being divided, the sternal insertion of the sterno-mastoid muscle is laid bare; 3d, divide this in the direction of the external incision, and beneath it will be found the sterno-hyoid and sterno-thyroid muscles, which are to be pushed inwards towards the trachea; 4th, the sheath containing the vessels is now in view, and it should be opened, in the usual manner, as near to the trachea as possible, in order to avoid the vein.

§ 3. *Ligature of the lingual artery.—Malgaigne's method.*—(Pl. 11, fig. 4.) 1st, Having recognized the position of one of the greater *cornua* of the hyoid bone, make an incision about an inch in length parallel with, and about two lines above it, through the skin, cellular tissue, and platysma; 2d, this incision will expose the lower border of the submaxillary gland, on lifting which slightly, the shining tendon of the digastric will be recognized; 3d, less than a line below this lies the great hypoglossal nerve, and at the distance of a line below the nerve, a transverse incision through the fibres of the *genio-hyo-glossus* muscle, will certainly expose the artery, which in this situation is accompanied by neither vein nor nerves.

§ 4. *Ligature of the facial artery as it crosses the lower jaw.*—(Pl. 11, fig. 4.) 1st, Let the patient close his jaws firmly, and feel with the finger for the anterior border of the masseter muscle, where the pulsations of the vessel can generally be distinguished; 2d, make over this point a vertical incision an inch in length, down to the fibres of the masseter; 3d, at its anterior edge the vessel will be found, resting immediately upon the bone, in company with its vein, the artery being nearer the median line. In isolating the artery the cellular tissue around it will be found to be somewhat dense.

PLATE XII.

LIGATION OF THE RADIAL, AND DORSALIS PEDIS ARTERIES.

FIG. 1. SURGICAL ANATOMY OF THE RADIAL ARTERY AT THE WRIST.

1. Posterior annular ligament of the carpus ; tendons of the *extensor ossis metacarpi pollicis*, 2 ; *extensor primi internodii*, 3 ; and *extensor secundi internodii pollicis*, 4.

A, the radial artery (see pl. 7, fig. 1), opposite the radio-carpal articulation, winds around the styloid process of the radius to the back of the wrist, and passes beneath the united tendons, 2, 3, of the *extensor ossis metacarpi*, and *extensor primi internodii pollicis* ; it then descends a little obliquely beneath the tendon of the *extensor secundi internodii pollicis*, and plunges through the first interosseous space of the metacarpus to the palm of the hand, where it terminates by forming the deep palmar arch.

In this course it is accompanied by its veins, and some small branches of the radial nerve ; it is covered by the deep fascia of the limb, and the integuments.

FIG. 2. OPERATION.

a, incision in the skin ; b, deep fascia ; A, radial artery.

FIG. 3. SURGICAL ANATOMY OF THE ARTERIA DORSALIS PEDIS.

1. Anterior annular ligament of the tarsus ; 2, tendon of the *extensor proprius pollicis pedis* ; 3, tendons of the *extensor longus digitorum pedis* ; 4, *extensor brevis digitorum pedis*.

A, the *arteria dorsalis pedis*, a continuation of the anterior tibial, commences beneath the anterior annular ligament of the tarsus, 1, midway between the malleoli, and extends to the commencement of the first interosseous space, where it passes directly downwards to the sole of the foot, and anastomoses with the plantar arch.

Covered by a layer of aponeurosis which binds it down upon the bones of the tarsus, and above this by the fascia of the limb, and the

Fig. 1.

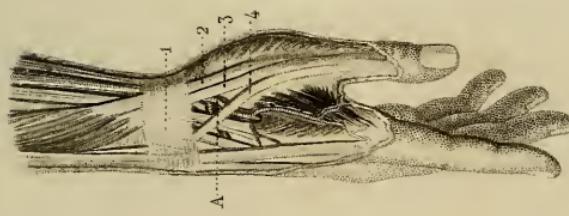


Fig. 2.

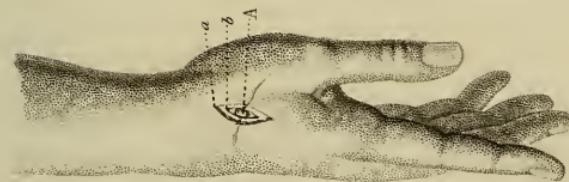


Fig. 3

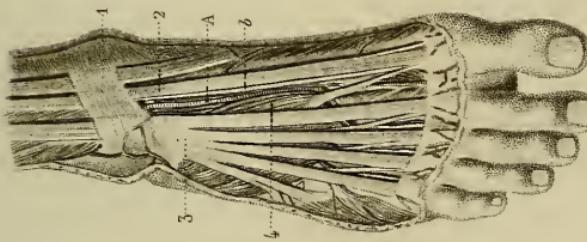
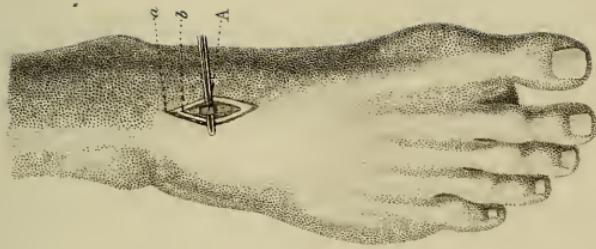
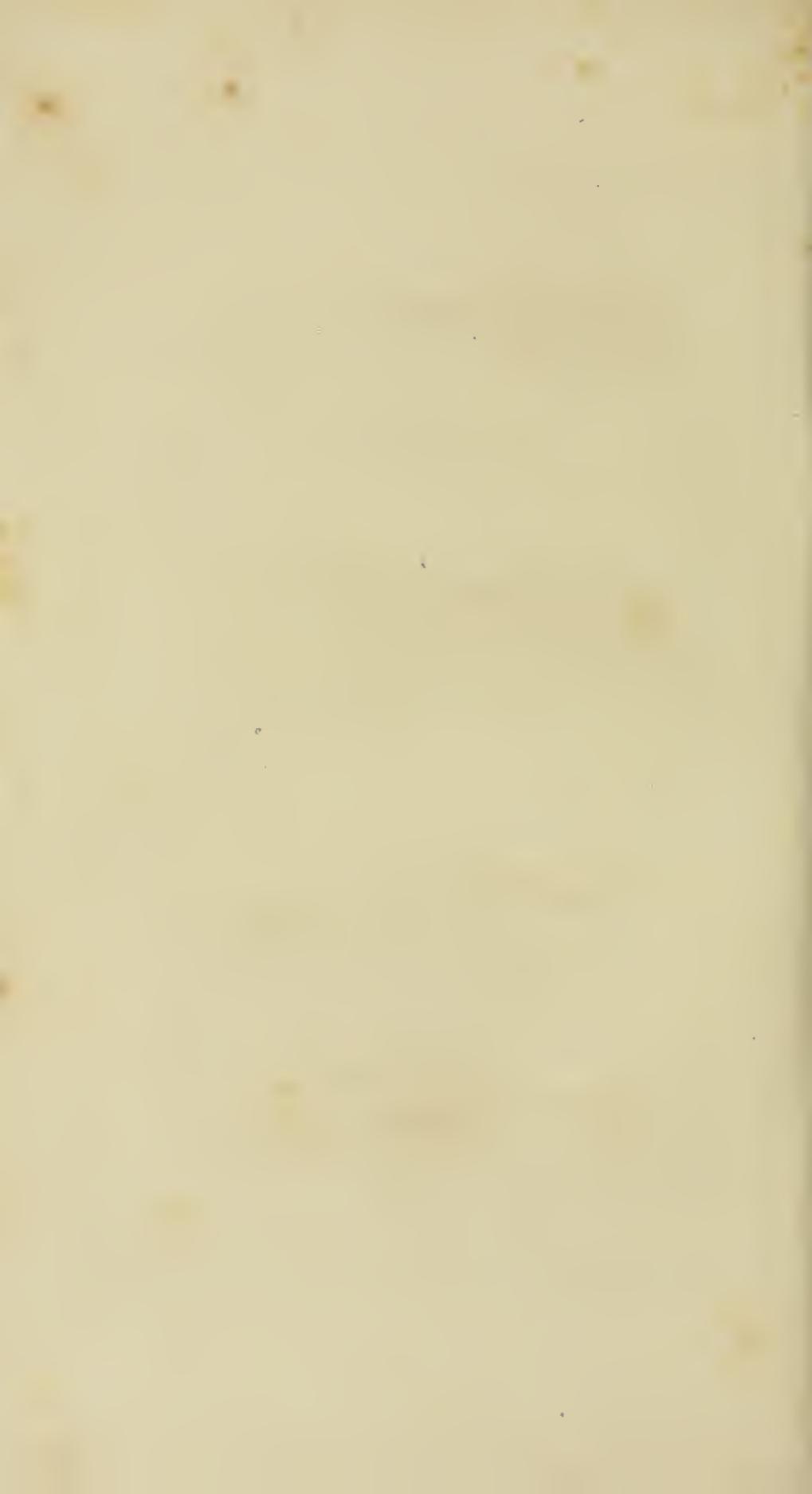


Fig. 4.





skin, the *dorsalis pedis* descends upon the instep, accompanied by its two *venæ comites*, and the anterior tibial nerve *b*, on its inner side. It runs along the outer edge of the tendon, 2, of the *extensor proprius pollicis*, an important relation, which offers an invariable guide to the artery by placing the great toe in the extended position. On its outer side it is in relation with the *extensor brevis digitorum pedis*, 4, which in muscular subjects overlays it to some extent.

FIG. 4. OPERATION.

a, incision in the skin; *b*, incision in the aponeurosis; A, *arteria dorsalis pedis* upon the director.

MODES OF OPERATING.

§ 1. *Ligature of the radial artery at the wrist.—Ordinary method.*—1st. By forced extension of the thumb determine the position of the tendon of the *extensor secundi internodii*; 2d, make an incision about an inch in length along the inner border of this tendon and parallel to it, the centre of which shall correspond to the proximal end of the first interosseous space; 3d, incise the deep fascia in a slanting direction; 4th, beneath this, in the angle at the extremity of the first interosseous space, the artery will be found lying upon the bone between its two veins; isolate it with the point of the director, and pass the ligature beneath it.

§ 2. *Ligature of the dorsalis pedis.*—1st, Make an incision about two inches in length about the middle of the instep, in the course of a line drawn from midway between the two malleoli to the upper end of the interosseous space, between the first two metatarsal bones, along the external border of the tendon of the *extensor proprius pollicis pedis*, and parallel to it; 2d, divide the deep fascia upon a director; 3d, endeavor to recognize the innermost division of the *extensor brevis digitorum*, and lay open the aponeurotic sheath of this muscle; 4th, beneath this, the artery will be found lying upon the bone, between its two veins, from which it is to be isolated and tied in the usual manner.

PLATE XIII.

LIGATION OF THE ANTERIOR TIBIAL ARTERY.

FIG. 1. SURGICAL ANATOMY.

1. Patella; 2, external malleolus; 3, external aponeurosis of the limb; 4 and 5, *tibialis anticus* and *extensor longus digitorum* muscles, separated by blunt hooks, exposing the vessels deeply situated between them; 6, *peroneus longus* and *brevis* cut across; 7, fibula.

A, the anterior tibial artery, the external and anterior branch of the popliteal, akes its origin beneath the tendinous arch uniting the two heads of the *soleus* muscle, and terminates in the *dorsalis pedis*, under the anterior annular ligament of the tarsus. Its direction, which is slightly oblique from above downwards and from behind forwards, would be represented by a line drawn from the centre of the space between the head of the fibula and tuberosity of the tibia, to the centre of the inter-malleolar space on the front of the ankle. The artery passes through the interosseous ligament in the upper fourth of the limb, to its anterior surface, and lies upon it in the upper two-thirds of its course; below this it lies upon the anterior face of the tibia. In the upper half of its course it lies deeply, between the *tibialis anticus* 4, and *extensor longus digitorum*, 5; in its lower half it is more superficially situated between the *tibialis anticus* 4, and *extensor proprius pollicis* 8, which latter muscle crosses it from without inwards, anteriorly, as it passes to its destination; the artery then skirts along the outer side of its tendon, and passes beneath the anterior annular ligament, in the same tendinous sheath.

The *extensor longus* and *tibialis anticus* muscles take their origin partly from the deep fascia in the upper part of the leg, 3, and this arrangement renders it difficult to recognise the intermuscular septum before dividing it freely, and also interferes with the ready separation of the muscles.

B, B, the *anterior tibial veins*, which accompany the artery throughout its course.

Pl. 13.

Fig. 1.

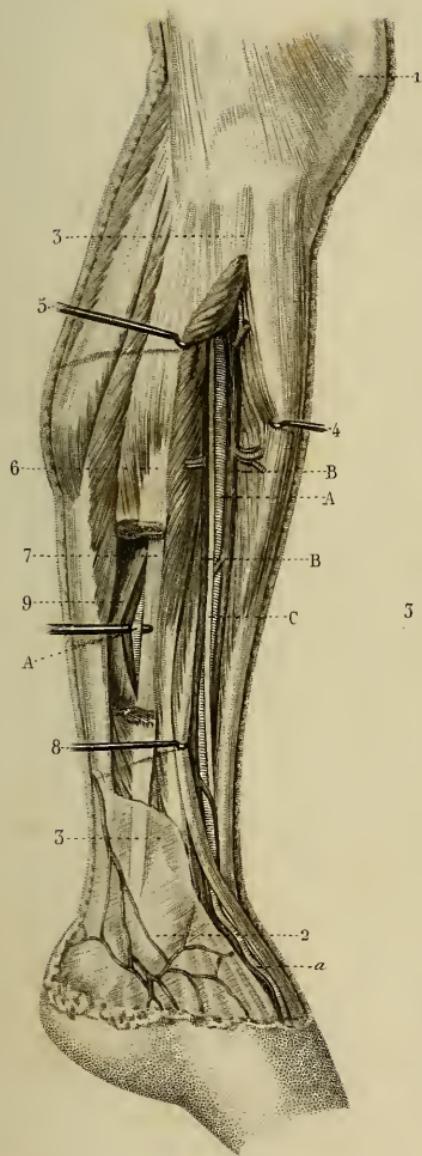
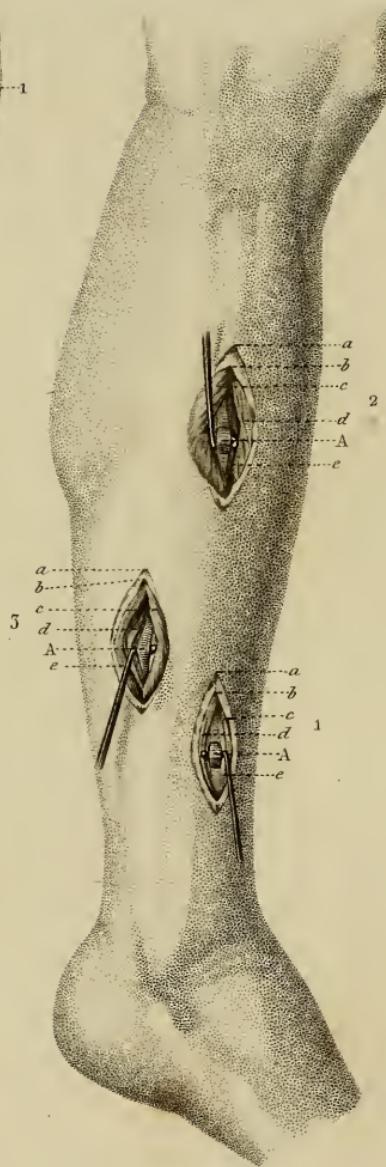


Fig. 2.





C, anterior tibial nerve; at first it lies external to the artery, afterwards crosses it in its lower fourth, and lies internal to it under the anterior annular ligament of the tarsus.

A', the peroneal artery, the most external and posterior branch of the popliteal, runs down the posterior face of the fibula to the *os calcis*, covered above by the *solæus* muscle; lower down it lies between the *flexor longus pollicis*, 9, and the *tibialis posticus* muscles; and in its lower fourth lies upon the interosseous ligament.

FIG. 2. OPERATION.

Incision No. 1. *Ligature of the anterior tibial artery below its middle.*—*a*, incision in the skin; *b*, deep fascia; *c*, *tibialis anticus*; *d*, *extensor proprius pollicis pedis*; *e*, anterior tibial nerve; *A*, artery upon Deschamps' needle.

Incision No. 2. *Ligature of the anterior tibial in its upper half.*—*a*, incision in the skin; *b*, deep fascia; *c*, *extensor longus digitorum*; *d*, *tibialis anticus*; *e*, anterior tibial vein; *A*, artery with the needle beneath it.

Incision No. 3. *Ligature of the dorsalis pedis.*—*a*, incision in the skin; *b*, deep fascia; *c*, *peronæus longus*; *e*, external border of the *solœus*; *d*, *flexor longus pollicis*; *A*, artery upon the needle.

MODES OF OPERATING.

§ 1. *Ligature of the anterior tibial below its middle.*—1st, in the course of a line representing the direction of the artery, or, along the external border of the *tibialis anticus* muscle, the prominence of which can be generally recognised, make an incision through the integuments about three inches in length; 2d, lay open the deep fascia to the same extent upon a director; 3d, separate with the index finger the two muscles until the artery is recognised lying upon the tibia, in company with its two veins; 4th, separate it from its connections and apply the ligature with a needle.

§ 2. *Ligature of the anterior tibial in its upper half.*—1st, about ten lines to the outer side of the spine of the tibia, and in the course of a line drawn from the external tuberosity at the head of the tibia to the middle of the instep, make an incision through the integuments from three to three and a half inches long; 2d, the inter-muscular space being difficult to recognise, it is better to lay open the deep fascia by a crucial incision; 3d, the intermuscular septum will then be sought

for by the finger in the wound, and will generally be recognised by the diminished resistance which it offers; when found, the muscles are to be forcibly separated down to the interosseous ligament, upon which the artery will be found with the nerve lying in front of it, and a vein on either side; 4th, the artery being isolated, the ligature is to be passed beneath it by means of a needle.

§ 3. *Ligation of the peroneal artery below its middle.—Malgaigne's method.* Seek for the external border of the fibula, and about two lines behind it, and parallel with it, make an incision through the integuments from two and a half to three inches in length; 2d, divide the deep fascia to the same extent; 3d, the external border of the *solæus* muscle sometimes lies over the fibula, detach this gently and push it inwards; then, commencing from the external border of the bone, which should be fairly in view, detach from its posterior surface the attachments of the *flexor longus pollicis*, which takes its origin from its lower two thirds; 4th, push this muscle inwards, and at its inner border, near the insertion of the interosseous ligament, the artery will be found lying beneath a layer of the deep fascia derived from the investment of the muscle; having divided this, the artery will be found immediately beneath it.



Pl. 14.

Fig. 1.

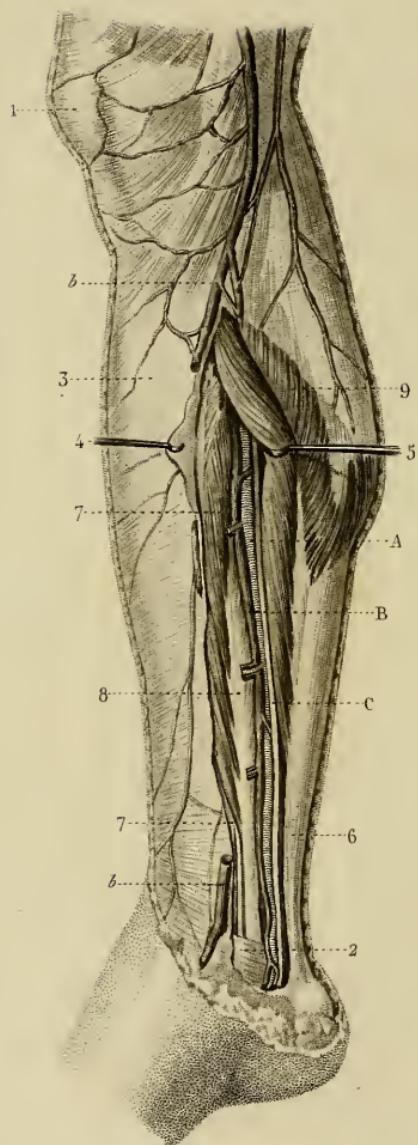


Fig. 2.

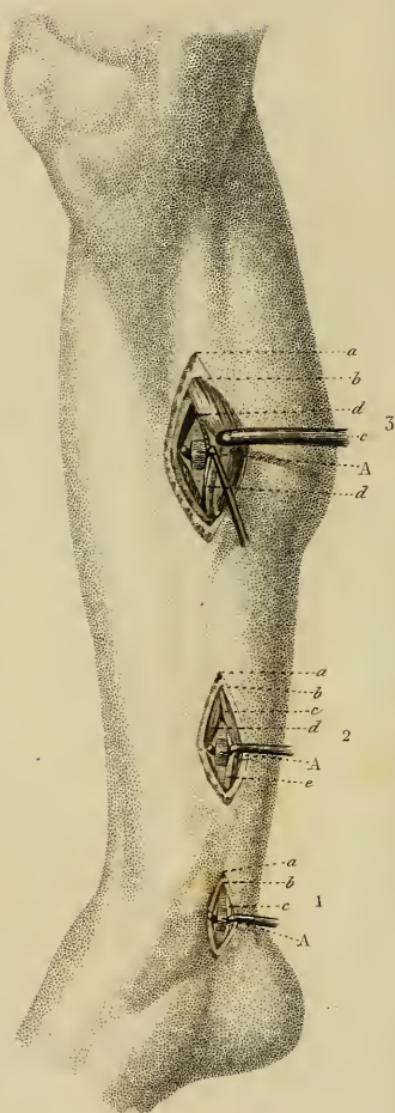


PLATE XIV.

LIGATION OF THE POSTERIOR TIBIAL ARTERY.

FIG. 1. SURGICAL ANATOMY.

1, patella; 2, internal malleolus; 3, internal surface of the tibia; 4, internal aponeurosis of the limb; 5, *solæus* muscles, pulled backwards by the blunt hook.

A, the *posterior tibial artery*, arises from the popliteal on the inner side, and terminates beneath the internal annular ligament of the tarsus, where it divides into the internal and external plantar arteries. Its direction, somewhat oblique from without inwards, would be represented by an imaginary line drawn from the middle of the popliteal space, and terminating behind the internal malleolus.

In its *upper third*, the *posterior tibial artery* is situated deeply beneath the *tibialis posticus*, 7, and covered also by the deep aponeurosis, 4, the *solæus*, 5, and the *gastrocnemius*, 9; in its middle third, it lies nearer the surface, running parallel with the internal border of the tibia, and separated from that bone by the *flexor longus digitorum* muscle, 8, and covered by the deep aponeurosis and the internal border of the *solæus*, 5; finally, in its lower third, lying immediately beneath the deep aponeurosis, it runs behind the tendons of the *tibialis posticus* and *flexor longus digitorum*, in relation posteriorly with the inner edge of the *tendo Achillis*, 6.

BB, the two *venæ comites* of the artery, which anastomose frequently with each other; 6, internal saphœna vein.

C, the *posterior tibial nerve*, lying external to, and behind the artery.

FIG. 2. OPERATIONS.

Incision No. 1. *Ligation of the posterior tibial, in its lower third.* —a, incision in the skin; b, deep fascia; c, posterior tibial nerve; A, artery on the director.

Incision No. 2. *Ligation of the posterior tibial in its middle third.* —a, incision in the skin; b, deep fascia; c, external border of the so-

lœus; *d*, flexor longus digitorum; *e*, posterior tibial nerve; *A*, artery on the needle.

Incision No. 3. *Ligature of the posterior tibial in its upper third.*

—*a*, incision in the skin; *b*, deep fascia; *c*, gastrocnemius, carried backwards by a blunt hook; *d*, incision in the *solœus* muscle; *A*, artery with the needle beneath it.

MODES OF OPERATING.

§ 1. *Ligature of the posterior tibial artery in its lower third, or behind the malleolus.*—*Velpeau's method.*—About one-third of an inch behind the posterior border of the internal malleolus, make a semicircular incision through the skin only, of an inch and three quarters in length, with its concavity looking towards the malleolus; 2*d*, incise the aponeurotic layer beneath cautiously upon a director, carefully avoiding the sheaths of the tendons which lie immediately behind the malleolus; 3*d*, beneath the aponeurosis, and in front of the nerve, the artery will be found, between its accompanying veins.

§ 2. *Ligature of the posterior tibial in its middle third.*—1*st*, At the distance of three-quarters of an inch from the internal border of the tibia, or, in a line midway between the internal border of the tibia and the *tendo Achillis*, make an incision from two and a half to three inches in length through the integuments; 2*d*, incise the deep fascia to the same extent, and push the edge of the *solœus* muscle out of the line of incision; 3*d*, divide the deep aponeurosis upon the director, when immediately beneath it, the artery will be seen, between its two veins.

§ 3. *Ligature of the posterior tibial artery in its upper third.*—*Malgaigne's method.*—1*st*, At the distance of two thirds of an inch from the internal border of the tibia make an incision at least four inches in length, through the integuments and deep fascia; 2*d*, carrying the index finger into the wound, detach and push outwards the internal head of the *gastrocnemius*, and divide also the attachments of the *solœus*, thus exposed, from the posterior surface of the tibia; 3*d*, whilst an assistant keeps this muscle held backwards and outwards with a blunt hook, divide the deep layer of aponeurosis upon a director, and search for the vessel immediately beneath it; 4*th*, detach the artery, and pass the ligature beneath it with the artery needle.

Manec's method. Instead of detaching the *solœus* muscle from the tibia, this author directs that it should be divided, throughout its entire thickness, about an inch from the internal border of the tibia; this

brings in view a thick, pearly, fibrous layer of tissue, into which its fleshy fibres are inserted, the anterior sheath of the muscle, which is perforated by several small arteries. Dividing this freely upon a director, the deep aponeurotic layer covering the artery is brought in view. In the first mode of operating it may happen in the living subject, as in the case of M. Bouchet of Lyons, that in consequence of the contraction of the muscles interfering with the operator, it might become necessary to cut across the *solæus* muscle. The object of Manec's method is to prevent the necessity of this step.*

* Mr. Guthrie proposes to substitute a perpendicular incision, six to seven inches in length, through the centre of the calf, for the ordinary modes of reaching the posterior tibial artery.—EDS.

PLATE XV.

LIGATION OF THE POPLITEAL ARTERY.

FIG. 1, 2, AND 3. SURGICAL ANATOMY.

Fig. 1. *View of the parts after removal of the integuments.*
Superficial vessels and nerves.

1, 1. Deep fascia removed in the upper half of the popliteal region ;
2, *semi-membranosus* muscle ; 3, *biceps* ; 4, cutaneous vessels and
nerves ; 5, internal saphœna vein.

A, *external, or posterior saphœna vein* ; it runs perpendicularly, following the median line of the limb to the middle of the popliteal space, where it perforates the deep fascia ; beneath the fascia it still ascends, and winds around the popliteal nerve, to empty into the popliteal vein. In the first part of its course, above the deep fascia, it is accompanied on its outer side by the *external saphœnous nerve, b* ; it frequently overlays the nerve, and is separated from it by a process of the deep fascia which forms a separate sheath for the nerve.

C, popliteal nerve, lying immediately beneath the deep fascia, passes down the centre of the popliteal space, being situated superficial to, and a little on the outside of the popliteal vessels, from which it is separated by a thin layer of adipose tissue. It gives off several branches, of which the principal is the *external saphœnous nerve, b*, which, after running a short distance beneath the deep fascia, emerges through the same opening which transmits the external saphœna vein.

D, *the peroneal nerve* ; more superficial and smaller than the preceding, it is given off from it, at an acute angle, in the upper part of the popliteal space, and descends obliquely from within outwards, beneath the deep fascia, to be distributed to the muscles on the outside and front of the limb. In the popliteal space it gives off the *communicans peronei*, which is one of the roots of the external saphœnous nerve, and a branch, c, which pierces the deep fascia, and ultimately anastomoses with the external saphœnous nerve.

FIG. 2. *View after removal of the deep fascia.*—The popliteal

Pl. 15.

Fig. 2.
Fig. 3.

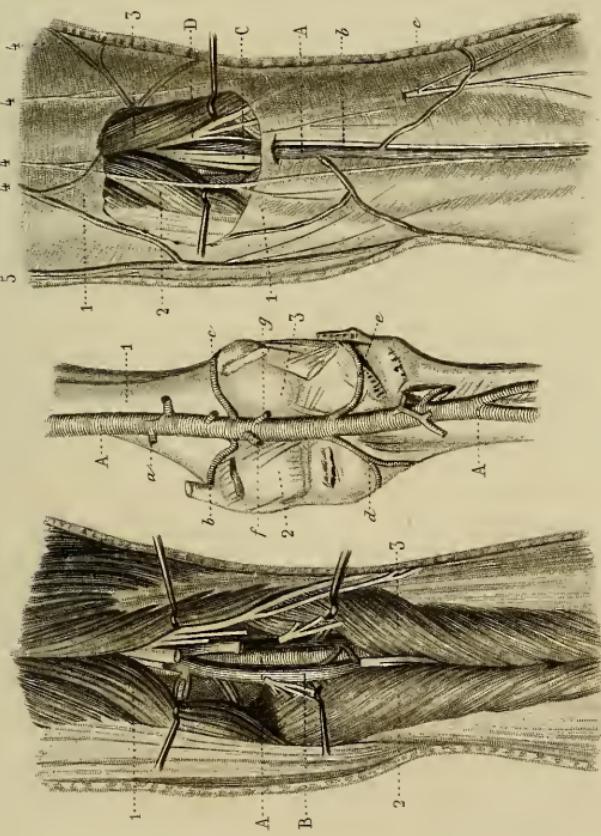
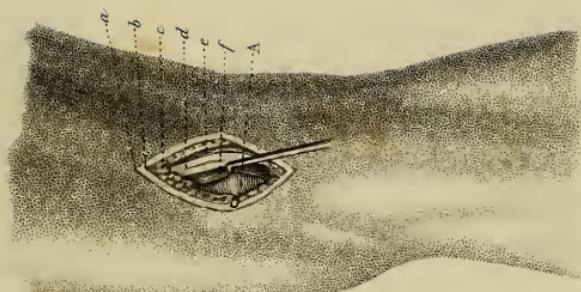


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.





nerve being cut away in a part of its course, and the adipose tissue dissected out, the vessels are exposed to view.

A, the *popliteal artery*, extending from the tendinous opening in the *adductor magnus* muscle to the lower border of the popliteus, runs a little obliquely from within outwards, covered in its whole course, and crossed about the middle of the popliteal space, by the *popliteal vein*, B, whose direction is vertical; in consequence of this relation the artery, always beneath the vein, is somewhat internal to it above, and external to it below. The two vessels are covered superiorly by the belly of the *semi-membranosus*, 1; below they pass between the two heads of the *gastrocnemius*, 2, 3. They are connected together, throughout their course, by dense cellular tissue which renders their separation difficult.

FIG. 3. The *popliteal artery*, at first on the inner side of the femur, 1, afterwards approaches the centre of its posterior face, and passes downwards between the condyles, 2, 3, in contact with the articulation, 2. In its course it gives off several branches, of which the principal are: the *superior articular arteries*, a, b, c; the *inferior articulars*, d, e, which anastomose with the preceding in front of the knee; the *middle articular arteries*, which enter the articulation, and the *sural arteries*, f, g, which enter the *gastrocnemius* muscle.

FIG. 4. OPERATION.

Ligature of the popliteal artery in its superior half.—a, incision of the skin; b, deep fascia; c, adipose tissue; d, peroneal nerve; e, external saphoena vein; f, popliteal vein; A, artery upon the needle.

MODE OF OPERATING.

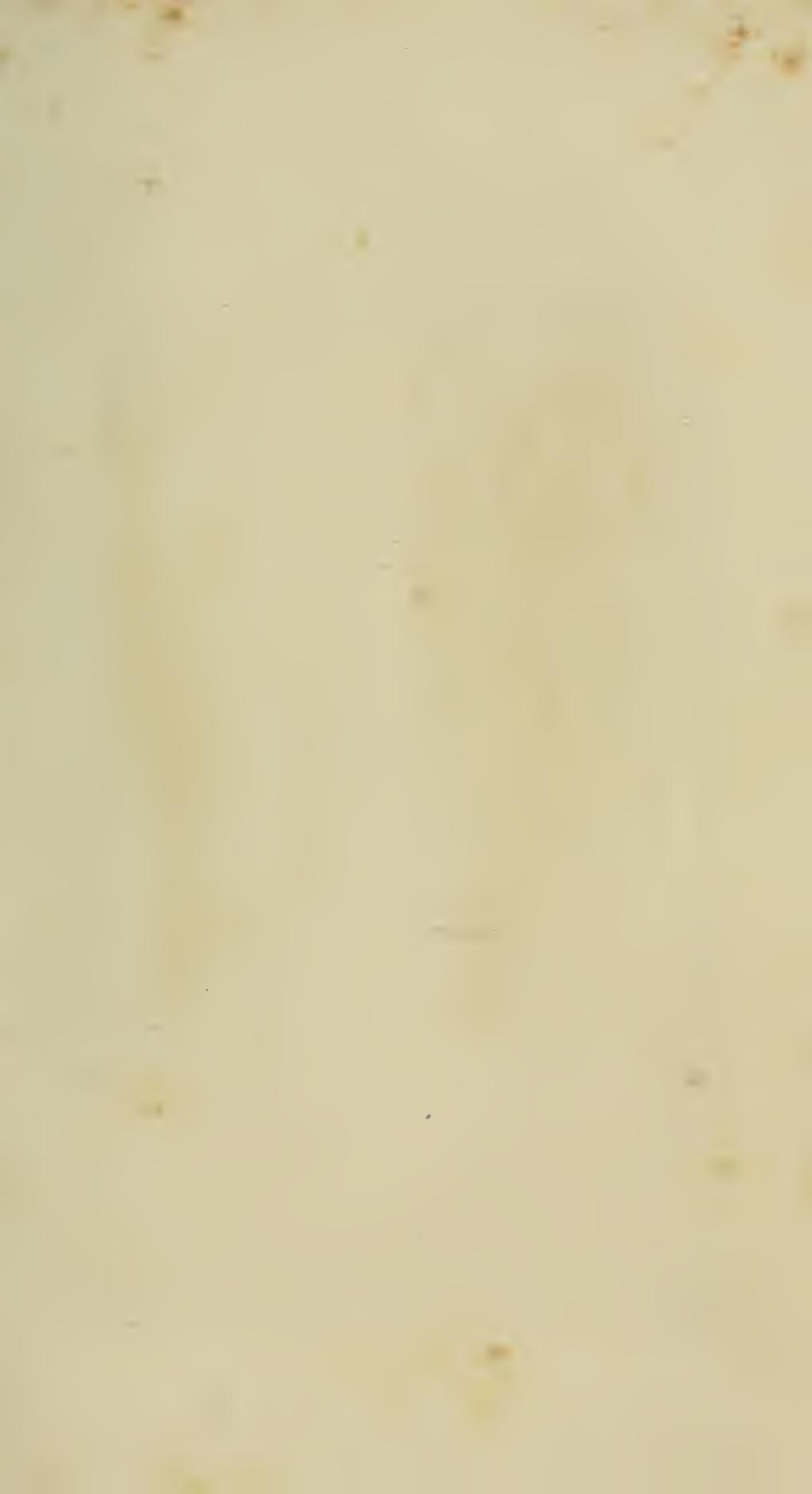
Ordinary method.—1st, the patient lying on his face with the limb extended moderately, make an incision from three to four inches in length through the skin and cellular tissue in the middle of the popliteal space, and in the dissection of the length of the limb; 2d, divide the deep fascia to the same extent upon a director, taking care to push the external saphoena vein to the outside; 3d, tear very carefully through the cellular tissue and fat, with the point of the director, at the same time flexing the leg slightly upon the thigh in order that the muscles may be separated with more facility; 4th, push the popliteal nerve, which is encountered first in the wound, to the inside; beneath this and a little to the inner side is found the popliteal vein, whose

connections are to be cautiously detached and the vein pushed also to the inner side, whilst the artery is sought for beneath it, in contact with the ligaments of the articulation.

The popliteal artery may also be tied, both in the upper and lower half of the popliteal space, by the following method, with this difference only, that in order to reach the artery *in its lower half*, the external incision must be made three and a half inches long, commencing half an inch below the articulation of the knee, and extending along in the centre of the interval between the two heads of the gastrocnemius muscle. To tie the artery *in the upper part of its course* (see fig. 4), above the condyles of the femur, an incision four inches in length is required, which should begin on the lower third of the thigh, at a point opposite to the commencement of the artery, near the external border of the muscular prominence bounding the popliteal space on its inner side, and terminate at the centre of the space, opposite to the articulation.

Marchal's method.—Here the operator proposes to tie the artery in its lower half, but in place of getting at it through the popliteal space, as heretofore, the incision is made on the inner side of the limb just below the internal condyle of the femur. To do this, the patient should be placed upon his back, the limb flexed and lying on its outer side, and the surgeon standing on its outer side; an incision three inches in length is then made obliquely downwards and inwards, hugging the internal edge of the inner head of the gastrocnemius, and four or five lines distant from the inner border of the tibia. The integuments being incised, and the internal saphœna vein kept out of the way, the inner head of the gastrocnemius is separated from the deep layer of muscles by introducing the finger into the wound, and breaking down its cellular adhesions, and at the same time bending the leg upon the thigh to secure relaxation of its muscles; in this manner the artery is soon reached, lying on the inside of the posterior tibial nerve, and surrounded by several veins; nothing more is required but to divide the lamina of deep fascia which lies over it.

Jobert's method.—Here the artery is tied in its upper part, but through the inner side of the thigh, just above the condyle, instead of through the ham. The incision should be three inches long, and should correspond to the *vastus internus*, and the muscles which form the inner border of the popliteal space.



Pl. 16.

Fig 1.

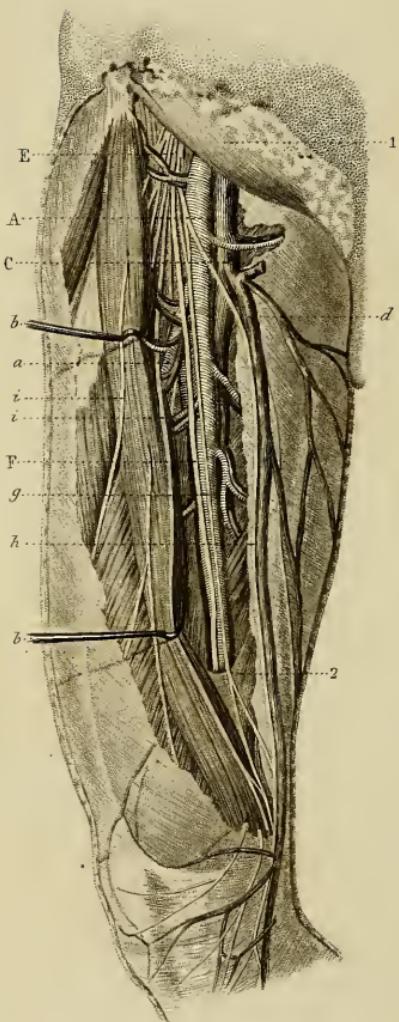


Fig 2.

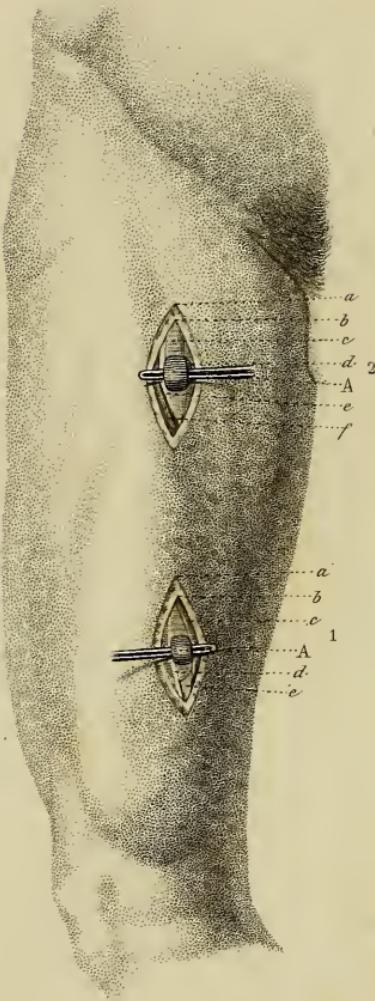


PLATE XVI.

LIGATURE OF THE FEMORAL ARTERY.

FIG. 1. SURGICAL ANATOMY.

A, the *femoral artery*, the continuation of the external iliac, commences beneath the middle of the crural arch, formed by Poupart's ligament, 1, and terminates at the tendinous opening in the *adductor magnus* muscle, where it takes the name of *popliteal*. Its course is oblique, winding around the thigh in a spiral direction; at its commencement it is in front; in the middle of the thigh, on its internal side; and below, in the popliteal space, on its posterior aspect. In its upper fourth the artery is covered only by the lymphatic glands of the groin, the fascia lata, and the skin; here, its superficial position renders it easily compressible against the horizontal ramus of the pubes, or the head of the femur, which lie behind it. Lower down, the *sartorius* muscle lies between it and the integuments, crossing its track very obliquely, in such a manner that the artery corresponds with the internal edge of the muscle at one part of its course, and below, at the opening in the *adductor* muscle, with its external edge.

C, the *femoral vein*, accompanies the artery throughout its course; on its inner side, beneath Poupart's ligament; behind it, in the middle of the thigh; and behind, and a little to its outer side, below. The two vessels, which are connected by an unusually dense cellular tissue in the lower two-thirds of their course, are contained besides in a sheath given off by the fascia lata. The *internal saphœna vein*, d, which lies immediately beneath the skin, skirts along the internal edge of the *sartorius* muscle, and empties into the femoral vein of the saphœnous opening.

Æ, the *anterial crural nerve* lies on the outer side of the artery, and is separated from it by a layer of the iliac fascia.

The *long saphœnous nerve*, F, enters the sheath of the vessels, in their upper fourths, and runs down in company with them from this point, lying on the outer side of the artery; at the opening in the ad-

ductor magnus it crosses in front of the artery, and still lower down leaves it to accompany the internal saphœna vein. Another branch of the anterior crural nerve, *g*, lies in front of the femoral sheath, and from this a filament is given off, *h*, which passes across the vessels to join the internal saphœnous vein which it accompanies *i*, *i*; musculo-cutaneous branches.

FIG. 2. OPERATION.

Incision No. 1. *Ligature of the femoral artery in its lower fourth.*—*a*, incision in the skin and subcutaneous cellular tissue; *b*, fascia lata; *c*, external edge of the *sartorius*, pushed inwards; *d*, long saphœnous nerve; *e*, the tendinous sheath of the femoral vessels; *A*, the artery, on the director.

Incision No. 2. *Ligature of the femoral artery in its upper third.*—*a*, incision through the integuments; *b*, fascia lata; *c*, sheath of the femoral vessels; *d*, femoral vein; *e*, saphœnous nerve; *f*, inner edge of the *sartorius*; *A*, artery upon the director.

MODES OF OPERATING.

§ 1. *Ligature of the femoral artery in its lower fourth, or at the opening in the adductor muscle.* (See fig. 2, incision No. 1.) 1st. The thigh being slightly flexed and rotated outwards, and the course of the artery being represented by a line drawn from the middle of Poupart's ligament downwards, and crossing the thigh obliquely inwards to the centre of the popliteal space, make an incision on this line,—or still better, if it can be recognised beneath the integuments, along the external edge of the *sartorius* muscle,—to the extent of three inches, through the skin and subcutaneous cellular tissue,—the centre of the incision corresponding to the union of the middle with the lower third of the thigh.

2d. Recognise with the finger the position of the *sartorius* muscle, and divide the fascia lata some two lines within its outer border; this will allow the muscle to be pushed inwards, and the posterior layer of its fascial sheath to be divided to the same extent. Then, feeling with the finger for the separation between the *vastus internus* and *adductor* muscles, divide carefully on a director the fibro-cellular layer which lies between them; this is the anterior wall of the canal formed for the passage of the artery, and after its division the vessel is brought in sight, with the vein behind it, and the nerve in front, and to its outer side.

3d. Separate very cautiously the dense cellular tissue by which the vessels are connected, and pass the needle from without inwards.

§ 2. *Ligature of the femoral at the middle of the thigh.*—1st, The limb being placed in the situation already described, make an incision on the course of the artery, at the middle of the thigh, following the internal edge of the sartorius muscle, and taking care not to wound the internal saphena vein; 2d, push the *sartorius* muscle outwards until the sheath of the vessel, which lies beneath it, is brought into view; 3d, carefully lay open the sheath of the vessels upon a director; 4th, separate the vein from the artery, which is more easily effected at this point, and pass the needle from within outwards (see fig. 2, incision No. 2).

§ 3. *Ligature of the femoral in the upper third of the thigh, or in Scarpa's space.* In this method the object is to get at the artery near the apex of the triangle in which it lies in the upper third of the thigh, which is formed by the meeting of the *sartorius* and the *adductor brevis* muscles, its base being Poupart's ligament.

1st. At about four inches and a half below Poupart's ligament, the point where the artery begins to pass beneath the *sartorius* muscle, and where its pulsations become consequently somewhat less distinct, commence an incision three inches in length and carry it downwards along the internal edge of the *sartorius*. 2d, the *saphena* vein, which lies in the cellular tissue beneath the skin, must be pushed inwards to avoid its being wounded, and some of the lymphatic vessels and glands are almost of necessity involved in the incision. 3d, the fascia lata being divided on the director, we come at once upon the artery in its sheath, lying along the inner border of the muscle, with the saphenous nerve on its outer side, and the femoral vein within and behind it. 4th, the artery having been carefully isolated, pass the needle, or director, beneath it from within outwards.

PLATE XVII.

LIGATION OF THE FEMORAL ARTERY UNDER POUPART'S LIGAMENT, OF THE EXTERNAL ILIAC, AND EPIGASTRIC ARTERIES.

FIG. 1 AND 2. SURGICAL ANATOMY.

Fig. 1, 1. The external oblique, internal oblique and transversalis muscles with the integuments and aponeurotic layers which constitute the anterior wall of the abdomen, removed by dissection, leaving, 2, the peritoneum and fascia transversalis, concealing the convolutions of the intestines. The fascia transversalis furnishes an investment for the spermatic cord in the shape of an infundibuliform prolongation, 3; 5, Poupart's ligament, or crural arch; 6, fascia lata,—its cribiform portion removed to show the femoral vessels.

A, *femoral artery*; B, *femoral vein*; between the vein and artery a layer of fascia is seen, 7, which is the partition by which the femoral canal is divided into separate compartments. C, D, *internal saphena vein*, with lymphatic vessels and glands.

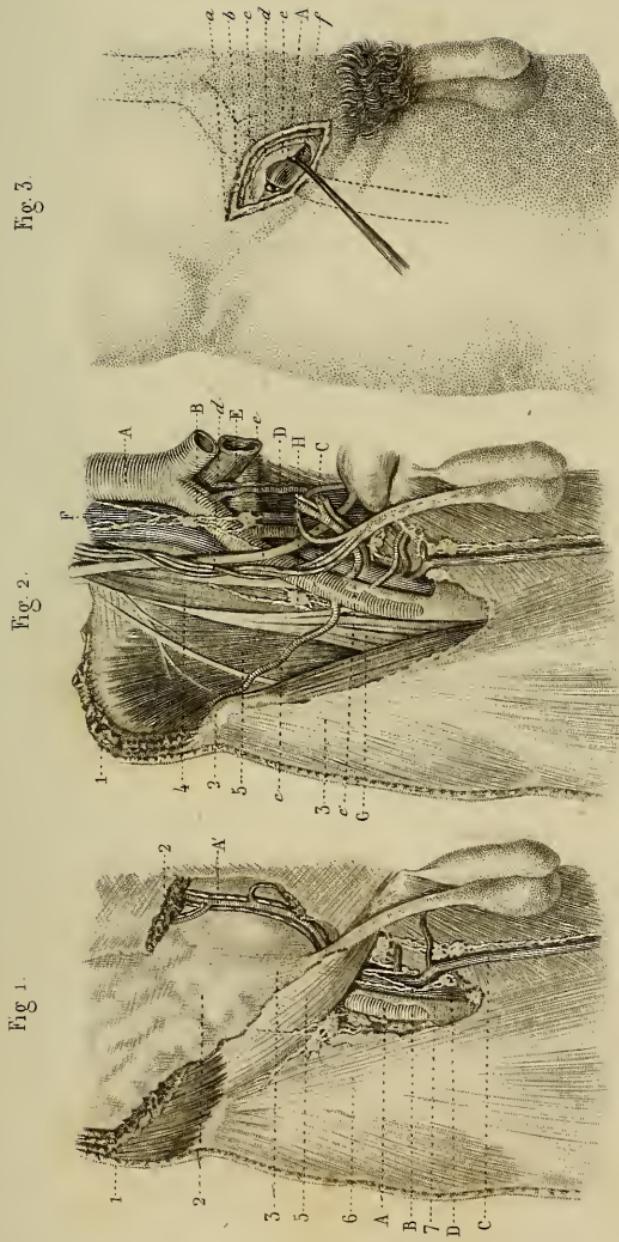
A', the epigastric artery, arising from the inner side of the external iliac, beneath Poupart's ligament. It passes beneath the spermatic cord, (beneath the round ligament in the female,) making a curve the concavity of which looks upward, and passes up obliquely from without inwards, between the peritoneum and fascia transversalis to the external edge of the rectus muscle, beneath which it is lost. 8, the two veins which accompany the artery.

Fig. 2. 1, section of the muscles of the abdomen at their insertion into the crest of the ilium; 2, anterior superior spine of the ilium; 3, fascia lata of the thigh; 4, psoas muscle; 5, iliacus internus muscle.

A, *aorta*; B, *right primitive iliac*; arising from the aorta at its bifurcation, opposite to the inferior border of the fourth lumbar vertebra, it descends obliquely outwards to the sacro-iliac symphysis, where it divides into the *external iliac artery*, C, and the *internal iliac*, D.

The *external iliac* C, continues in the direction assumed by the primitive iliac until it arrives beneath Poupart's ligament, so that the

Pl. 17.





two arteries together form almost a straight line, resting above upon the vertebral column, and lower down upon the psoas muscle, 4 ; the external iliac artery, whilst passing beneath Poupart's ligament, gives origin on its outer side to the circumflex iliac artery, *c*, and within, to the epigastric, *c'*.

The internal iliac, or hypogastric artery, D, diverges from the preceding at an acute angle, and passing downwards into the pelvis is distributed to the organs contained in that cavity.

At their point of origin at the sacro-iliac symphysis, the *iliac arteries* are crossed by the *ureter*, *e*, and the *spermatic vessels*, *d*.

E, the *iliac veins*, situated at first on the inner side and behind the arteries, unite to the right of the bifurcation of the aorta to form the *inferior vena cava*, F.

The left iliac vein, at first in contact with its artery, towards its termination crosses behind the right iliac artery, in order to form a union with its fellow of the opposite side.

G, *anterior crural nerve*. H, H, *lymphatic vessels and glands*.

FIG. 3. OPERATION.

a, incision in the skin ; B, C, D, divided edges of the muscles and fascia of the anterior abdominal walls ; *e*, peritonœum detached and pushed upwards ; *f*, external iliac vein ; A, external iliac artery, with the needle beneath it.

MODES OF OPERATING.

§ 1. *Ligature of the femoral artery beneath Poupart's ligament*.—1st, beneath the centre of a straight line drawn from the anterior superior spine of the ilium to the symphysis pubis the pulsations of the femoral artery can be readily felt, as it is here very superficial. 2d, make an incision commencing immediately over Poupart's ligament, and extending two inches downwards in the course of the vessel ; this incision will involve the skin, subcutaneous cellular tissue, and some lymphatic vessels and glands which it is impossible to avoid. 3d, divide with care, upon the director, the sheath of the vessels, beneath which the artery will be found, with the nerve on its outer side and the vein within, but separated from each by a process of fascia, (see fig. 1-7). 4th, separate the artery from its connections, and pass the needle from within outwards.

§ 2. *Ligature of the external iliac artery*.—The patient lying upon his back with the muscles of the abdomen in a state of relaxation, make

an incision three and a half inches in length, just above Poupart's ligament, and parallel with its general direction, but in a curved line, with the convexity downwards: The first stroke of the knife through the skin and superficial fascia divides sometimes the superficial epigastric artery, the cut ends of which should be tied before proceeding farther. The aponeurotic expansion of the external oblique should then be carefully divided, and afterwards the internal oblique and transversalis to the same extent. The finger should now be carried along the spermatic cord into the internal ring, and the fascia transversalis pushed upwards and outwards, taking great care not to injure the peritoneum. If at this stage of the operation the artery cannot be recognised by the eye at the bottom of the wound, the finger should be employed to ascertain its exact position, and then, with the point of the director, the sheath of the vessels furnished by the *fascia iliaca* should be cautiously torn through, and by the same means the artery should be separated from the vein and the nervous filament which accompanies them, and the needle inserted beneath it from within outwards.*

§ 3. *Ligature of the epigastric artery.*—The incisions employed in the ligature of the preceding artery may be applied to the epigastric, only they should not be so extensive. When the spermatic cord is brought in view, let it be lifted up so as to expose the inner border of the internal ring, through which it is about entering the cavity of the abdomen. Dilate the ring by introducing the point of the finger, and immediately behind the layer of transversalis fascia, which constitutes its internal border, the pulsations of the artery will be felt.

§ 4. *Ligature of the internal iliac artery.—Stevens' method.*—1st. Make an incision from four and a half to five inches in length, half an inch on the outer side of the epigastric artery and parallel with it. 2d. Having divided successively the integuments and abdominal muscles, detach the peritoneum with the utmost care from the psoas and iliacus muscles, and push it gently inwards and upwards until the bifurcation of the primitive iliac can be distinguished. 3d. Feel for, and isolate the artery with the index finger, and pass the ligature beneath it.

A similar process may be employed for the ligature of the *primitive iliac artery.*†

* This operation was first performed by Abernethy, in 1796.

† The *primitive iliac artery* may be tied by means of an incision similar to that employed for the ligature of the external iliac, but carried upwards and outwards to the extent of from five to seven inches. The external iliac being recognised as

§ 5. *Ligature of the gluteal artery. Robert's method.*—The patient lying upon his face, ascertain in the first place the position of the top of the great trochanter and the posterior superior spine of the ilium. 2d. Make an incision three inches in length, commencing an inch below the posterior superior spine of the ilium, and an inch to the outer side of the sacrum, and descending obliquely towards the top of the great trochanter. 3d. The incision having been carried successively through the skin, cellular tissue, and the fibres of the *glutæus magnus* muscle, the artery will be found lying immediately below the upper edge of the great sciatic notch. 4th. Separate the *pyramidalis* and *glutæus medius* muscles, which tend somewhat to conceal the artery, isolate it, and pass the ligature.

above, it is followed upwards, the peritoneum being very cautiously detached and raised in the same direction until the common iliac trunk is brought in view. The ligature is then passed beneath it, with the aid of the American artery needle, from within outwards, carefully avoiding the ureter.

This operation was first successfully executed in this manner by Mott, in 1827. It has been performed in all, fourteen times, at least six of which were successful.
—Eps.

AMPUTATIONS

THROUGH THE JOINTS, OR DISARTICULATIONS.

When it becomes necessary, from one of the various causes, which it is not required to enumerate in this place, to remove a limb, or a part of a limb, by amputation through one of its joints, it is requisite : 1st, to recognize accurately the situation of the articular surfaces ; 2d, to divide the parts which unite them by cutting across the articulation ; 3d, to manage the incisions through the soft parts surrounding the articulation in such a manner that enough of them shall be left to cover the stump fairly, in order that cicatrisation may take place without difficulty.

§ 1. *General rules for determining the position of a joint.*—Around the extremities of almost all the bones which articulate with other portions of the skeleton certain bony prominences, or *tuberosities*, are distinguishable beneath the skin. These tuberosities, situated at variable distances from the joint, always bear to it accurate and unvarying relations, and are therefore sure guides to the surgeon. To recognize them with facility, the following mode of examination should be adopted : 1st. Commence always with that which is the most prominent and well marked, and having recognized its exact position and relations, the other smaller and less distinct projections will be more readily made out. 2d. To do this to the best advantage, place the limb to be examined in a convenient position, and from time to time, as required, give the joint all its natural motions in succession, and thus the bony prominences around it will be rendered more evident, and the tendons, or ligaments, attached to them, will be thrown more or less into relief.

We generally find also around the articulations *wrinkles*, or *creases in the skin*, the position of which is sufficiently constant to serve as indications to the surgeon of the situation of the joint. These folds in the skin, which are particularly well marked around the joints of the fingers, are sometimes found lying immediately over the articulation, at others again at a constant distance from it.

It might happen, however, that an accumulation of fat, or serum, around a joint, should mask the bony prominences, and efface the

wrinkles in the skin; or that a painful disease in its vicinity should render it impossible to give the joint its natural motions. In such a case we should endeavor to recognize the parts, as far as possible, by searching along the shaft of the bone towards its extremity with the finger, and then, if absolutely necessary, cut in the probable situation of the joint, making an appropriate flap, and feel in the wound for its exact position; failing in this search, the heel of the knife, applied perpendicularly to the bone, should be carried up and down its surface, in the probable situation of the joint, until its edge enters between the articular surfaces.

§ 2. Rules for cutting through an articulation. To traverse an articulation without hesitation, in the midst of the blood and soft parts which frequently mask the articular surfaces, the operator should have the disposition of the joint so fixed in his mind, that he could trace it out exactly without having it under his eye. It is no less necessary that he should be familiar with the exact situation, size and attachments of its ligaments, in order to recognize and cut through them without delay.

According to Lisfranc, knives for disarticulations should be narrow in the blade, in order that they may be readily turned in a joint, and thick in the back to ensure sufficient strength.

These points settled, we proceed to the operation of disarticulation, keeping in mind the following general rules:

1st. The thumb and index finger of the left hand should be applied one on either side of the joint, for the purpose of defining its exact position, when ascertained, and of guiding the knife accurately.

2d. When an articulation is to be entered from its anterior aspect, it should be held in the extended position; when on the contrary, the knife is applied to its posterior surface, the limb should be semi-flexed, in order to increase the distance between the articular surfaces.

3d. The principal ligaments of the joint should be divided at first. The lateral and dorsal ligaments being severed, the knife can generally be carried between the articular surfaces. But if the joint present several irregular surfaces for articulation, what are denominated *interosseous ligaments* may exist, passing from one bone to the other, within the joint; these require to be divided with the point of the knife before it can be fairly entered.

4th. When the articulation has been thus opened, it is in general sufficient to make gentle traction on the distal portion of the limb, in

the direction of its axis, in order to separate the articular surfaces enough to allow the knife to be passed between them. If the joint is too close and tight for this manœuvre to succeed, the articular surfaces must be partially dislocated, always, however, employing great care that no violence be done to the neighboring soft parts. Finally, if any ligaments should prove to be ossified, they must be divided by the saw.

5th. When the knife has fairly entered the articulation, its heel and point should act in the same plane, and if, whilst it is being carried around the articular surfaces to the opposite side of the limb, the integuments from which the flap is to be formed should be in danger of being cut irregularly, they should be drawn out of the way by the thumb and index finger of the hand which supports the articulation.

§ 3. *Of the mode of operating.*—The manner of making the incisions in the soft parts to provide a covering for the stump, depends upon the kind of operation selected. For all amputations of the limbs there are three principal forms given to the wound. In the first, the soft parts are all divided by a *circular* incision around the limb, and the cut surface is afterwards covered by the integuments only, which, before the section of the muscles, are turned up like the cuff of a sleeve. In the second, the part to be removed is circumscribed by an elliptic incision, which, after the operation is finished, leaves a wound, the edges of which are easily brought in contact, and whose shape gives the name to this style of amputation of the *oval* method. Finally, in the third mode, one or more flaps are fashioned out of the soft parts in its vicinity for the purpose of covering the extremity of the amputated limb; and to this process the name of *flap* operation is applied. To each of these general methods belongs a variety of operative procedures; all of which result, however, in the production of a stump bearing the characteristics either of the *circular*, *oval*, or *flap* operation. Thus, then, the general method indicates the character of the result aimed at, and the modes of operating, the different means by which this result is attained.

§ 4. *On the formation of flaps.*—1st. One, or several flaps may be made, according to circumstances. In the latter case, the least important flap should be made first, and that containing the larger vessels should be left until after the separation of the bones is completed, in order that, if necessary, they may be seized and compressed by an assistant before their final section.

2d. The flap should terminate by a curved line, and not by a point,

and to effect this, the knife must be carried along freely and without hesitation, parallel with the bone, until, by bringing it in contact with the surface it is intended to cover, it is found to be of sufficient length, when turning the edge of the knife directly outwards, the tissues are cut through square and clear. If the tendons project beyond the skin, they should be cut off with the scissors.

3d. Healthy tissues should be selected as much as possible for the formation of flaps; nevertheless, if necessary, they may be made from inflamed or infiltrated parts, as by judicious management this swelling will diminish under the suppurative process without much danger of gangrene. Finally, according to Lisfranc, a disarticulation may be undertaken where there are no soft parts from which to form a stump, experience having proved that a sound cicatrix will be formed over the articular surfaces.

PLATE XVIII.

DISARTICULATION OF THE LAST TWO PHALANGES OF THE FINGERS, AND OF THE WHOLE FINGER.

SURGICAL ANATOMY.

Fig. 1. *Bones of a finger in their natural relation, seen on their palmar aspect.*—*a*, inferior extremity of the metacarpal bone; *b*, first phalanx; *c*, head of the first phalanx; *d*, second phalanx; *e*, third phalanx.

The phalangeal articulations are all perfect ginglymoid joints, that is to say, they allow but of two motions, flexion and extension. The head of the first phalanx presents two condyles separated by a groove; these fit into the two corresponding cavities in the second phalanx, which have a ridge between them. Each phalanx presents, also, near its articular surfaces, decided bony projections, both on its palmar and dorsal aspect, (Fig. 1, *c, c*; fig. 2, *e*); two lateral ligaments give the articulations almost all their firmness. The extensor tendon behind, and a ligament in front, of little strength, complete the ligamentous apparatus of each joint. The interarticular line, the direction of which is almost transverse, of the articulation of the first with the second phalanx, is exactly opposite the fold of the skin on its palmar surface, and in the articulation of the second with the third, it is a line and a half below its corresponding fold.

Fig. 2. *Vertical section of the bones of a finger, showing the relations which the lines of the articulations bear to the folds of the skin.*—*a*, inferior extremity of the metacarpal bone; *bb*, line of the metacarpo-phalangeal point, to be found, in the normal state, about twelve or thirteen lines above the commissure of the fingers, *c*; *dd*, inter-articular line between the first and second phalanges, situated exactly opposite the fold of the skin; *ff*, inter-articular line between the second and third phalanges, situated a line and a half below the fold of skin on the palmar surface of the finger.

Fig. 3. *Relation of the flexor tendons to the bones of the finger.*—

Pl. 18.

Fig. 1.

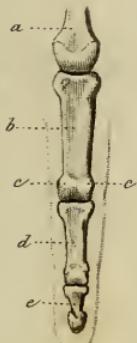


Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

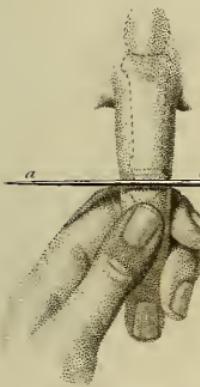


Fig. 6.

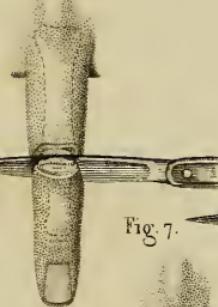


Fig. 10.



Fig. 9.

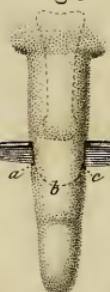


Fig. 8.



Fig. 12.

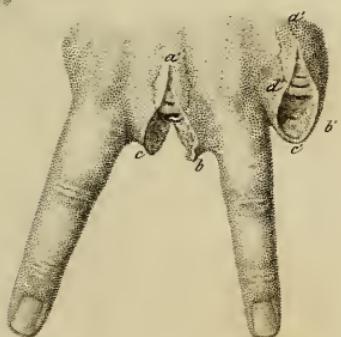
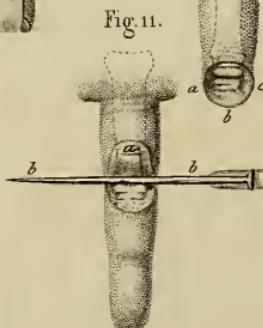
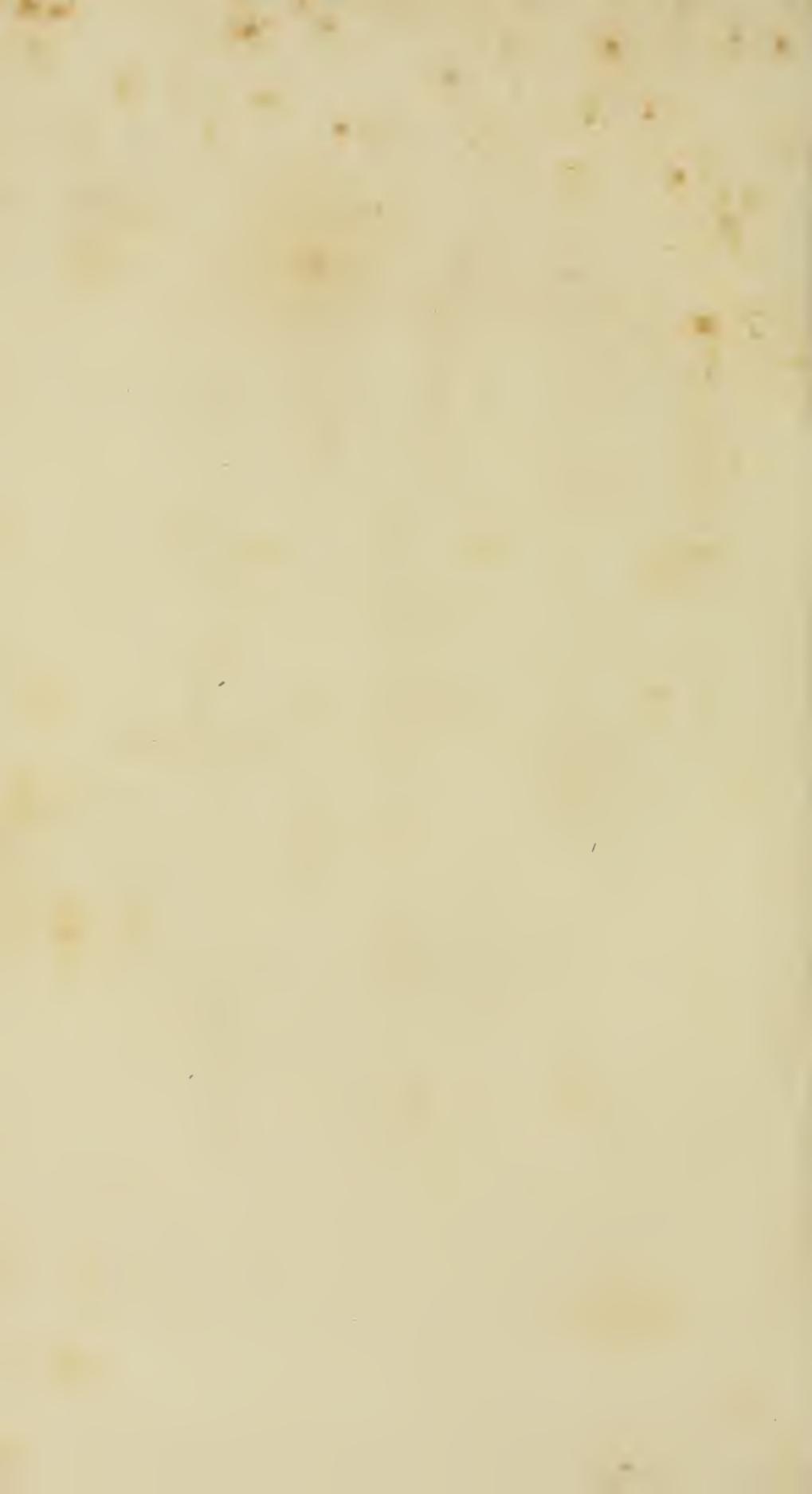


Fig. 11.





a, a, a, dorsal aspect of the articulations ; *b*, tendon of the *flexor digitorum sublimis perforatus* ; *c*, tendon of the *flexor profundus perforans*.

Fig. 4. *View of a finger in a state of flexion, showing the relation of the articular surfaces of the phalanges to each other when flexed.*

OPERATIONS.

Fig. 5. *Disarticulation of the second phalanx (finger) ; from the dorsal aspect of the joint. 1st, Lisfranc's method.*—1st, the edge of the bistoury *a, a*, about to enter the articulation.

Fig. 6. Same operation. 2d, after having cut through the articulation, the bistoury is brought beneath the second phalanx, for the purpose of cutting out a flap from its palmar surface.

Fig. 7. Operation finished ; flap brought up into its place, and retained there by a strip of adhesive plaster.

Fig. 8. A modification of the preceding method. (*See modes of operating.*)

Fig. 9. *Disarticulation of the second phalanx ; from the palmar aspect of the joint. Lisfranc's second method.*—*a, b, c*, shape to be given to the palmar flap.

Fig. 10. Operation completed.

Fig. 11. Same operation after the bistoury *b b* has entered the joint, the flap being turned upwards.

Fig. 12. *Disarticulation of the entire finger.*—*a, b, c*, wound left after the operation with two flaps ; *a' b' c' d'*, wound left after the operation by the oval method.

MODES OF OPERATING.

§ 1. *Amputation of the finger between the first and second phalanges. Circular method.*—The hand being placed in the state of pronation, an assistant should confine all the fingers in a flexed position except the one about to be operated on. Then the operator, holding the finger in an extended position with the thumb, index and middle finger of his left hand, makes a circular incision around it with the bistoury held in the first position, one-third of an inch below the articulation for the second phalanx, and one-fourth of an inch for the last phalanx. This incision being carried through the skin and cellular tissue, the assistant, by a suitable amount of traction, drags up the in-

teguments as far as the articulation, so that the surgeon can cut through it by dividing its ligaments, entering his knife on its dorsal aspect.

Flap Operations.—Ledran's method by two lateral flaps, and Garganeot's operation, with a dorsal and a palmar flap, are at present out of use, the operation with a single flap having been almost entirely substituted for them.

Lisfranc's first method, or disarticulation from the dorsal aspect of the joint.—An assistant supports the hand well pronated, and confines the sound fingers, keeping them as far as possible out of the way of the operator. The surgeon then takes the phalanx to be removed between the thumb and index finger of his left hand, (fig. 5,) and bends it to an angle of 45° ; then, with a straight bistoury held in the first position, (pl. 1, fig. 1,) he enters the articulation on its dorsal aspect, cutting perpendicularly, a line and a half from the top of the inclined plane formed by the semi-flexed phalanx, or on a level with the fold in the skin on the palmar aspect of the joint for the second phalanx, and a line and a half below the corresponding fold for the first phalanx. At the same time that it penetrates the joint, the bistoury, carried from heel to point, should form a little semi-circular flap on its right and left sides, and the lateral ligaments should be divided as the blade enters between the articular surfaces, (fig. 6.) The phalanx should now be grasped by its sides, and the knife carried around its head to its palmar surface, along which it should be carried towards the operator, to a distance of four lines, in order to make a semi-circular flap of suitable size to cover the stump.

Fig. 7. In cutting the lateral ligaments of the articulation, care must be taken not to nick the base of the flap. The condyles of the first phalanx sometimes project on either side through the wound. To obviate this, the dorsal incision should be made as much of a curve as possible, with its concavity looking downwards, especially towards its lateral extremities.

Fig. 8. *Lisfranc's second method, or disarticulation from the palmar aspect of the joint.*—The hand is to be held in the position of forced supination by an assistant, who confines all the fingers in a flexed position, except the one about to be operated upon. The surgeon grasps the phalanx to be removed with the thumb and finger of his left hand, and in order to avoid wounding himself with the point of the bistoury, he should grasp it in such a manner that his thumb is applied upon the palmar surface of the phalanx at its distal end, and

the second phalanx of his index finger should cross its dorsal surface at right angles. The operator, then, holding a sharp-pointed bistoury in his right hand, in the first position, (pl. 1, fig. 2), with its blade flat-wise, and its edge towards him, enters its point a line and a half below the fold of skin opposite the joint for the third phalanx, and exactly in a line with it for the second phalanx. It is then carried through the finger directly from one side to the other, in front of the articulation, and in contact with the bone, so as to take up as much upon the blade as possible, (fig. 9.) In this manner, the blade is introduced up to its heel, and then, by alternate motions, its edge being kept close to the bone, it is carried down along its palmar surface to a distance of half an inch, and then made to cut its way out, forming in this manner a semi-circular flap, which is immediately carried upwards by the assistant. The edge of the bistoury is then applied perpendicularly to the joint and carried directly through it, dividing its ligaments and the integuments on the opposite side of the joint without making any posterior flap. Nevertheless, if it is feared that the posterior integuments should retract to too great an extent, their section can be effected a line or two below the articulation.

After the description of these two modes of operating, it can readily be understood, without any further details, how, in varying cases, arising from injuries or otherwise, *two flaps of the same size* could be made, one from the dorsal and the other from the palmar aspect of the finger; or, a *dorsal flap*, somewhat shorter than the palmar one; or, even *lateral flaps* of varying proportions. The rules already laid down for the disarticulation of the phalanges of the fingers are also applicable to the removal of the second phalanx of the thumb, which corresponds with the third phalanx of a finger—(Lisfranc.)

§ 2. *Disarticulation of an entire finger*, (fig. 12.) *Method by double flaps. Lisfranc's mode of operating.*—The hand being held in a state of pronation, and the fingers, except the one about to be operated upon, confined on either side by an assistant, the surgeon, before commencing the operation, should endeavor to recognize as accurately as possible the situation of the metacarpo-phalangeal articulation. To do this, it is to be borne in mind that the joint usually lies about an inch above the commissure between the fingers. Another method recommended by Malgaigne, and to which the operator can have recourse, especially when the parts are deformed by injury or otherwise, consists in applying strong traction to the finger whilst the metacarpus is held

firmly, by which means the articular surfaces are drawn apart one or two lines, and a depression, manifest to both sight and touch, is the result of the separation, indicating with exactness the situation of the joint. This being ascertained, the operation is to be effected in the following manner :—

1st. The first phalanx of the finger to be removed, is to be grasped by its dorsal and palmar surfaces, and flexed to an angle of 45° . With a straight bistoury, having a prominent heel to its blade, the surgeon commences an incision over the articulation above the head of the metacarpal bone, starting from the union of the internal two-thirds of the interarticular line with its external third, if he is operating upon the left hand, and *vice versa* for the right hand, and carrying it down to the end of the commissure between the fingers. This incision, made by drawing the bistoury towards himself, and from heel to point, should divide at once all the soft parts down to the bone. Having attained the end of the web between the fingers, the blade of the bistoury should be brought to a perpendicular position, lying flatwise against the side of the phalaux, and then, at the same time that the hand of the patient is elevated so that the operator's eye shall precede the edge of the bistoury, he depresses its handle towards the palm of the patient's hand, whilst the heel of the knife is making an oblique incision on the palmar aspect of the joint similar to that on its dorsal surface.

2d. By the process just described, a lateral semi-circular flap has been circumscribed, which is to be detached from the phalanx. Then the bistoury, still held in the first position, is carried to the bottom of the wound, its blade lying flatwise against the phalanx, and by a gently sawing motion, upwards towards the articulation, until an obstacle is encountered which arrests its progress. This is the head of the phalanx ; the blade of the bistoury must be carefully carried around it without allowing it to slip or move irregularly, and as soon as it arrives at the articulation, the diminished resistance will allow it to enter with facility.

3d. The joint is to be cut through with the narrowest portion of the blade of the bistoury, that nearest its point, and in order to effect this part of the operation more readily, the surgeon should make traction upon the fingers, so as to separate the articular surfaces, at the same time that the integuments of the opposite side of the joint are kept out of the way of the edges of the bistoury. The knife having traversed the articulation, it is brought back hugging the opposite side of the

head of the phalanx, and a second semi-circular flap is made like the first, as it cuts its way out through the commissure.

When the double flap amputation is made use of for the index or little fingers, there is but one flap, of course, made from the commissure of the fingers; the other flap, taken from the outer or inner border of the hand, has generally more tendency to contraction, and hence, should be made somewhat larger on this account.

Oval method. Scoutetten's operation.—The surgeon, having grasped the finger as in the preceding description, commences, with the heel of the bistoury held in his right hand, an incision, which, commencing on its dorsal aspect, and a quarter of an inch beyond the articulation, is carried down to the end of the commissure, and thence across the base of the finger on its palmar surface, following exactly in the fold of the skin which lies between the finger and the hand. To facilitate the incision on its palmar surface, the surgeon should carry the finger back into a state of forced extension, but as soon as the knife reaches the commissure on the opposite side, he should flex it again, and resume the same form of incision with which he commenced, carrying it back to join the first near its origin. Each border of the wound should then be detached from the head of the phalanx, and the joint entered from its dorsal aspect, dividing first the extensor tendon, and then the lateral ligaments. By increasing the flexion slightly, and an effort as if to luxate the joint, the division of the flexor tendons is facilitated, and the remaining soft parts being detached, the amputation is finished.

The *circular method* is hardly used at present for the disarticulation of the fingers.

PLATE XIX.

DISARTICULATION OF THE FOUR FINGERS; OF THE METACARPAL BONES.

OPERATIONS.

FIG. 1. *Disarticulation of the four fingers at once.* a, b, c, incision over the metacarpo-phalangeal articulations from their dorsal aspect; the knife is about passing beneath the phalanges to cut out a palmar flap.

FIG. 2. Wound resulting from the operation. a, b, c, form of the palmar flap.

FIG. 3. *Disarticulation of the first metacarpal bone*, by a modification of the oval method; a, b, c, outline of the external incision.

FIG. 4. The thumb is carried across the hand, and the knife about completing the disarticulation of the head a, of its metacarpal bone.

FIG. 5. Edges of the wound brought together, shewing the appearance of the cicatrix when healed.

FIG. 6. *Disarticulation of the metacarpal bone of the little finger*, by a variety of the oval method; a, b, c, outline and extent of the external incision.

FIG. 7. The preceding operation completed; shape of the cicatrix.

MODES OF OPERATING.

§ 1. *Disarticulation of the four fingers together.—Operation with one flap.*—*Lisfranc's method* (fig. 1). The hand being pronated, the surgeon grasps the four fingers in the palm of his left hand, whilst his thumb, placed on the dorsal aspect of the fingers, flexes them moderately. An assistant supports the hand, and retracts the skin as much as possible. Then, with a straight narrow knife, the operator makes a curved incision with its convexity looking downwards, from six to eight lines below the heads of the metacarpal bones, from the index towards the little finger if he is operating on the left hand, and in the opposite direction for the right. The extensor tendons being exposed by the retraction of the integuments, which the operator assists by a

Pl. 19.

Fig. 2.

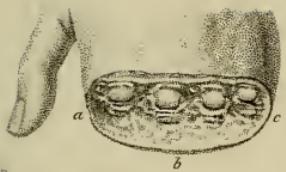


Fig. 7



Fig. 6.

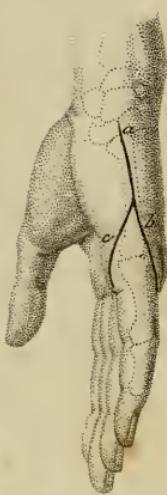


Fig. 1.

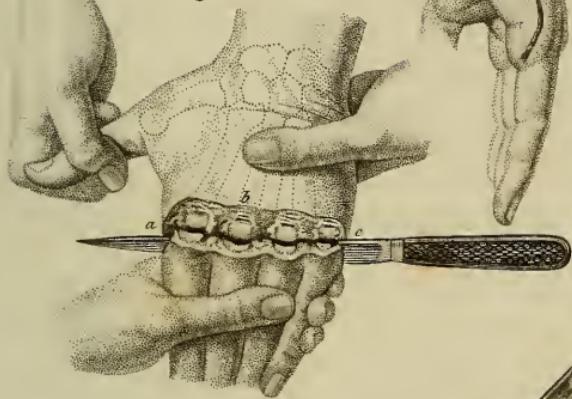


Fig. 3.

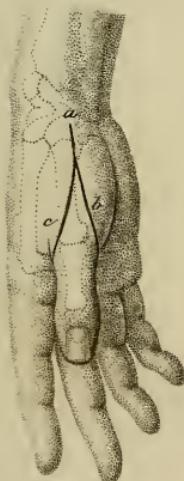


Fig. 4

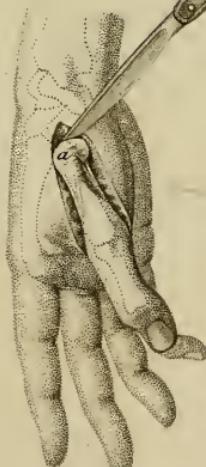
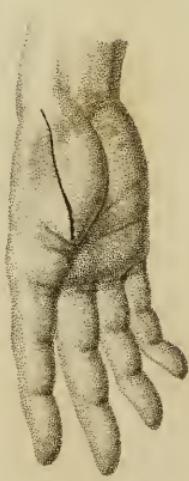


Fig. 5.





few strokes of the knife, each of the metacarpo-phalangeal articulations is then successively opened, the extensor tendon being first divided, then the lateral, and finally the palmar ligamentous attachments. It remains to carry the knife through the articulations to the palmar aspect of the phalanges, and cut out a flap, which is limited anteriorly by the folds in the skin at the base of the fingers on their palmar surface.

§ 2. Disarticulation of the metacarpal bone of the thumb.—Oval operation.—Scoutetten's method modified by Malgaigne (fig. 3, 4, 5). The hand being held in a position between supination and pronation, make an incision along the dorsal surface of the metacarpal bone of the thumb, commencing six lines above its articulation with the trapezium, and extending through all the tissues down to the bone, to the inner side of the head of the first phalanx of the thumb, on a level with the commissure between the thumb and index finger. Then, carrying the hand into a state of pronation, continue the incision around the palmar surface of the phalanx to its outside, and thence to the dorsum of the metacarpal bone, to meet the first incision about at its middle (fig. 3). Detach the muscles and integuments from either side of the bone, and open the articulation from its dorsal aspect; then, endeavoring to dislocate the bone outwards, complete the division of its remaining attachments.

§ 3. Disarticulation of the metacarpal bone of the little finger.—Oval method.—Scoutetten's operation modified by Malgaigne (fig. 6, 7). The hand being held in a state of forced pronation, commence an incision six lines above the carpo-metacarpal joint, which should be carried down in a straight line to the inner border of the first phalanx of the little finger, until it meets the depression at the base of the finger on its palmar surface, and brought around the base of the finger, following this depression exactly. Then the operator, lifting up the little finger, continues the incision around to its inside, and upwards to join its first portion about opposite to the centre of the metacarpal bone. The integuments and muscles are then detached from the bone, and its articular connections divided with the point of the bistoury in the manner already described.

PLATE XX.

AMPUTATION THROUGH THE CARPO-METACARPAL, AND RADIO-CARPAL ARTICULATIONS.

SURGICAL ANATOMY.

FIG. 1. *a*, inferior extremity of the ulna; *b*, that of the radius; *c*, *d*, *e*, *f*, *g*, *h*, *i*, bones of the carpus; 1, 2, 3, 4, 5, first, second, third, fourth and fifth, metacarpal bones.

The *carpo-metacarpal articulation* is represented by an irregular line, the two extremities of which are easily recognised. *Externally*, it corresponds with the upper extremity of the first metacarpal bone; this can be made to stand out from its articulation with the trapezium *i*, to which it is connected by rather lax ligamentous attachments, by carrying the thumb across the palm in a state of forced adduction. *Internally*, the carpo-metacarpal joint is marked by the articulation of the fifth metacarpal with the unciform bone, *f*. The long projection at the upper end of the fifth metacarpal serves as a guide to this point, and it can be readily recognised by carrying the finger along the bone from before backwards; the joint lies a line or so above it. The hook-like process of the unciform bone might also be of some assistance as a landmark; the articulation lies immediately below it.

The *radio-carpal articulation* is formed by the inferior extremities of the radius and ulna, which being slightly concave receive the convexity formed by the scaphoid *d*, the semi-lunar *c*, and the cuneiform, *e*. The pisiform bone, situated farther in front and below the line of the articulation, forms a projection on the front of the wrist over which the knife passes necessarily in cutting out the palmar flap. The two styloid processes, that of the radius externally, and of the ulna internally, mark the situation of the joint with accuracy. The styloid process of the radius projects downwards two lines farther than that of the ulna; and the articulation lies about two lines and a half above a line passing through the extremities of the two processes. The second fold in the skin on the palmar surface of the wrist, reckoning from the palm, lies immediately over the articulation, and would also answer as a guide to it in case the position of the styloid processes could not be distinguished.

PL. 20.

Fig. 1.



Fig. 3.



Fig. 2.

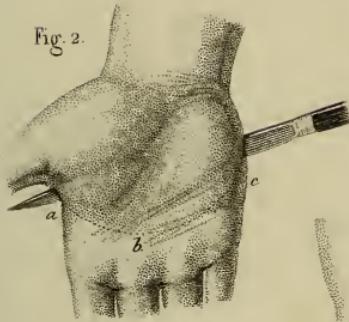


Fig. 6.



Fig. 4

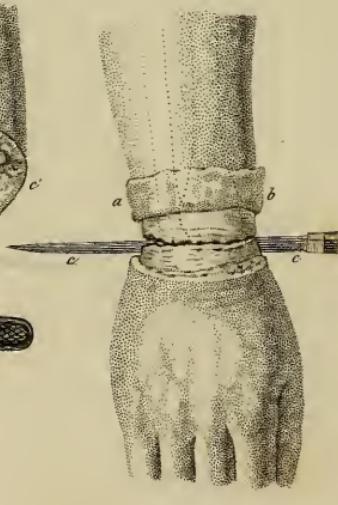
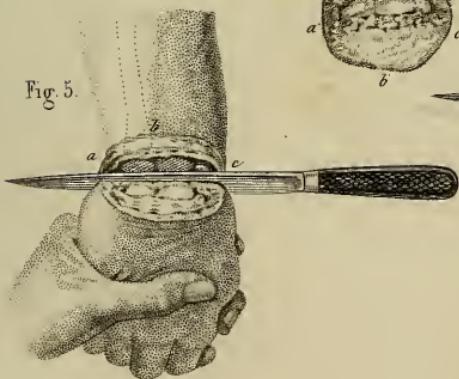
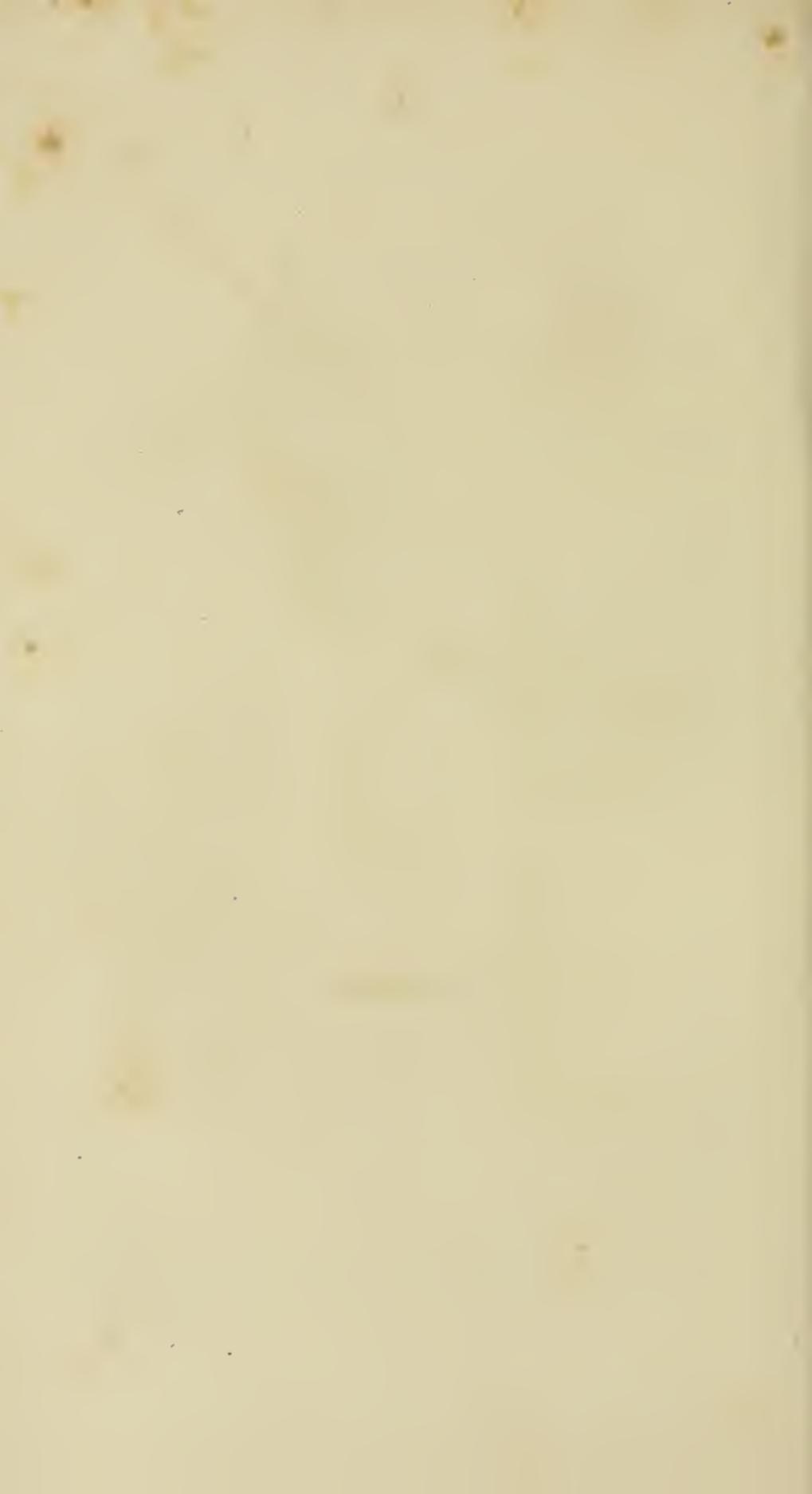


Fig. 5.





OPERATIONS.

FIG. 2. *Disarticulation of all the metacarpal bones, preserving that of the thumb. Maingault's operation.* a, b, c, form of the palmar flap.

FIG. 3. Same operation. a, b, c, incision in the integuments on the back of the hand ; the joint is about being opened.

FIG. 4. *Amputation through the wrist-joint. Circular operation.* a, b, fold of integuments turned up like the cuff of a sleeve ; c c, knife dividing circularly the tendinous tissues around the joint.

FIG. 5. *Denonvilliers' method. Flap operation.* a, b, c, semi-circular incision on the back of the wrist. The knife is cutting out the palmar flap.

FIG. 6. Stump, showing shape of wound: a, b, c, palmar flap.

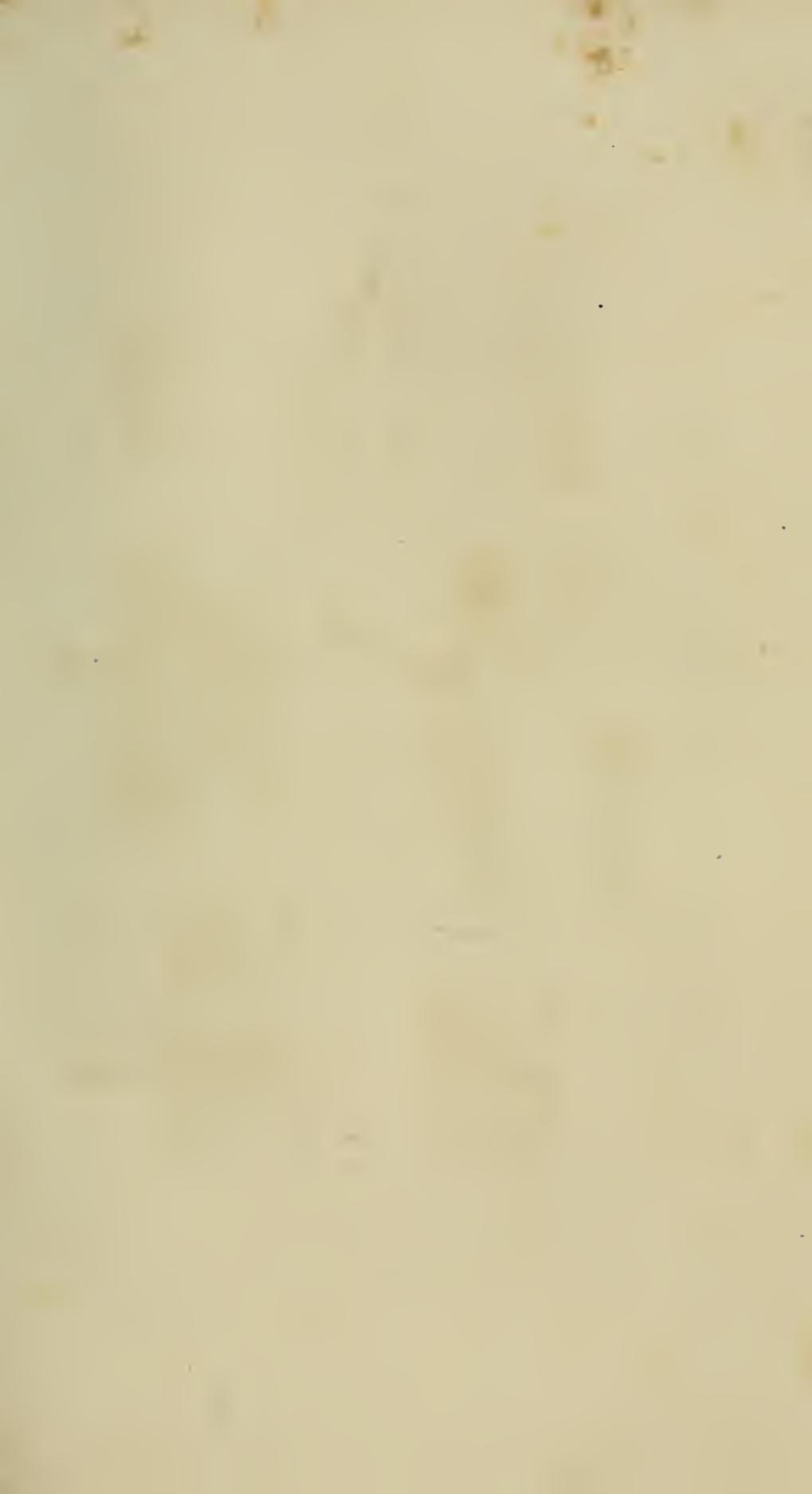
MODES OF OPERATING.

§ 1. *Disarticulation of the four metacarpal bones of the fingers. Operation with a single flap. Maingault's method.* (fig. 2 and 3.) 1st. The hand being held in the position of forced supination, recognise at its outer border the articulation of the first metacarpal bone with the trapezium, and, at its internal side, the articulation of the unciform bone with the fifth metacarpal. 2nd. Introduce a small, straight knife between the bones and the soft parts, carrying it a little below the projections formed by the unciform and the trapezium, so as to bring out its point below the thumb. 3d. Carry the blade of the knife along the anterior surfaces of the metacarpal bones, and cut out a large flap of an elliptical outline. 4th. Then turn the hand in the prone position, and make a semi-circular incision across its back, two thirds of an inch below the line of the articulations, and carrying the knife through the tissues connecting the thumb with the index finger, join the first incision. Whilst an assistant is drawing the integuments upwards, the surgeon, holding the metacarpus in his left hand, proceeds with the disarticulation from the front of the hand, commencing with the metacarpal bone of the index or the little finger, according as he is operating upon the right or left hand.

§ 2. *Amputation through the wrist-joint. 1st. Circular operation. Ordinary method.* (fig. 4.) 1st. One assistant forcibly retracts the skin of the forearm, whilst a second holds the hand to be removed. 2d. The surgeon, holding the knife in his right hand, makes

a circular incision through the integuments, just grazing the thenar and hypothenar eminences at the root of the palm. 3d. He then dissects up the skin as far as the line of the articulation, and reflects it upwards, like the cuff of a coat sleeve. 4th. Second circular incision is then carried through the tendons, and the joint is cut through from its dorsal towards its palmar aspect.

2d. *Operation with a single flap. Denonvilliers' method.*—The hand being held conveniently in a state of pronation, and the integument strongly retracted by an assistant, the operator satisfies himself of the position of the styloid processes of the radius and ulna, grasps them with the thumb and index finger of his left hand, and makes a semi-circular incision with its concavity looking downwards across the back of the wrist, its two extremities falling a little below the styloid projections of the two bones. After this first incision through the skin and cellular tissue, the retraction of the integuments upwards and downwards leaves the wrist joint entirely exposed. A second incision then, in the same direction as the first, across the articulation, divides the extensor tendons and the posterior radio-carpal ligaments. The lateral ligaments are now cut through, and the knife carried through the joint in front of the carpal bones in order to cut out an anterior or palmar flap, which should be at least two-thirds of an inch in length. In order to complete this flap without difficulty, the edge of the knife should be turned sufficiently away from the bones of the carpus so as not to be arrested by their projections, and especial care should be taken that the pisiform bone is not cut away with the flap. After disarticulation by the process just described, there is no danger of the protrusion of the styloid apophyses through the angles of the wound; if the tendons are too long, they may be cut shorter before the wound is dressed.



PL. 21.

Fig. 5.

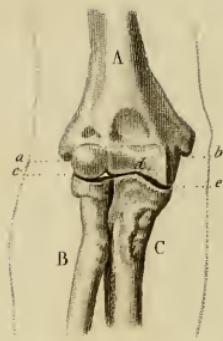


Fig. 1.

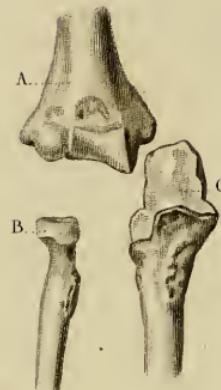


Fig. 2.

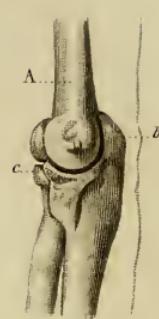


Fig. 4.

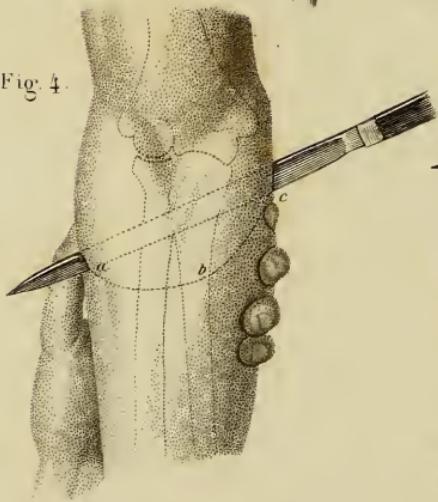


Fig. 5.

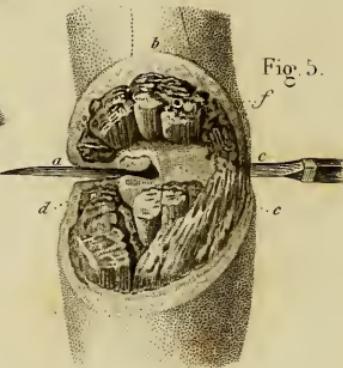


Fig. 7.

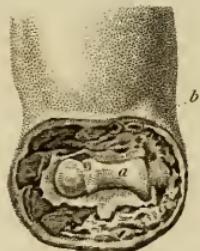


Fig. 6.

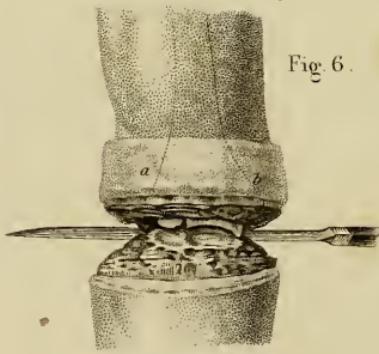


PLATE XXI.

AMPUTATION AT THE ELBOW-JOINT.

SURGICAL ANATOMY.

Fig. 1. The elbow joint is composed of the inferior extremity of the humerus, A, and the superior extremities of the radius, B, on the outside, and the ulna, C, on the inside.

Fig. 2. The radius is merely in juxtaposition with the humerus, whilst the ulna receives its trochlea in a corresponding depression of considerable depth, formed by the olecranon, b, behind, and the coronoid process, c, in front; this arrangement prevents the articulation from being opened directly, except from its outer side. The articular surfaces are retained in contact by anterior, posterior, and lateral ligaments.

Fig. 3. To recognize the exact position of the articulation, its relation to the neighboring bony projections is to be determined; the internal condyle, or epitrochlea, b, is prominent and easily detected; the external condyle, or epicondyle, a, is less prominent, and blends insensibly with the external aspect of the humerus. The two condyles, situated almost exactly on a horizontal line to which the axis of the humerus is perpendicular, lie just above the inter-articular line, c, d, e, whose two extremities are unequally distant from the horizontal line a, b. In fact, its external end, c, is but three and a half lines below the most inferior point of the external condyle, a, whilst its internal extremity is at least double that distance below the most inferior point of the internal condyle, b, (*Malgaigne*.)

OPERATIONS.

Fig. 4. *Flap operation*.—a, b, c, form of the anterior flap.

Fig. 5. a, b, c, anterior flap turned upwards; d, elbow joints opened; e, knife about to complete the division of the anterior ligament of the joint.

Fig. 6. *Circular operation. Velpeau's method*.—a, b, fold of integuments reflected.

Fig. 7. Wound which is left after the circular operation ; *a*, lower end of the humerus ; *b*, section of the humeral artery.

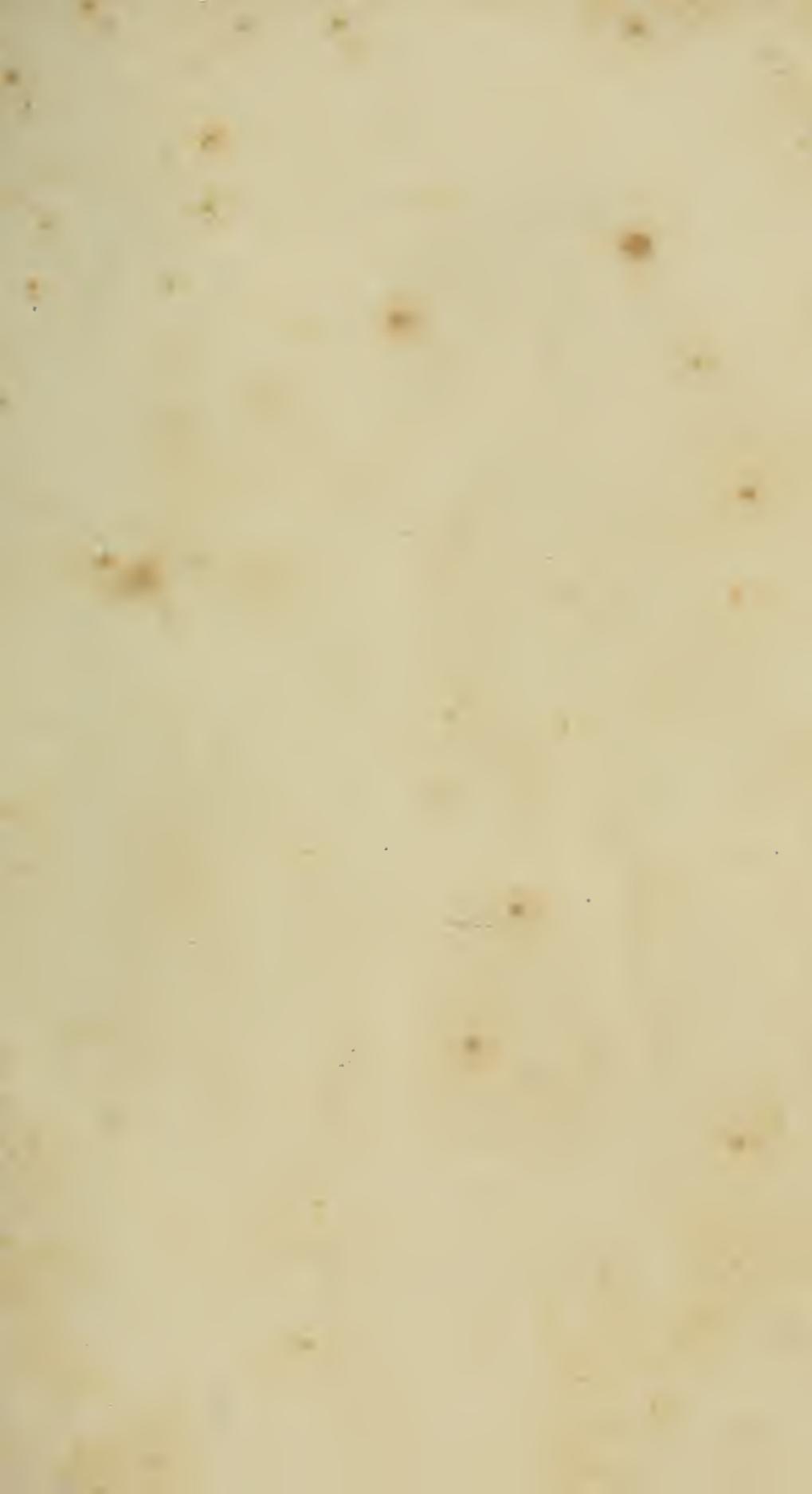
MODES OF OPERATING.

§ 1. *Method with a single flap.*—(Fig. 4 and 5.)—The forearm should be supinated as completely as possible, and held in a slightly flexed position. The surgeon, then, standing on the inner side of the limb, grasps the soft parts lying immediately in front of the articulation, and raises them from the bones of the forearm. He passes in a straight knife, from the inner side of the joint, about an inch below the prominence of the internal condyle, and keeping its point well in contact with the bones of the forearm, bring it out half an inch below the prominence of the external condyle, and cuts out a semi-circular anterior flap three inches in length. This flap being at once carried backwards by an assistant, who also retracts the skin of the arm so as to draw the angles of the wound as far upwards as possible, the surgeon carries his knife to the outside of the limb at the base of the flap, and at once enters its heel between the articulation of the radius with the humerus ; he then continues his transverse incision across the back part of the forearm through all the tissues, until he reaches the inner angle of the wound. Nothing remains then but to divide the anterior and lateral ligaments of the joint with the point of the knife, and, by luxating the bones forward, to cut through the insertion of the *triceps*, which is still attached to the olecranon process.*

§ 2. *Circular operation. Velpeau's method.*—(Fig. 6 and 7.)—The arm being held in the same position as in the preceding operation, but the surgeon standing on the outside of the limb, a circular incision is made around the forearm three fingers' breadth below the elbow joint ; the integuments are dissected up as far as the joint, and reflected upwards, and then the muscles in front of the joint are cut through, with the lateral ligaments, the joint entered in front, and the operation terminated by the division of the triceps behind.

In this mode of operating, the brachial artery is divided above its bifurcation, and the form of the wound is supposed to favor its union by the first intention.

* Some surgeons prefer to saw across the olecranon, and thus to leave the insertion of the triceps muscle untouched. The result is not materially different.—EDS.



Pl. 22.

Fig. 1.



Fig. 2.



Fig. 4.

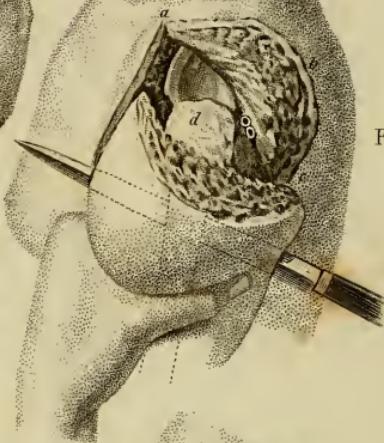


Fig. 3.

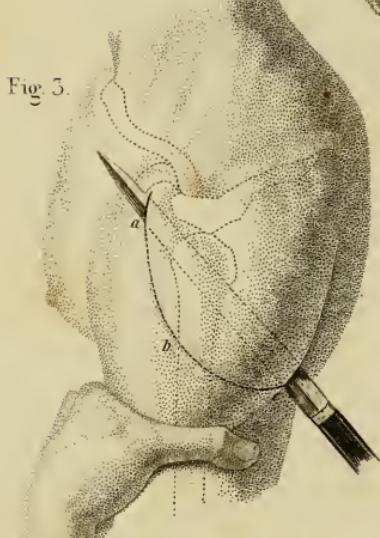


Fig. 5.

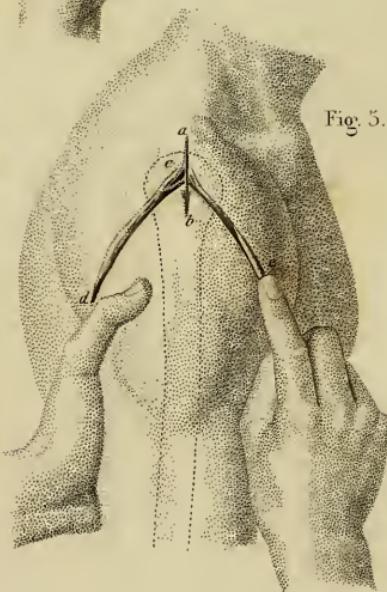


Fig. 6.



PLATE XXII.

AMPUTATION AT THE SHOULDER JOINT.

SURGICAL ANATOMY.

FIG. 1. *a*, head of the humerus ; its shape is that of an almost perfect hemisphere ; *b*, clavicle ; *c*, acromion ; *d*, infra-spinous fossa of the scapula ; *e*, head of the humerus, connected with the glenoid cavity by the capsular ligament of the joint.

FIG. 2. *a*, glenoid cavity ; it presents an elongated concave articular surface which receives but about one-third of the articular surface of the head of the humerus ; *b*, acromion ; *c*, coracoid process.

The head of the humerus is connected with the glenoid cavity by a loose capsular ligament, which would allow a considerable amount of separation between the articular surfaces, if they were not also retained in contact by the muscles arising from the scapula. The *supra-spinatus*, the *infra-spinatus*, the *teres major* and *minor* behind, and the *subscapularis* in front contribute to strengthen the joint, as well as the ligamentous fibres extending from the acromion to the capsule of the joint, and the deltoid muscle.

The acromion and coracoid processes form an arch which protects the articulation above. The acromion is situated nearly half an inch above the glenoid cavity, and projects an inch beyond it. The coracoid process situated within and lower down, is more nearly in contact with the head of the humerus.

OPERATIONS.

FIG. 3. *Lisfranc's operation*.—*a*, *b*, *c*, shape to be given to the posterior flap.

FIG. 4. *a*, *b*, *c*, posterior flap raised upwards ; *d*, head of the humerus disarticulated.

FIG. 5. *Larrey's operation*.—*ab*, first incision, vertical ; *cd*, posterior incision taking its origin from the first ; *ce*, anterior incision starting also from the same point.

FIG. 6. *a, b, c, d*, wound which is left after the preceding operation; *e*, glenoid cavity and remains of the capsular ligament; *ff*, axillary vessels.

MODES OF OPERATING.

§ 1. *Disarticulation of the shoulder.—Operation with two flaps.—Lisfranc's method (fig. 3, 4).*

1st. The patient is supported in a convenient position upon a chair, and the arm kept close to the trunk, the head of the humerus at the same time being pushed upwards and outwards as much as possible. The surgeon then, being provided with a long straight knife cutting on both edges, assures himself of the exact position of the acromion and coracoid processes. If it is the left shoulder upon which he is about to operate, the point of the knife should be entered in a direction almost parallel with the humerus at the outer side of the posterior border of the axilla, in front of the tendons of the *latissimus dorsi* and *teres major* muscles. As the knife passes in, the plane of its blade should form an angle of 35° with the axis of the shoulder, and its point should graze the posterior and external surface of the humerus, until it reaches the under surface of the acromion; at this point the handle of the knife should be raised, and its point lowered, so that it is brought out below and in front of the clavicle, in the triangular space between the acromion and coracoid processes, which is bounded posteriorly by the clavicle. The knife should then be made to cut its way outwards around the head of the humerus, and as soon as it becomes disengaged from beneath the acromion, the arm is carried a little distance away from the trunk, and the surgeon grasps with his left hand the deltoid muscle, raising it as much as possible from the bone, and carries the knife directly downwards, grazing the bone, and cutting out a posterior semicircular flap about three inches in length. In making this flap the upper part of the capsule of the joint should be divided, as well as the tendons of *latissimus dorsi*, the *teres major and minor*, and a part of the deltoid.

2d. The head of the humerus being readily separated from the glenoid cavity after the division of the parts just mentioned, the operator passes the blade of the knife behind it, and carries it downwards and forwards, grazing the humerus, to cut out the internal flap, and at this moment the artery contained in the substance of this flap should be compressed by an assistant. In operating upon the shoulder of the

right side the same rules are followed, except that the knife should be entered in the infra-clavicular triangle described above, to be brought out at the posterior border of the axilla, thus reversing the direction of the knife in transfixing the articulation to cut out the posterior flap.

§ 2. *Oval operation.—Larrey's method* (fig. 5, 6).—Make a vertical incision on the outer surface of the shoulder through the skin and subjacent tissues down to the bone, and extending from the edge of the acromion process to a point one inch below the top of the humerus; 2d, make then two oblique incisions starting from the centre of the vertical one, one on the anterior, and the other on the posterior aspect of the joint, carrying them through the tissues composing the anterior and posterior walls of the axilla, to the lower border of each, and dividing their attachments to the humerus; 3d, push the edges of the wound on either side to expose the joint, and open it, making traction on the bone to put its ligament on the stretch; 4th, luxate the bone, pass the knife behind it, and finish the operation by cutting directly through the tissues in the axilla, which intervene between the extremities of the incisions already made, recollecting that the artery is contained in them, and requires to be compressed by an assistant. The wound which results from this operation is almost perfectly oval in shape (fig. 6).

PLATE XXIII.

DISARTICULATION OF THE TOES.

SURGICAL ANATOMY.

Fig. 1. *Bones of the foot.—Dorsal aspect.*—*a* and *b*, inferior extremities of the tibia and fibula; *c*, astragalus; *d*, os calcis; *e*, scaphoid; *f*, cuboid; *g*, internal cuneiform; *h*, middle cuneiform; *i*, external cuneiform; *1, 2, 3, 4* and *5*, first, second, third, fourth and fifth metatarsal bones; *k, k, k, k, k*, phalanges of the toes.

Fig. 2. *Articular ligaments of the dorsum of the foot.*—*a, a*, anterior tibio-tarsal ligaments; *b*, anterior fasciculus of the internal lateral ligament; *c*, internal calcaneo-scaphoid ligament; *d*, external calcaneo-astragalo-ligament; *e*, superior astragalo-scaphoid ligament; *f*, the superior calcaneo-cuboid ligament; *g, g, g*, scaphoido-cuneiform ligaments; *h*, cuboido-metatarsal ligament; *i, i, i*, cuneo-metatarsal ligaments; *k, k, k, k, k*, articulations of the metatarsal bones between themselves, and of the phalanges with the metatarsal bones; *l, l, l, l, l*, lateral ligaments of the phalanges.

Fig. 3. *Horizontal section of the bones of the tarsus*, showing the inter-articular ligaments.

OPERATIONS.

Fig. 4. *Disarticulation of the third, and of the great toe.*—*a, b, c, d*, wound resulting from the oval operation; *e*, head of the first metatarsal bone; *f, g, h*, wound resulting from the flap operation; *i*, head of the third metatarsal bone.

Fig. 5. *Disarticulation of the five toes together.*—*a, b, c*, form and direction of the incision across the heads of the metatarsal bones.

Fig. 6. The integuments *a, b, c*, are retracted, and the knife is carried behind the heads of the phalanges in order to make a flap from the plantar surface of the foot.

Fig. 7. Wound which results from the preceding operation.—*a, b, c*, shape of the plantar flap.

Fig. 1.



Fig. 3.



Fig. 2.

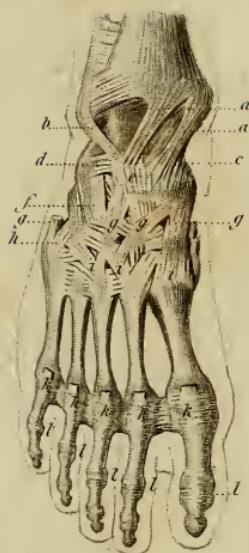


Fig. 6.

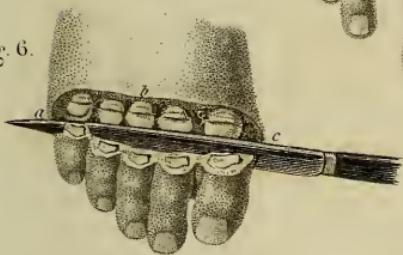


Fig. 5.

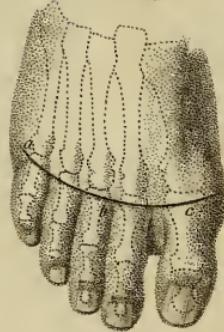


Fig. 9.

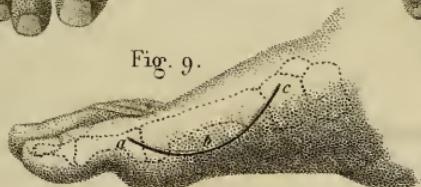


Fig. 7.

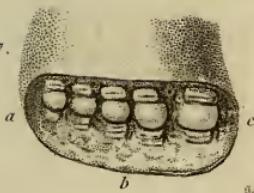


Fig. 8.

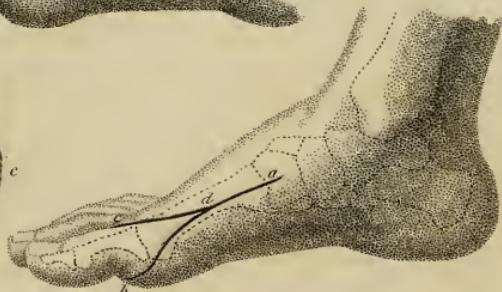




Fig. 8. *Disarticulation of the first metatarsal bone.*—*a, b, c, d,* outline of the incision.

Fig. 9. *a, b, c,* incision employed in disarticulation of the first metatarsal bone, without removing the great toe, (see “exsections.”)

MODES OF OPERATING.

§ 1. *Disarticulation of a single toe* (fig. 4.)—The rules laid down for the disarticulation of the fingers are entirely applicable to the corresponding operations upon the toes; we will only remark, that the oval operation is most generally preferable, as it is very rare that less than an entire toe is removed; the small size of the phalanges, and their unimportance, renders the preservation of a single phalanx a matter of much less moment than in the hand.

It has been proposed by many surgeons, that in disarticulation of the great toe, (fig. 8,) the head of its metatarsal bone should be removed at the same time, on account of the unsightly projection, which, moreover, is a source of constant irritation from the friction of the shoe in walking. (See “exsection” for further remarks on this subject, and for amputation of the metatarsal bones.)

§ 2. *Disarticulation of all the toes at the same time. Flap operation. Lisfranc's method* (fig. 6 and 7,)—1st. The operator, grasping all the toes in his left hand, makes, with a narrow knife, a semi-circular incision, extending (for the left foot, and *vice versa*) from the internal border of the first metatarsal bone, to the external border of the fifth, in front of the articulations of the toes with the metatarsus, (fig. 5); 2d, the articulations are opened in succession with the point of the knife, and their ligaments divided; 3d, the knife is then carried behind the phalanges for the purpose of cutting out a semi-circular flap from the plantar surface of the foot, (see fig. 6.)

PLATE XXIV.

AMPUTATION THROUGH THE TARSO-METATARSAL ARTICULATION.

SURGICAL ANATOMY.

Fig. 1. The tarso-metatarsal articulation, formed posteriorly by the cuboid, *a*, and the three cuneiform bones, *b*, *c*, *d*, and in front of the five metatarsal bones, presents an irregularly curved line, the general direction of which, with its irregularities, require attention. Externally, the cuboid, *a*, articulates with the fourth and fifth metatarsal bones, making a line somewhat oblique from without inwards, and from behind forwards. This line presents a very obtuse angle about its middle, the articulation of the fourth being less oblique than that of the fifth metatarsal bone. About the twelfth of an inch farther forwards is the articulation of the third metatarsal with the internal cuneiform, *b*; at least two lines behind this articulation lies that of the second metatarsal with the middle cuneiform, *c*; and, finally, nearly the third of an inch in front of the last we find the line of articulation of the first metatarsal with the internal cuneiform, *d*.

This arrangement presents two especial points for the consideration of the operator: 1st, the internal extremity of the articulation lies at least seven lines anterior to a transverse line *e*, *f*, drawn directly through its external extremity; 2d, the proximal extremity of the second metatarsal bone is enclosed in a mortise formed by the three cuneiform bones, *b*, *c*, *d*, which is at least one-third of an inch deep antero-posteriorly.

The dorsal ligaments connecting the tarsal and metatarsal bones are inserted several lines behind and in front of the inter-articular line, and hence the articular surfaces can always be partially separated, even when these are cut across not exactly upon the inter-articular line. The interosseous ligaments, which are stronger towards the plantar aspect of the foot, are generally easily divided; nevertheless, those situated on the inner side of the mortise, which connect the second metatarsal with the first and second cuneiform bones, the real key to the articula-

PL. 24.

Fig. 1.^{bis}

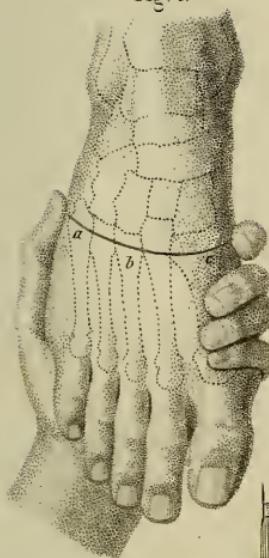


Fig. 1.

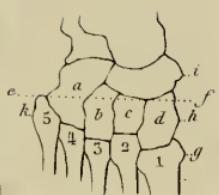


Fig. 2.

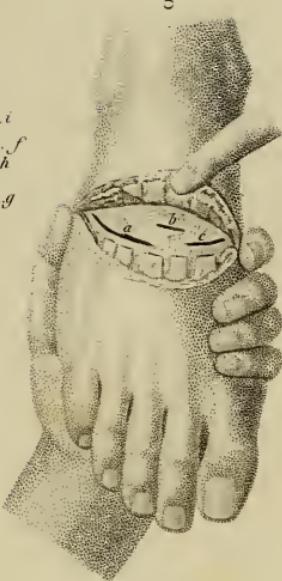


Fig. 3.

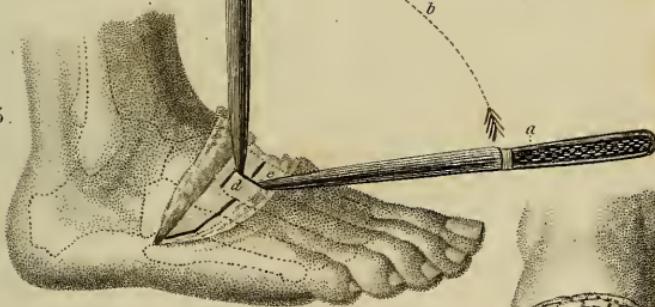


Fig. 4.

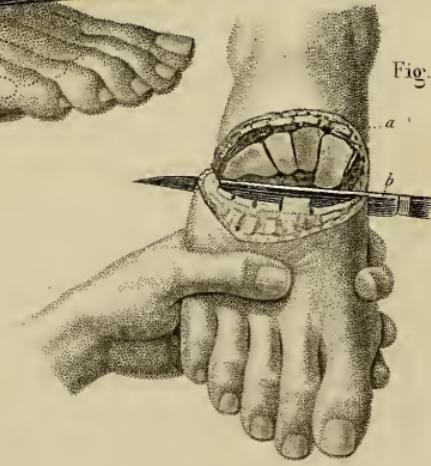
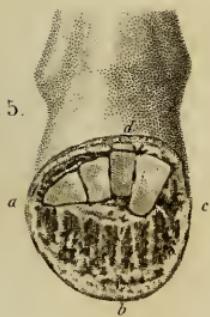
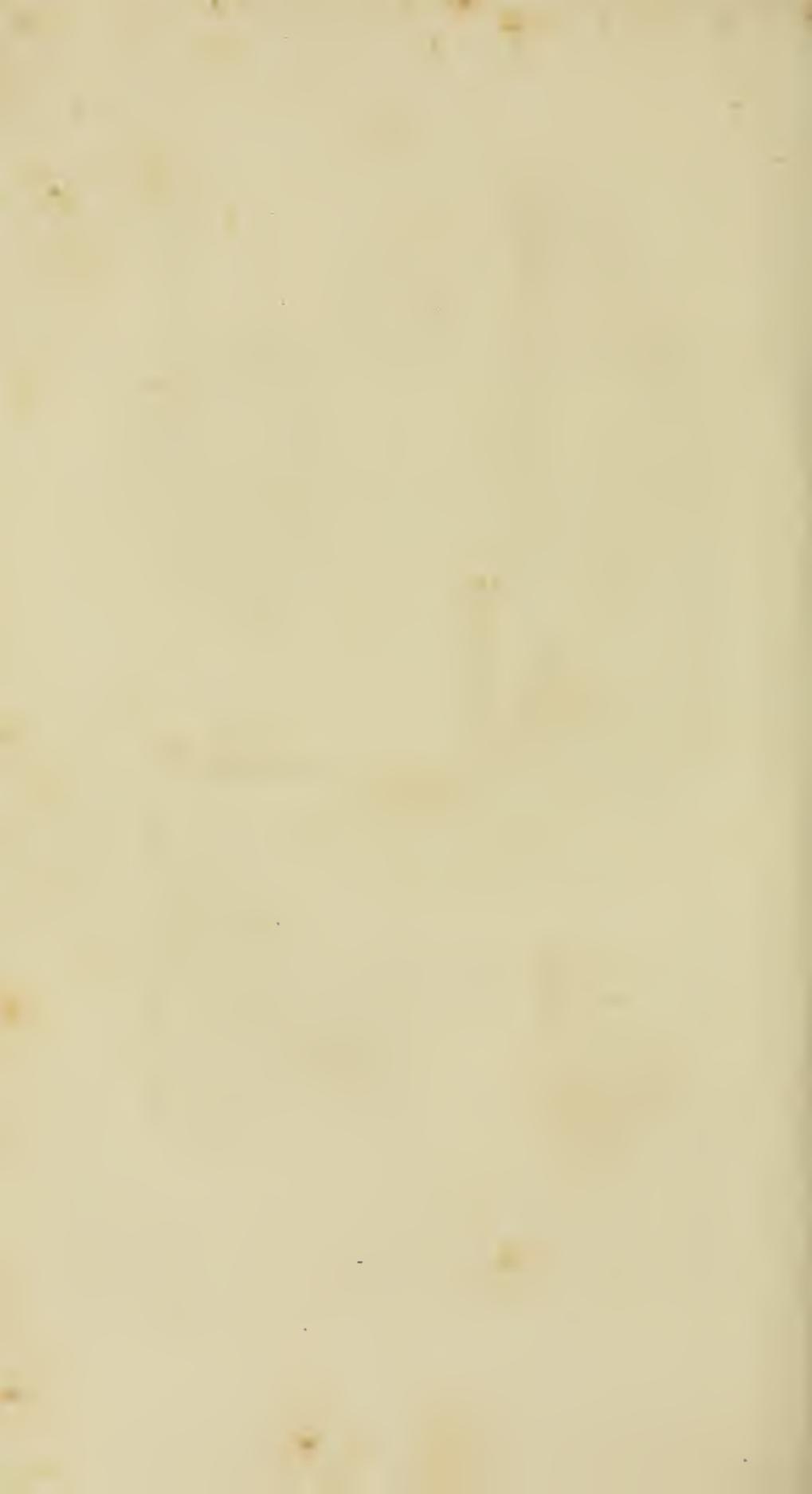


Fig. 5.





tion, require for their ready division a particular manœuvre to be hereafter described.

To recognize the articulation.—1st. On the inner side of the foot, carry the finger backwards along the inner border of the first metatarsal bone until a projection is encountered, *g*; one or two lines beyond this is the articulation, situated in a depression between the two projections marked *g* and *h*, the internal cuneiform. The articulation may also be found just one inch anterior to the prominence of the scaphoid bone, *i*.

2d. On the outer side : Follow the external border of the fifth metatarsal bone until the prominence at its proximal extremity is recognized, *k*; the articulation lies immediately behind it; in some instances, the head of the metatarsal bone projects a trifle beyond the articulation.

OPERATIONS.

Fig. 1 bis. *Lisfranc's method.*—*a, b, c*, form and direction of the incision to be made across the metatarsus.

Fig. 2. *a, b, c*, dorsal ligaments of the tarsus, divided.

Fig. 3. *Manner of opening the mortise formed by the head of the second metatarsal bone.*—*a, b, c*, are of the circle to be described by the knife; *d*, second metatarsal; *e*, first metatarsal bone.

Fig. 4. *a, dorsalis pedis artery.* The knife, *b*, is in the act of cutting out the plantar flap.

Fig. 5. *a, b, c, d*, wound left after the operation; *a, b, c*, shape of the plantar flap.

MODES OF OPERATING.

1st. The patient is placed upon his back, and the foot rotated moderately inwards. The surgeon recognizes the exact situation of the articulation by the rules already laid down, and then grasps, with the palm of his left hand, the sole of the foot, his thumb being placed on the outer side of the proximal end of the fifth metatarsal bone, and the index finger at the internal extremity of the articulation. He then makes a semi-lunar incision with its convexity looking downwards, from without inwards, across the dorsum of the foot, passing about half an inch below the articulation, and extending from one of its extremities to the other down to the bones.

2d. The surgeon divides, with the point of his knife, the dorsal ligaments, carrying it along the line of the articulation from without in-

wards, as already indicated, and recollecting that the articulation of the second metatarsal lies a third of an inch posterior to the others, (fig. 2.)

3d. The mortise in which the head of the second metatarsal is enclosed remains to be opened. This is effected by introducing the point of the knife between the internal cuneiform and the head of the first metatarsal bone, its edge being turned upwards, and making an angle of 45° with the axis of the foot. The knife is then carried up to a right angle, its point traversing the whole of the inner surface of the mortise, in order to insure the division of the interosseous ligament; it is then withdrawn, and applied to the external surface of the mortise.

4th. When this has been accomplished, pressure is made upon the metatarsus to separate the articular surfaces, and their remaining ligamentous attachments are successively divided, especially those on the plantar aspect of the articulation, so that the knife may be carried readily beneath the heads of the metatarsal bones, and the operation is then finished by cutting out a flap from the sole of the foot, which should be somewhat larger at its internal than at its external part.*

* The operation above described is generally known in this country as *Lisfranc's operation* on the foot, and it is distinguished by this title from *Hey's operation* through the metatarsus, in which the bones are divided with the saw, and *Chopart's operation* through the tarsus, as next described.—EDS.



Pl. 25.

Fig. 1.

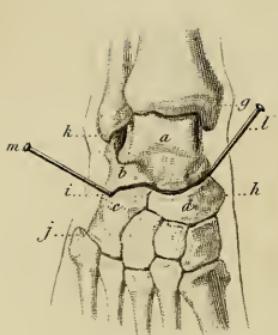


Fig. 2.

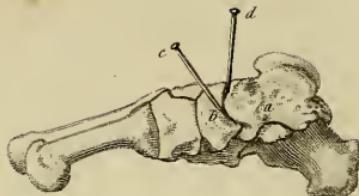


Fig. 3.

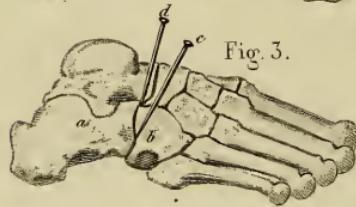


Fig. 4.

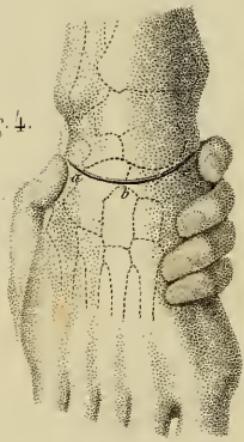


Fig. 5.

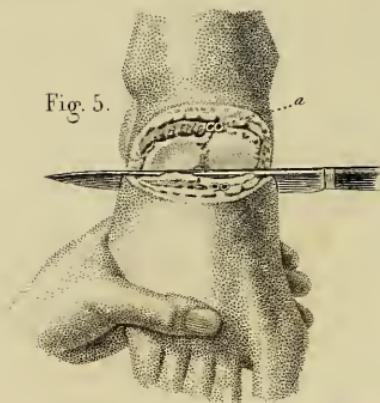


Fig. 6.

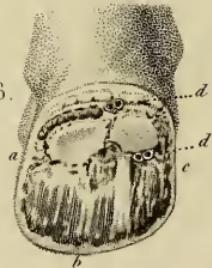
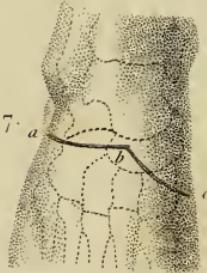


Fig. 7.



AMPUTATION THROUGH THE TARSUS, OR CHOPART'S OPERATION.

SURGICAL ANATOMY.

FIG. 1. The articulation at the middle of the tarsus is formed by the astragalus, *a*, and the os calcis, *b*, behind, and by the cuboid, *c*, and scaphoid, *d*, in front, and the inter-articular line, which crosses the foot transversly, resembles the *ileum*, of which the anterior convexity is internal, and its posterior convexity, external.

The internal extremity of the articulation is just one inch in front of the internal malleolus, *g*, and two lines and a half behind the tuberosity, *h*, of the scaphoid.

The external extremity, *i*, is half an inch behind the projection formed by the head of the fifth metatarsal bone, *j*. It corresponds with a prominence on the external surface of the cuboid bone, which is situated just one inch in front of the external malleolus, *k*.

The centre of the articulation lies immediately in front of the head of the astragalus, which can be made to project by forcibly extending the foot. On the outside of this prominence is a depression, sensible to the touch, lying between the astragalus, the cuboid, and the os calcis; the articulation is immediately in front of this (*Malgaigne*).

In order to cut through the joint readily, it is necessary to be familiar with the different directions which are assumed by its articular surfaces. The pin, *l*, introduced between the astragalus and scaphoid, indicates the direction to be given to the knife in opening the articulation from its internal side.

The pin, *m*, introduced between the os calcis and cuboid, just in front of the prominence on the cuboid mentioned above, indicates also the direction to be given to the knife in entering the joint from its external side.

FIG. 2. When it has once entered the articulation by its inner side, the blade of the knife should follow the different degrees of obliquity assumed by the articular surfaces, of the astragalus, *a*, and the os calcis, *b*; at first directed obliquely backwards as at *c*, it becomes almost perpendicular at *d*.

FIG. 3. In operating upon the right foot, the blade, slightly oblique at *c*, will become more nearly perpendicular at *d*, between the os calcis, *a*, and the cuboid, *b*, when the joint is entered from its external side.

The interosseous ligament which is found about in the centre of the articulation, and which connects the four bones together, should always be cut through with the point of the knife as soon as the bones can be sufficiently separated. In aged subjects it is sometimes ossified ; in this case it must be divided with the saw. The other ligaments require no particular remark.

OPERATIONS.

FIG. 4. *Ordinary method.*—*a, b, c*, form and direction of the incision to be made across the joint.

FIG. 5. The joint being cut through, the knife is about making the flap from the sole ; *a*, *dorsalis pedis* artery.

FIG. 6. *a, b, c*, form of the plantar flap ; *d* and *d'*, the dorsal and plantar arteries.

FIG. 7. *Sedillot's method.*—*a, b, c*, form of the incision on the dorsum of the foot.

MODES OF OPERATING.

§ 1. *Chopart's operation through the middle of the tarsus* (fig. 4 and 5).—*Ordinary method.*—1st, the exact position of the articulation having been recognized by the means already indicated, the surgeon grasps the foot with his left hand, its sole being placed in his palm, his thumb upon the external extremity of the articulation, and the index finger upon the tuberosity of the scaphoid bone ; 2d, the knife is then to be carried across the dorsum of the foot, from the thumb towards the index finger (fig. 4), making a semi-circular incision which descends about half an inch below the line of the articulation ; 3d, after the retraction of the integuments, divide the tendons which remain uncut, and open the articulation, bearing in mind the varying obliquity of the articular surfaces as already indicated, and also to divide thoroughly the fibrous bands connecting the scaphoid and astragalus before attempting to enter the joint, as the thin edge of the scaphoid juts over the latter in some degree ; 4th, the articulation being entirely laid open, and all its ligaments freely divided, pass the flat of the blade behind the bones, and having brought up the end of the foot into its natural position, cut out a flap from its plantar surface, which should extend be-

yond the sesamoid bones in order to possess sufficient length; the knife should graze the bones in making the flap, care being taken to avoid the projections of the scaphoid, cuboid and first and fifth metatarsals.

§ 2. *Sedillot's method* (fig. 6 and 7).—After determining the position of the articulation, and the foot being properly supported, a transverse incision is made, commencing a few lines in advance of the calcaneo-cuboid articulation, and terminating about the middle of the dorsum of the foot, on the outer side of the tendon of the *tibialis anticus*. From this same point a curved incision, with its convexity downwards, is then carried around the inner border of the foot, extending downwards to within two fingers' breadths of the metatarso-phalangeal articulation of the great toe, and thence across the sole to the commencement of the first incision. The plantar integuments should be cut as much as possible in a slanting direction to rid their edges of the subcutaneous fat, the protrusion of which tends to prevent the union by the first intention. It remains now to dissect up the internal flap to just beyond the tuberosity of the scaphoid bone, where the joint is to be entered. The disarticulation is then completed as usual, and the remaining soft parts divided transversely.*

* *Amputation through the ankle-joint*, although not an operation in general use at the present day, is highly praised by Baudens, amongst the French surgeons, and also by Mr. Syme of Edinburgh, who has lately reintroduced it with much success. Each of these surgeons has a mode of operating peculiar to himself. (See Malgaigne, Eng. ed., p. 255, and Lond. and Ed. Monthly Journal, Feb., 1843, p. 93.)—EDS.

PLATE XXVI.

AMPUTATION AT THE KNEE-JOINT.

SURGICAL ANATOMY.

Fig. 1.—*Anterior view of the knee-joint.*—*a*, femur; *b*, patella; *c*, tibia; *e*, fibula; *g*, external lateral ligament; *f*, internal lateral ligament; *d*, ligament of the patella.

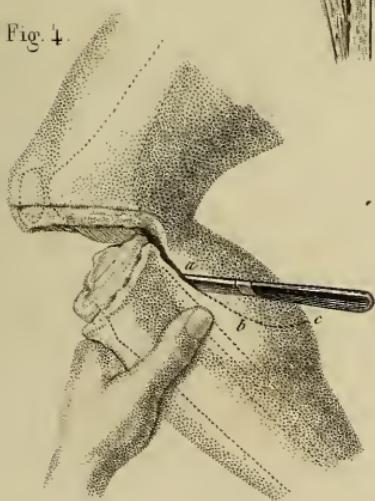
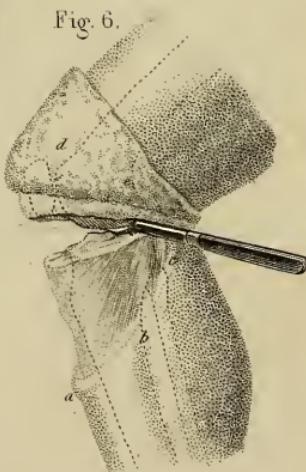
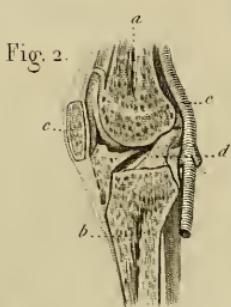
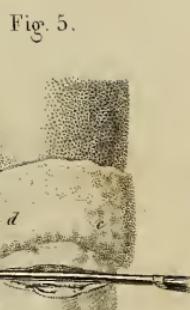
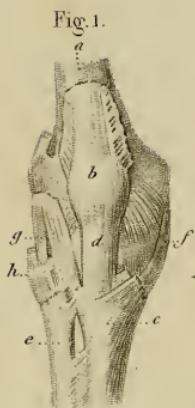
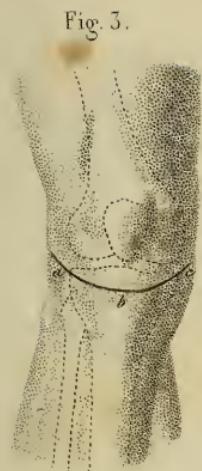
Fig. 2. *A vertical antero-posterior section exhibiting the crucial ligaments, d, and the popliteal artery, e.* *a*, femur; *b*, tibia; *c*, patella.

This articulation possesses some anatomical peculiarities worthy of the attention of the operator. The internal condyle descends lower than the external, nearly half an inch. They are both received into concave articular surfaces on the head of the tibia, which are rendered deeper by the semi-lunar cartilages attached to their edges. The popliteal artery, (fig. 2, *e*) lies in the depression between the two condyles, posteriorly, and in immediate contact with the joint.

In addition to the patella and its tendinous connections, the articular surfaces are held together by an internal and external lateral ligament, a posterior ligament, and two very strong interosseous ligaments, called crucial, which also tend to prevent displacement in an antero-posterior direction.

To determine the exact position of the joint, find out the head of the fibula, and three-fourths of an inch above it is the inner side of the articulation. On the external aspect of each of the condyles of the femur is a prominence of bone which can generally be felt beneath the integuments; the articulation lies three-fourths of an inch below these. The lower border of the patella, also, is exactly on a line with the joint.

PL. 26.





OPERATIONS.

*FIG. 3. Amputation through the knee-joint.—Flap operation.—
a, b, c, form to be given to the anterior incision.*

*FIG. 4. Same operation.—The articulation having been opened, the
knife is cutting out the posterior flap ; a, b, c, shape to be given to
this flap.*

*FIG. 5. Same operation by the circular method.—a, b, c, section of
the skin ; d, e, integuments reflected ; the knife is just entering the
joint in front.*

*FIG. 6. Same operation by the oval method.—Bauden's process.
a, b, c, oblique section of the skin ; d, e, integuments turned upwards ;
the knife is opening the articulation from before backwards.*

MODES OF OPERATING.

*§ 1. Amputation through the knee-joint.—1st. Flap operation.—
Hoin's method.—1st, the limb being extended make a semi-circular
incision across the front of the articulation immediately below the pa-
tella, and extending from one condyle of the femur to the other ; 2d,
by a second incision, in the same direction, bending the knee slightly,
open the joint freely, and dividing all its ligamentous connections, pass
the knife flatwise behind the head of the tibia, and cut out a flap from
the calf of sufficient size to cover well the condyles of the femur.*

*§ 2. Circular operation.—Velpeau's method.—1st, make a circular
incision around the limb, from three to four fingers' breadths below the
patella, through the integuments only ; 2d, dissect them up and reflect
them backwards, preserving as much of the subcutaneous fat with the
skin, as possible ; 3d, the reflected integuments being held back by an
assistant, and the knee flexed, carry the knife through the articulation,
dividing all its ligamentous attachments, and cut through the nerves,
vessels and muscles behind the joint at one stroke, perpendicular to the
axis of the limb, and on a line with the reflected integuments.*

*§ 3. Oval operation.—Bauden's method.—1st, draw with a pen
and ink an oblique line starting from the crest of the tibia three fingers'
breadths below the patella and running backwards and upwards to the
popliteal space, and terminating two fingers' breadths below the line of
the articulation, and thence down the opposite side of the limb to the*

point from which it started; 2d, follow this line with the knife, dividing the integuments only, which should be dissected up as far as the line of the articulation and reflected upwards. The disarticulation is then effected as in the circular operation, the joint being opened from the front.



Fig. 1.

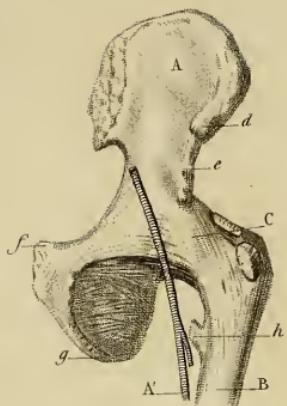


Fig. 2.

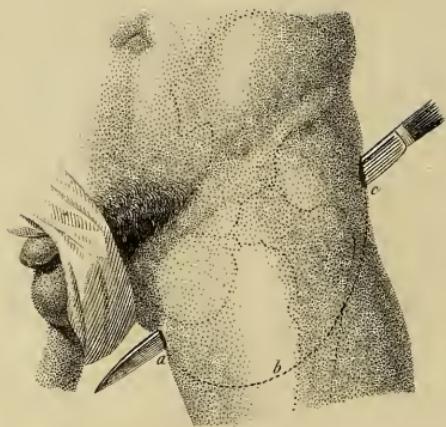


Fig. 3.

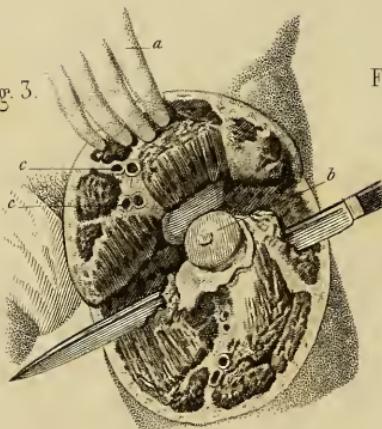


Fig. 5.

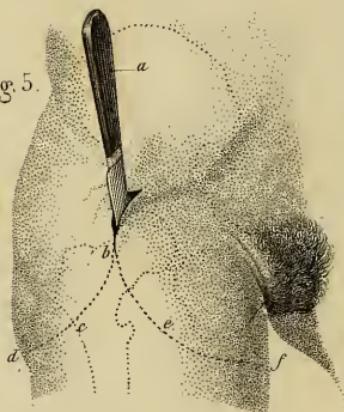


Fig. 4.

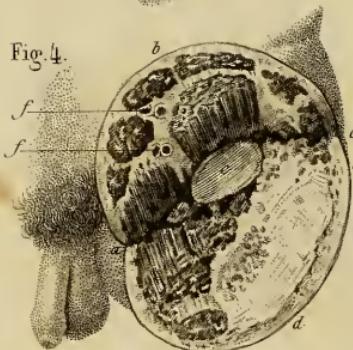


Fig. 6.

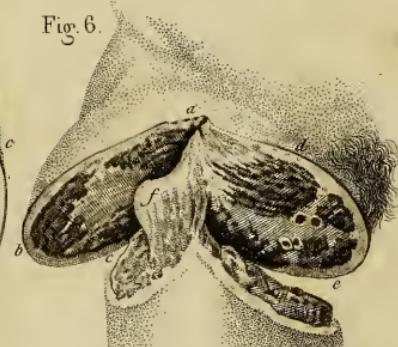


PLATE XXVII.

AMPUTATION AT THE HIP-JOINT.

SURGICAL ANATOMY.

FIG. 1. A, internal iliac fossa; A', femoral artery; B, the femur; C', head of the femur covered by the capsular ligament; d, anterior superior spinous process of the ilium; e, anterior inferior spine of the ilium; f, spine of the pubis; g, tuberosity of the ischium; h, trochanter minor.

The coxo-femoral articulation is formed by the acetabulum and the head of the femur; the head of the femur is not completely received into the acetabulum, but is maintained there by a large and strong capsular ligament, and also by a round ligament which is attached to the bottom of the cavity. The capsular ligament is attached to the anterior inferior spine of the ilium, and around the margin of the acetabulum; to disarticulate easily the head of the bone, we must sweep the knife around the acetabulum, cutting the attachments of the ligament close to the margin of the cavity. The plane of the circle formed by the brim of the acetabulum looks a little obliquely downwards and forwards, and hence it projects farther over the head of the femur posteriorly than in front; it is necessary to bear this arrangement in mind in dividing the capsular ligament from behind.

In order to find the articulation, we must be guided by the following anatomical facts:

1st. The anterior inferior spinous process of the ilium is three quarters of an inch above the superior margin of the acetabulum; the anterior superior spinous process is about an inch and three quarters above the same point, and three quarters of an inch to its outer side;

2d. The subject being erect, a line drawn from the anterior superior spinous process of the ilium, to the tuberosity of the ischium, crosses the acetabulum at the junction of its posterior with its two anterior thirds;

3d. The anterior border of the acetabulum is from an inch to an inch and a quarter to the outer side of the spine of the pubis;

4th. The axis of the horizontal ramus of the pubis, extended by an imaginary line, crosses the acetabulum at the junction of its superior with its middle third;

5th. The superior border of the trochanter major is on a level with the upper third of the cavity of the joint.

This articulation, superficial in front, where it is only covered by the inferior extremities of the psoas and iliac muscles and the vessels, is protected inwardly and behind by a considerable muscular mass; exteriorly the muscular parts have little volume.

The femoral artery A' passes in front of the articulation, on a level with the junction of the middle third of the head of the femur with its internal third; lower down it approximates the bone more closely, where it passes behind it to become the popliteal artery.

OPERATIONS.

FIG. 2. *Disarticulation of the thigh.—Flap method.*—The knife, plunged from without inwards, is about to cut out the anterior flap, *a b c*.

FIG. 3. The same operation. The hand of an assistant, *a*, raises the anterior flap; the head of the femur, *b*, is luxated, and the knife, passed behind it, is cutting out the posterior flap; *c c*, cut ends of the femoral vessels.

FIG. 4. Appearance of the wound after the operation, *a b c*, anterior flap; *a d c*, posterior flap; *e*, acetabulum; *f*, cut ends of the femoral vessels.

FIG. 5. The same operation with lateral flaps. The knife, *a*, is passed in such a manner as to cut successively two flaps; one internal, *b c f*, the other external, *b c d*.

FIG. 6. Result of this method. The internal and external flaps being cut, we have only to disarticulate the femur, *f*.

MODES OF OPERATING.

AMPUTATION AT THE HIP-JOINT.

§ 1. Operation with one flap.—Manec's method.—The patient being placed in a convenient position, and the left limb selected for the operation, the point of the knife is entered midway between the spine of the ilium and the trochanter major, and carried obliquely from above

downwards, in such manner as to graze the anterior part of the neck of the femur, and to come out about an inch below, and in front of the tuberosity of the ischium. Then, by cutting downwards, and parallel with the femur, a large semi-lunar flap is made in front from four to six inches in length. An assistant immediately lifts up the flap, and compresses the femoral artery, which is contained in its substance; then, placing the point of the knife upon the articulation, the capsule of the joint is divided in at least one half of its circumference, and very near to the acetabulum, as if we wished to cut across the middle of the head of the femur, without attempting to enter the articulation. This having been done, the limb is abducted in order to luxate it, after which the knife is passed behind the head of the femur, and divides the remainder of the capsule and the glutæi muscles. The articulation being passed through, the operation is concluded as in the circular method.

The flap operation has been variously modified; to prevent haemorrhage, Larrey and Delpech tie the artery before making the anterior flap. Plantade and Ashmead cut the flaps from without inwards, towards the deeper parts. Lenoir, after having cut out an anterior flap, makes a circular incision posteriorly, before completing the disarticulation. Lalouette and Delpech make an internal instead of an anterior flap, with this difference, that Lalouette makes his flap after disarticulating, while Delpech transfixes and cuts out his flap, and disarticulates afterwards.

§ 2. Operation by double flap.—Lisfranc's method, with two lateral flaps. (Fig. 5 and 6.)—The patient must be laid upon his back with the tuberosities of the ischia projecting slightly beyond the edge of the bed, and the limb held in a position between abduction and adduction. Then having determined by the anatomical rules laid down, the anterior and external side of the articulation, the operator holding perpendicularly a long double-edged knife, introduces it at this point, with its lower edge looking downwards towards the great trochanter. As the point of the knife enters, it should be carried around the head of the femur, on its outer side, whilst its handle is inclined upwards and outwards, and pushed steadily on in this direction so that it perforates the integuments a few lines below the tuberosity of the ischium. While this is being done, an assistant grasps the tissues over the trochanter and carries them outwards, in order to assist in the formation of the external flap, and the knife is carried downwards and outwards with a

slightly sawing motion, around the great trochanter, and along the femur, cutting out a flap from three to four inches in length, *a b c.*
Fig 6.

The first flap being thus made, the operator grasping the tissues on the inside of the thigh and carrying them inwards, introduces the knife below the head of the femur, and on the inner side of its neck, holding it in a perpendicular position. As it enters, the point of the knife should pass around the neck of the femur and come out at the lower angle of the wound already made, without coming in contact with the bones of the pelvis; it is then carried downwards along the femur, and avoiding the lesser trochanter, so as to make an internal flap (Fig. 6), of the same length as the external.

The flaps being drawn aside by the assistants, and the arteries tied, the surgeon grasps the femur with his left hand, and holding the knife perpendicularly on the inner side of the head of the bone, cuts the capsular ligament without attempting to penetrate the articulation. The joint being opened, the disarticulation is concluded by cutting the fibrous and muscular tissues which remain.

§ 3. *Oval operation.—Cornuau's method.*—1st. The patient being placed on the healthy side, the surgeon enters the point of the knife an inch above the great trochanter, and from this point makes an oblique incision backwards, outwards and downwards to a point below the tuberosity of the ischium. 2d. The knife placed in the superior angle of the wound, makes a similar incision forwards and inwards. 3d. The muscles are divided on the outside as deeply as possible, and the limb being luxated outwards, the knife enters the articulation externally and is carried through the joint to the inner side of the femur.

One assistant compresses the artery in the anterior flap, another lifts up the flesh on the external side, while the surgeon terminates the operation by dividing the soft parts between the two incisions in the form of a V.

The circular method is inconvenient, and rarely used for amputating at the hip joint.

PL 28.

Fig. 5.

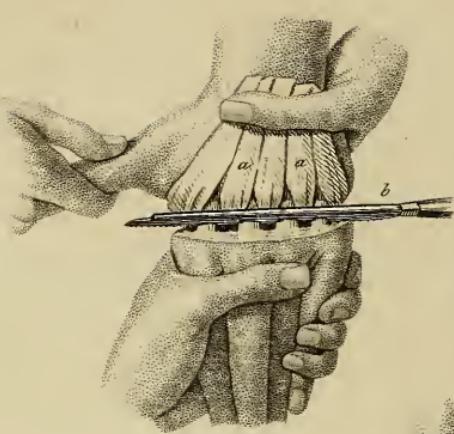


Fig. 2.

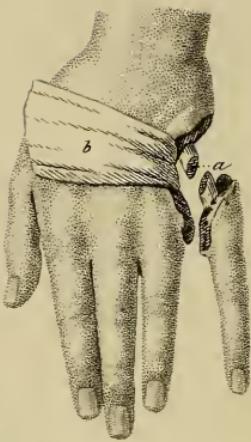


Fig. 1.

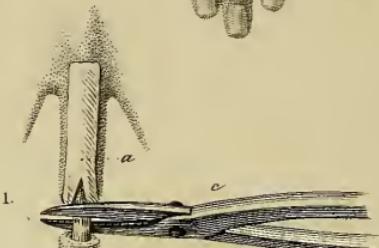


Fig. 4.

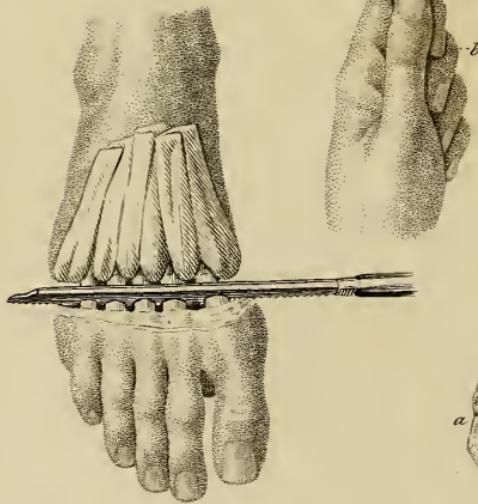
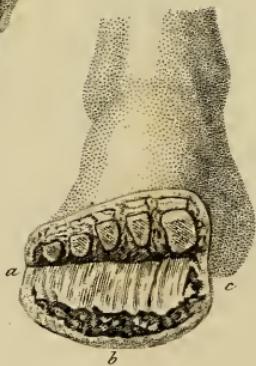


Fig. 5



AMPUTATIONS IN THE CONTINUITY OF LIMBS.

PLATE XXVIII.

AMPUTATIONS OF THE FOOT AND HAND.

OPERATIONS.

FIG. 1. *Amputation of a finger*.—*a*, a linen bandage for retracting the soft parts; *b*, the left hand of the operator grasping the extremity of the finger, while the right hand, holding a pair of Liston's forceps, *c*, effects the section of the bone with a single cut.

FIG. 2. *Amputation of the fifth metacarpal bone*.—*a*, the bone sawed obliquely from above downwards, and from without inwards, the hand being in a state of pronation; *b*, a compress for protecting the soft parts.

FIG. 3. *Amputation of the four metacarpal bones*.—*Circular method*; *a a*, linen bands between the bones to retract the soft parts, while the saw divides the bones.

FIG. 4. *Amputation of the metatarsal bones*.—Method with a planter flap; bandages are placed between the bones as in the amputation of the metacarpal bones.

FIG. 5. The same method.—Appearance after the operation; *a b c*, shape of the plantar flap.

MODES OF OPERATING.

§ 1. *Amputation of the fingers* (Fig. 1).—The circular method is usually adopted. After the circular incision of the skin, it must be retracted after dissecting it up for three or four lines above the first incision; the fibrous tissues and particularly the tendinous sheaths on the palmar aspect of the finger are then divided, and the bone sawn through by a watchmaker's saw, or cut with Liston's nippers. The skin being drawn over the bone, will unite with a transverse cicatrix, which is less likely to be injured by flexion of the fingers.

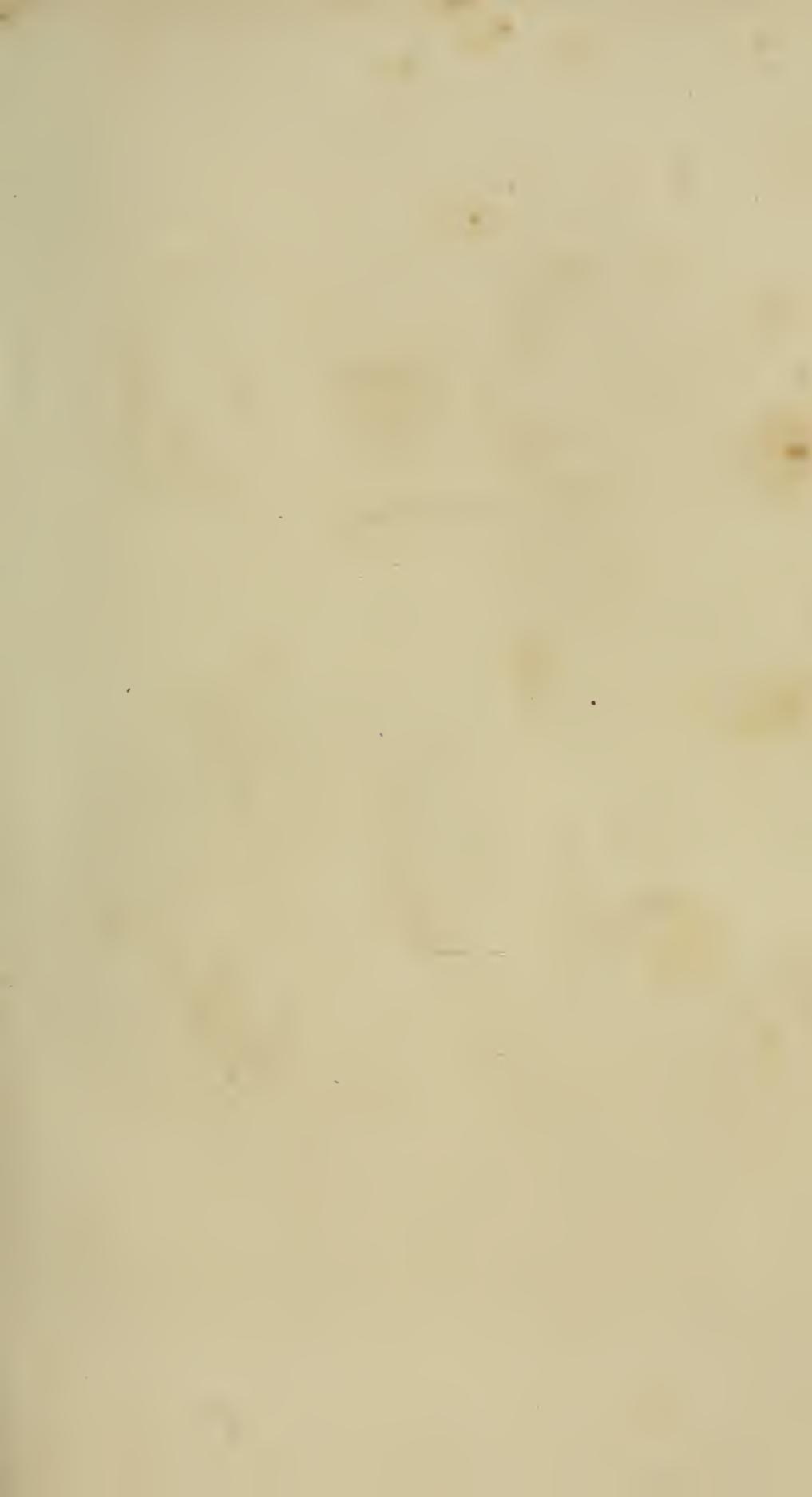
§ 2. *Amputation of a metacarpal bone and the finger attached to it*.—In these cases, as in disarticulation, the oval method may be most ad-

vantageously employed. When the bone is bare, a compress or piece of wood is placed behind it to protect the soft parts from the saw. A small saw should be used, and should be held obliquely from above downwards, and from without inwards. For the metacarpal bone of the thumb, we hold the saw perpendicularly, as in the operation upon the fingers. If we operate by the oval method in amputating the third or fourth metacarpal bone alone, it is very difficult to use the saw. In such cases Velpeau uses Liston's nippers, and experience proves that the cicatrisation is as complete and rapid when the bone is divided in this way, as by any other means.

§ 3. Simultaneous amputation of the four metacarpal bones (Fig. 3.)—A palmar flap is made from the palm of the hand, and the operation continued in the same way as in disarticulating the four fingers. (See pl. 20, fig. 2.) Then, with a straight bistoury, the muscles and periosteum are separated from the bones, and a five tailed retractor placed in the interosseous spaces, to protect the soft parts from the saw.

§ 4. Amputation of one metatarsal bone and the toe attached to it.—The same rules apply to this operation, as in the amputation of the metacarpal bones, with this exception, the bone is denuded of the soft parts only at the exact point where it is to be divided. The oval method is the most convenient, and is generally adopted. For the first and fifth metatarsal bones they should be sawn obliquely, the point resting against the adjoining metatarsal bone; by this means we prevent its projecting against the flap.

§ 5. Simultaneous amputation of all the metatarsal bones (fig. 4 and 5).—A plantar flap is first cut as in Chopart's operation; the two extremities of the base of the flap are united by a semi-circular incision, which crosses the dorsal aspect of the foot, dividing the skin and extensor tendons a few lines below the place where it is intended to saw the bone. The skin should then be retracted, and the bones carefully denuded with a straight bistoury, and the operation concluded by sawing through these bones, beginning upon the dorsum of the foot.



Pl. 29.

Fig. 3.

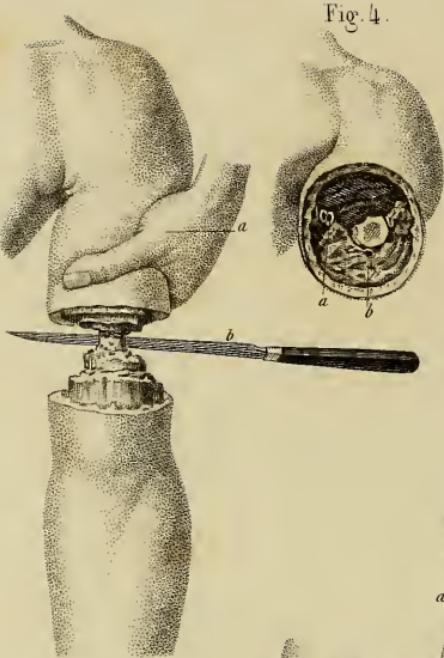


Fig. 5.

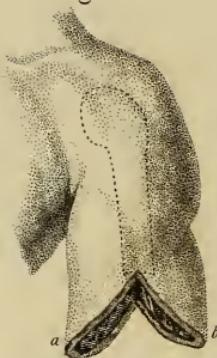


Fig. 2.

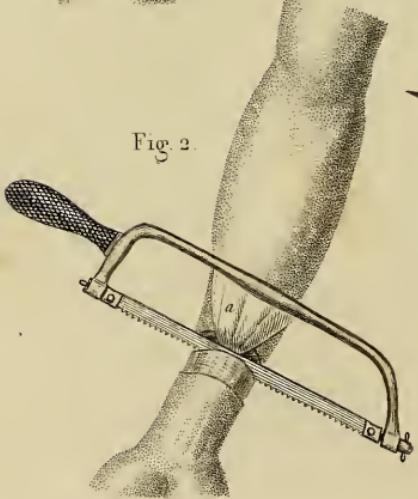


Fig. 1.



PLATE XXIX.

AMPUTATIONS OF THE FORE-ARM AND ARM.

OPERATIONS.

FIG. 1. *Amputation of the right fore-arm.—Circular and ordinary method.*—*a*, the hand of an assistant supporting the fore-arm. The surgeon standing on the outside of the limb, and holding the knife, is incising the muscles.

FIG. 2. *The same operation.* A three tailed retractor, *a*, passed between the bones, serves to retract the soft parts and protect them from the saw.

FIG. 3. *Amputation of the left arm.—Circular and ordinary method.*—*a*, the hand of an assistant drawing up the soft parts, while the surgeon, with the knife, *b*, cuts the deep muscles.

FIG. 4. Appearance of the stump, after the operation; *a*, the vessels, *b*, the humerus.

FIG. 5. *Same operation.—By double flaps.—Velpeau's method.*—The operation concluded; *a*, the internal flap; *b*, the external flap.

MODES OF OPERATING.

§ 1. *Amputation of the fore-arm.—Circular and ordinary method.*—The fore-arm being held by assistants in a position between pronation and supination, the surgeon holding a catlin, stands upon the inner side of the limb, if he operates upon the left fore-arm; upon the outer side, if upon the right. The operation is performed as follows:

1st. Make a circular incision which will divide the skin and subcutaneous cellular tissue down to the aponeurosis. Divide the cellular bands, and turn up the skin like the cuff of a coat, if it should not easily retract. If the limb is large and conical, it may be necessary to make a lateral incision in the skin.

2d. Divide circularly the muscles, with a sawing motion, at the border of the flap of skin which is turned up. The deep muscles between the bones must be divided by introducing the point of the knife, and

carefully cutting all the soft parts in the interosseous space. To do this the knife should be entered on the dorsal aspect of the radius, and carried around and between the bones by a figure of 8 incision. (See plate 30, fig. 2, and 2 amputation of the leg).

3d. A retractor with three ends must then be introduced into the interosseous space to draw up the soft parts. At the point where the bones are denuded, the surgeon draws the saw slowly at first across the radius and ulna, taking care to saw through the radius first, as the ulna, being more closely attached to the arm, serves as a support for the limb.

4th. The radial and ulnar, with the anterior and posterior interosseous arteries, are now tied. Then the skin, being drawn down, is so disposed as to form a transverse cicatrix.

This operation can also be performed by flaps, or by the oval method. In Graefe's method by a single flap, the flap is cut from the anterior portion of the fore-arm. By Vermale's method, with an anterior and posterior flap, a risk is run of exposing the ends of the bones at the angles of the wound. The oval method of Baudens offers no advantages over that usually adopted.

§ 2. Amputation of the arm.—Circular and ordinary method (fig. 3 and 4).—The arm being held by an assistant at a right angle with the trunk, the surgeon, holding the knife, stands on the outer side of the limb, and performs the operation according to the following rules:

1st. The skin and subcutaneous cellular tissue are cut circularly down to the aponeurosis. The skin is usually easily retracted.

2d. After which the surgeon, following the margin of the skin, cuts the muscles, with a sawing motion, down to the bone. The assistant again retracts the skin, and a second incision, carried as high up as possible, divides the deep muscles down to the bone, care being taken to cut through the periosteum and the radial nerve, which is in a sulcus in the bone.

3d. A doubled tailed retractor is now passed around the limb, and the bone sawed through. The brachial artery, and its branches, if necessary, are now tied.

Double flap method.—This amputation may also be performed by double flaps, either anterior and posterior, or lateral; Velpeau prefers the lateral.



Pl. 30.

Fig. 1.



Fig. 2.

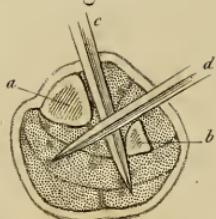


Fig. 2^{bis}

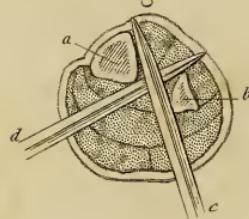


Fig. 4.

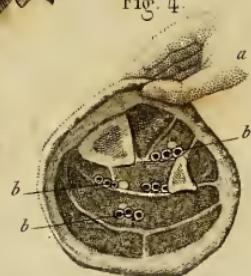


Fig. 3.

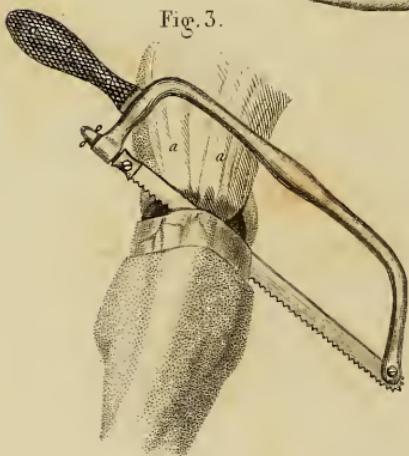


Fig. 5.



PLATE XXX.

AMPUTATION OF THE LEG.

OPERATIONS.

FIG. 1. *Amputation at the place of election.—Circular and ordinary method.*—*a, b, c*, circular incision of the integuments; *d*, flap of skin turned up. The surgeon stands on the inner side of the limb, and cuts the muscles with a double-edged knife.

FIG. 2 and 2 bis. *The same operation.—Incision of the deep muscles surrounding the bone.*

FIG. 3. *The same operation.—A three tailed retractor, aa, passed between the bones, supports the soft parts, and protects them from the saw.*

FIG. 4. *Appearance of the wound after the preceding operation.—The hand of an assistant, a, holds up the flap formed by the integuments; bb, vessels of the leg.*

FIG. 5. *Amputation of the leg at its inferior third.—Lenoir's method.—Appearance of the wound after the operation. a, b, angular flaps formed by the division and dissection of the skin making a kind of cuff divided in front; c, the tibia; d, the fibula.*

METHODS OF OPERATING.

§ 1. *Amputation of the leg at the most desirable point, two or three fingers breadth below the tuberosity of the tibia.—Ordinary method.*—(Fig. 1, 2, 2 bis, and 3.) The patient lying down, the leg, projecting beyond the bed, should be held at a convenient distance from the other by the assistants; the surgeon, grasping a catlin, stands on the inner side of the limb.

1st. A circular incision is made through the skin and subcutaneous cellular tissue. This incision should commence at the crest of the tibia, and be concluded without removing the knife. After this division, the surgeon dissects up the skin for an inch and a half or two inches, and turns it up like a cuff.

2d. Beginning at the border of the skin, which is turned up, with a

sawing motion of the knife the remainder of the flesh is cut through to the bone.

3d. The muscular fibres in immediate contact with the bones are divided by a figure of 8 incision, which is effected as follows (fig. 2): the edge of the knife is placed on the fibula at the outer side of the limb, carried across it and thrust through the interosseous space where it is made to cut upon the tibia *a*, and the inner surface of the fibula *b*, and brought out as at *d*. Then (fig. 2 bis) it is withdrawn, and applied to the posterior aspect of the limb, acting first upon the fibula as at *c*, and the same process being repeated as before, it is brought out finally as at *d*. The retractor is then applied in the usual manner for the protection of the soft parts.

4th. The surgeon now taking the saw, marks the point at which the tibia is to be divided with the thumb nail of his left hand, and drawing the saw towards himself, slowly at first, until it is fairly engaged, then elevates its handle so as to make it act upon the fibula at the same time, and having divided it entirely, finishes with the tibia. The arteries requiring ligature (fig. 4), are the anterior and posterior tibial, and the peroneal, and sometimes the sural branches.

Remarks.—Roux advises the surgeon to saw the fibula a little higher up than the tibia, in order to prevent its subsequent protrusion from the stump. Many surgeons saw off the anterior angle of the tibia, after the section of the bones. Sanson makes an oblique section of it, inwards and upwards. Sabatier recommends an oblique incision of the integuments on the calf of the leg, on account of the greater retraction of the muscles at this point, and, when the skin is turned up, concludes the operation by the circular method.

The operation by single flap, by double flap, or the oblique or oval method, may all be employed at the place of election in exceptional cases where the circular operation is not applicable.

§ 2. *Amputation at the inferior third of the leg.—Lenoir's method.* (Fig. 5.) The surgeon standing on the inner side of the limb makes a circular incision through the skin and subcutaneous cellular tissue, about an inch and a quarter below the place where it is intended to saw the bones. A vertical incision of the same length is also made along the crest of the tibia. This flap is then dissected up, and when turned up has the appearance of a collar open in front. The muscles are now divided down to the bone, beginning at the margin of the flap, their remaining fibres in the interosseous space are then cut, a three tailed retractor passed between the bones, and they are sawn through.

Fig. 1.

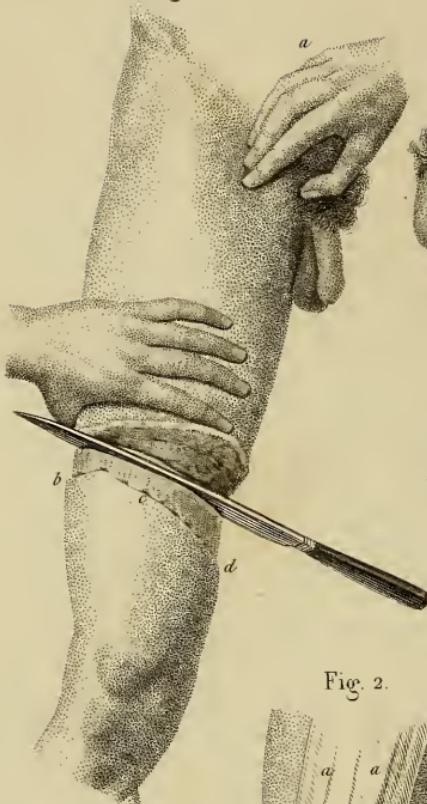


Fig. 4.



Fig. 2.

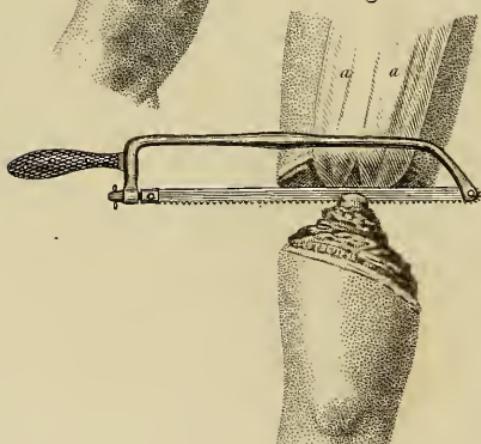


Fig. 3.

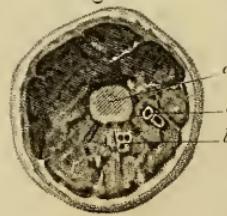


PLATE XXXI.

AMPUTATION OF THE THIGH.

OPERATIONS.

FIG. 1. *Circular operation.—Ordinary method.*—The hand of an assistant, *a*, compresses the femoral artery; *b, c, d*, circular incision of the integuments.

FIG. 2. The same operation. The muscles being incised to the bone, a split retractor, *aa*, serves to draw up the soft parts and protect them from the saw.

FIG. 3. The same operation concluded; appearance of the stump, *a*, section of the femur; *bb*, the open femoral vessels.

FIG. 4. *By double flaps.—Sédillot's method.*—*a*, the first flap drawn aside; the knife, *b*, entered obliquely, and following the line, *c, d*, is cutting the second flap.

METHODS OF OPERATING.

Circular and ordinary method (fig. 1, 2, and 3).—The patient lying on his back, the thigh is separated to a convenient distance from the other, slightly flexed upon the pelvis, and firmly held in this position by the assistants. The surgeon stands upon the inner side of the limb.

1st. Make a circular incision through the skin and subcutaneous cellular tissue, a short distance above the knee, and four or five fingers breadth below the place where it is intended to saw the bone. An assistant retracts the skin, while the surgeon divides the fibres of cellular tissue by which it is attached.

2d. Beginning at the margin of the retracted integuments, the superficial muscles are now cut; from the point of their retraction, the surgeon divides the deeper muscles down to the bone; a split retractor is passed around to protect the soft parts, and the bone is sawn through as usual (fig. 2).

3d. The *femoral artery* lying beneath the sartorius muscle, the *superficial* and *deep muscular*, and the *perforating arteries* are now to be tied. The edges of the wound should be brought together so as to obtain an oblique cicatrix.

If desirable, the double flap or the oval method may be adopted for the amputation of the thigh.

Fig. 1.

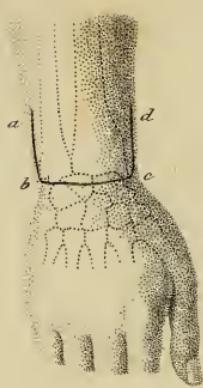


Fig. 4.

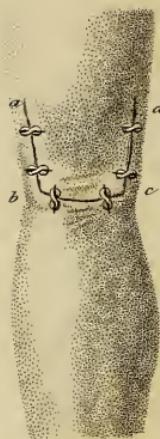


Fig. 2.

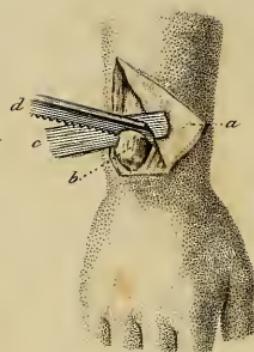


Fig. 5.

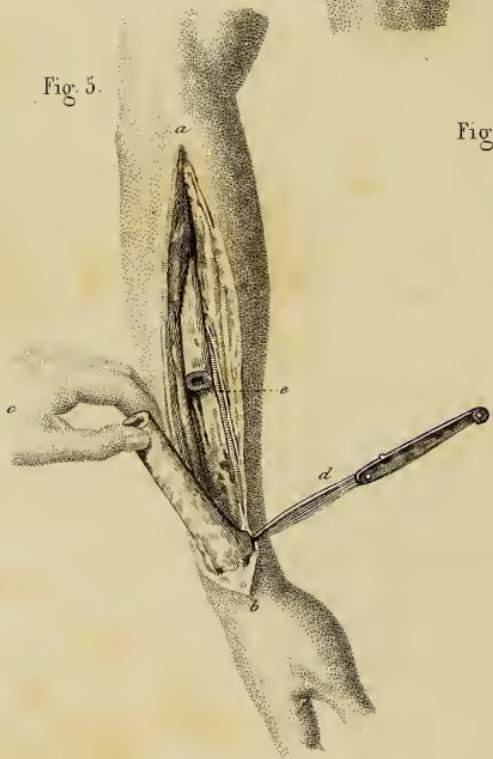


Fig. 3.



PLATE XXXII.

EXSECTIONS PERFORMED IN THE SUPERIOR EXTREMITY.

OPERATIONS.

FIG. 1. *Exsection of the wrist-joint.*—*Velpeau's method.*—*a, b, c, d,* quadrilateral cutaneous flap cut out from the posterior face of the radio-carpal articulation.

FIG. 2. *Exsection of the inferior extremity of the ulna.*—*a*, triangular flap of skin drawn aside; *b*, inferior extremity of the ulna; *c*, a thin piece of wood placed beneath the bone to protect the soft parts from the saw, *d*.

FIG. 3. *Exsection of the elbow-joint.*—*Moreau's method.*—*a*, the hand of an assistant holding up a quadrilateral flap, which has been dissected from below upwards from the posterior aspect of the joint; *b*, a thin slip of wood placed beneath the humerus while the saw, *c*, divides the bone.

FIG. 4, The same operation concluded. *a, b, c, d*, the quadrilateral flap brought back to its place, and re-united by the twisted suture.

FIG. 5. *Extirpation of the radius.*—*a, b*, a long incision made upon the outer side of the forearm down to the radius; *c*, the left hand of the surgeon raising the inferior extremity of the radius, while the right hand holding a bistoury, *d*, completes the disarticulation; *e*, the radial artery accompanied by the radial nerve.

METHODS OF OPERATING.

§ 1. *Exsection of the metacarpo-phalangeal articulation.*—The head of the metacarpal bone, the end of a phalanx, or both may be removed, according to the nature of the case.

Make an oblique incision on the dorsal aspect of the metacarpal bone, commencing about half an inch beyond the point where it is to be divided, and extending it to the commissure of the fingers; a similar incision should then be made on the other side, and the two will form a V

shaped flap with its base toward the finger. After dissecting and turning up this flap, the extensor tendon should be drawn aside, without dividing it, and the interosseous muscles detached from either side of the bone. The joint is then opened by cutting through the lateral ligaments, care being taken not to injure the flexor tendons. Luxate the phalanx backward, and carefully separate the diseased from the sound parts. After slipping a piece of wood or a card under the bone to protect the soft parts, it may now be sawn through, or cut with Liston's forceps. In operating upon the index or little finger, it is better to make the flap on the free side of the joint, and thus to avoid exposing the extensor tendon.

§ 2. *Extraction of the first phalanx.*—This operation having been performed successfully by Velpeau upon the thumb, without injuring the movements of the last phalanx, might possibly be applied to the phalanges of the fingers. Make an incision upon the dorsum of the finger, commencing half an inch above the metacarpo-phalangeal articulation, and extend it one-third of an inch below the articulation of the first and second phalanx. Dissect up the skin, and drawing aside the extensor tendon, cut through the lateral and anterior ligaments without injuring the flexor tendon. Luxate the bone upward, carefully separate it from the soft parts, and its extraction is then easily effected by traversing the inferior articulation.

§ 3. *Exsection of the metacarpal bones.*—Make a longitudinal or crucial incision upon the dorsum of the metacarpal bone which is to be removed; draw aside the extensor tendon, separate the interosseous muscles from the bone, and if it is the superior portion of the metacarpal bone which is to be removed, cut through the carpo-metacarpal articulation; if the inferior, the metacarpo-phalangeal. Pass a small compass beneath the bone to protect the soft parts, and divide it with Liston's forceps, or the chain saw; the operation is then concluded by drawing upward the exsected portion and separating it from the soft parts.

The metacarpal bone of the thumb or the little finger should be sawn obliquely, to prevent the sharp angle from injuring the flap. (v. pl. 28, fig. 2.)

§ 4. *Exsection of the wrist joint*—The inferior extremity of the radius, or of the ulna, or the carpal extremities of both bones, may be removed, according to the necessities of the case.

I. *Exsection of the inferior extremity of the ulna.*—(Pl. 32, fig. 2.)—The hand being carried outwards, a longitudinal incision is made

along the internal border of the ulna, and terminated inferiorly by a transverse incision across the back of the joint. A triangular flap, *a*, is then carefully dissected up, and the tendons being drawn aside, and the vessels carefully avoided, the bone *b* is denuded of its soft parts and disarticulated with the bistoury. A small slip of wood, *c*, is passed beneath the extremity of the bone, which is then sawn through, as at *d*.

II. *Exsection of the inferior extremities of the radius and ulna* (pl. 32, fig. 1).—1st. The hand being pronated and held firmly upon some solid surface, two longitudinal incisions are made along the borders of the radius and ulna *a b, c d*. A transverse incision across the back of the joint unites the lower extremities of these *b c*, and (2d) the quadrilateral flap, *a b c d*, thus circumscribed, is dissected up and turned backwards. 3d. The disarticulation is then effected, the tendons surrounding the two bones being detached with as little injury as possible, and the radial and ulnar arteries in front being especially cared for; 4th, pass a thin slip of wood or pasteboard beneath the bones, and complete their section by the saw applied to both at the same time.

By Dubled's method, two longitudinal incisions alone are made, one upon the radius, and the other upon the ulna. By the internal incision, the ulna is extirpated; and through the external, the radius is disarticulated and removed.

To the longitudinal incisions of Dubled, Roux adds two transverse incisions, which are carried across the dorsum of the wrist to the edges of the extensor tendons, thus leaving a portion of undivided integument along the back of the wrist.

Velpeau's method is similar to that above described, with the exception that he dissects his quadrilateral flap from above downwards, instead of from below upwards.*

5. *Exsection of the elbow joint*.—One or all the bones composing this joint may be removed, according to the exigencies of the case.

I. *Exsection of the inferior extremity of the humerus* (pl. 32, fig. 3 and 4).—*Moreau's method*.—1st. The arm being semi-flexed, and

* Experience has proved that the removal of the lower end of the radius alone is of doubtful utility, the hand being permanently carried outwards out of the axis of the forearm by muscular contraction, and the subsequent removal of the lower end of the ulna being rendered necessary.

The thin slip of wood or pasteboard recommended in the text, is advantageously replaced by a slip of gutta percha of suitable size and thickness; its toughness and flexibility adapting it better to the protection of the soft parts from the action of the saw.—EDS.

the posterior face of the articulation turned towards the surgeon, two longitudinal incisions, each about two inches and a half in length should be carried upwards along the humerus, one from the outer side of the external condyle, the other from the inner side of the internal condyle; 2d, these two incisions should then be united by a transverse section through the skin and triceps muscle immediately above the olecranon; a quadrilateral flap is thus formed, which being dissected from below upwards, must be supported by an assistant, *a* (fig. 3); 3d, the surrounding parts, and the ulnar nerve divested of its fibrous sheath, should then be carefully isolated from the bone, and drawn inwards by an assistant; 4th, the bone being carefully denuded, a slip of wood or metal, *b*, is slid under it to protect the soft parts from the saw, *c* (fig. 3); the separated portion of the bone is then cut loose from its various adhesions, and the joint opened from behind.

II. *Exsection of the superior extremities of the bones of the forearm.*—Moreau's method may be adopted in this operation by extending the external lateral incision along the radius as far as the point where the bone is to be divided. The radius is then isolated from the ulna and the soft parts; a thin slip of wood, as usual, is slid beneath it, and the bone is then sawn through. If the ulna is to be removed, the internal lateral incision is prolonged, and the operation continued as with the radius, the attachments of the *brachialis anticus* being injured as little as possible.

III. *Extirpation of the radius* (pl. 32, fig. 5).—1st. Make a longitudinal incision along the anterior and external border of the radius, *a b*, so as to lay bare the bone; 2d, after denuding it to the soft parts, a small slip is passed beneath it, about its middle, if the ordinary saw is used, if the chain saw, this is unnecessary; 3d, each fragment of the radius is then isolated, and disarticulated below and above, the neighboring vessels and nerves being carefully avoided.

§ 6. *Exsection of the shoulder joint.*—Baudens' method, by simple incision.—A vertical incision commencing below the coracoid process is made along the anterior border of the deltoid. At each angle of the wound, a transverse section of the muscle is made, without cutting the skin. By this transverse section the lips of the wound are more easily separated, and the joint rendered more accessible.

Malgaigne's method.—A vertical incision, more external than in Baudens' method, is made opposite to and carried up to the summit of the coraco-clavicular triangle, which should involve the skin, the mus-

cle, and the capsular ligament. The articulation is thus opened superiorly and anteriorly. The lips of the wound separate very easily, and permit the knife to be carried freely round the head of the bone, the removal of which is easily effected with the chain saw, or the ordinary instrument.

2d. *Various methods by flaps.*—The single flap operation is usually performed in removing the head of the humerus. Moreau and Manne make a quadrilateral flap; the former with an inferior, the latter with a superior base. Morel makes a semilunar flap with its base above. Sabatier prefers a triangular flap with the same base. Malgaigne advises a lateral and posterior flap, after Lisfranc's method of amputating at the shoulder joint. The flap once cut, the articulation is opened, and carefully avoiding the vessels and nerves, the head of the bone is disengaged and turned out. It is then removed with the saw as usual.

§ 7. *Exsection of the clavicle.*—1st. *Exsection of the scapular extremity.*—Velpeau describes as follows, an operation performed by himself in 1828, upon a woman affected with necrosis of the external third of the clavicle: "A crucial incision whose two branches were each about two inches in length was first made; the flaps were then dissected and held back; the acromio-clavicular ligaments and a few fasciculi at the origin of the deltoid and trapezius were then divided, and with the assistance of a thin piece of wood placed beneath the articulation and used as a lever, the diseased bone was raised up and detached from the sound parts. The soft parts were then carefully separated from the bone before and behind, a chain saw slipped beneath it, and it was sawn from within outwards, and afterwards disarticulated."

2d. *Exsection of the sternal end.*—In a peculiar case, Dr. Davie performed this operation by making an incision two inches and a half in length from its inner end, along the axis of the clavicle. The ligaments were then divided as much as possible, and a strip of hammered leather being placed beneath the bone to protect the soft parts, the inner part was sawn through with a Hey's saw about an inch from its articular surface. The bone being sawn through, it was necessary, in order to remove the separated portion, to use the handle of the scalpel as a lever to rupture the interclavicular ligaments which could not

otherwise be reached, and which still retained the bone firmly in its place.*

3d. *Removal of the entire clavicle.*—Mott, of New-York, performed this operation successfully for an osteosarcoma of the size of the two fists. A curvilinear incision was made with its inferior convexity extending from one articulation to the other, beneath the tumor. Another incision was carried from the acromion process to the outer edge of the external jugular vein, dividing the platysma myoides and a portion of the trapezius; a grooved director was passed beneath the bone near the acromion, and it was cut through with a chain saw. The removal of the inner extremity was very tedious and difficult, on account of the size of the tumor, and the degeneration of the adjacent parts.

To facilitate this operation, Velpeau and Malgaigne advise a quadrilateral flap, which should be dissected and turned upwards.

§ 8. *Removal of the scapula.*—Janson extected a large part of the sub-spinous portion of this bone, for a tumour which was connected with it. The tumour was circumscribed with two elliptical incisions, and the lips of the wound dissected up and turned outwards. The scapula above the spine being healthy, the diseased portion was separated from it with the saw, thus preserving the articulation of the arm.

* This is the extraordinary case reported by Sir Astley Cooper as the only instance within his knowledge of a dislocation of the sternal end of the clavicle backwards. (Dislocations and Fractures, p. 309, Am. Ed., Phil., 1844.) It occurred in a young lady as a consequence of distortion of the spine, and the operation was undertaken for its removal on account of the pressure made by the sternal end of the bone upon the œsophagus, which rendered deglutition almost impossible.—EDS.



Pl. 55.

Fig. 1.

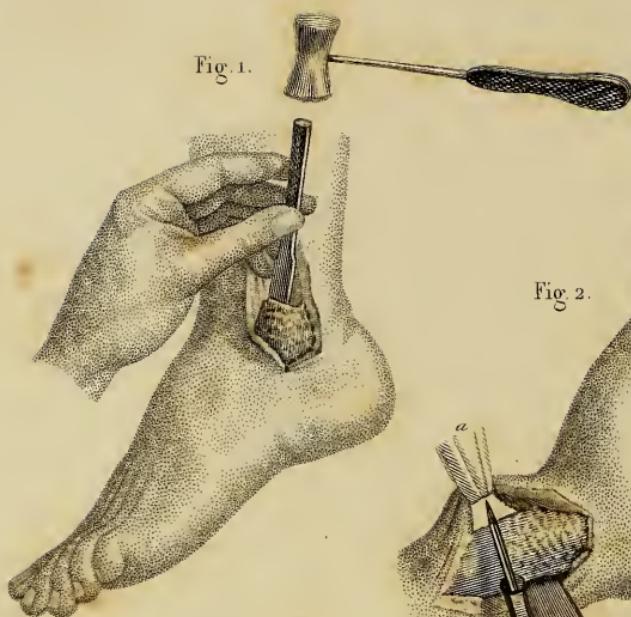


Fig. 2.

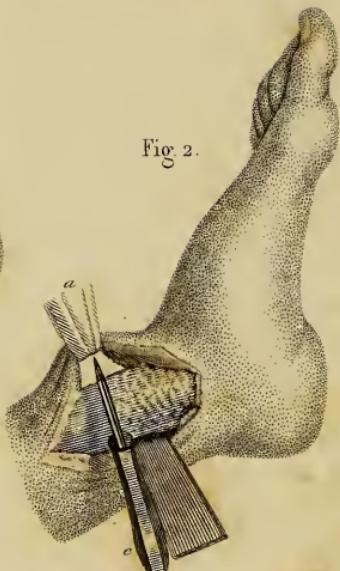


Fig. 3.

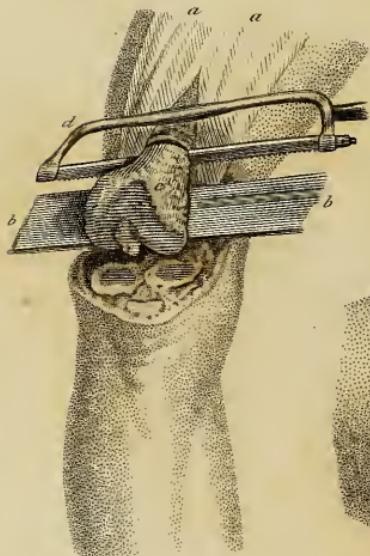


Fig. 4.

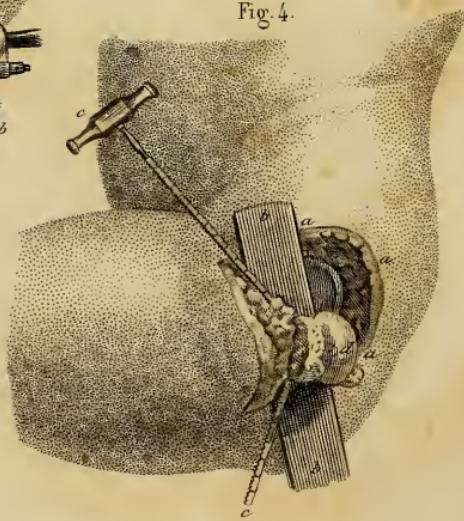


PLATE XXXIII.

EXSECTIONS PERFORMED UPON INFERIOR EXTREMITY.

FIG. 1. *Exsection of the lower extremity of the fibula.*—The surgeon holding a chisel, *a*, and a mallet, *b*, is removing the external malleolus.

FIG. 2. *Exsection of the lower extremity of the tibia.*—*a*, a linen retractor drawing up the soft parts in front of the bone; *b*, a thin slip of wood placed behind the soft parts to protect them from the saw, *c*.

FIG. 3. *Exsection of the lower extremity of the femur.*—*a a*, a retractor to draw up the soft parts; *b b*, a slip of wood to protect the parts behind from the saw, *d*; *c*, the lower end of the femur luxated forwards.

FIG. 4. *Exsection of the head of the femur.*—*Sedillot's Method.*—*a a a*, a semilunar incision with its convexity upwards, taking in the great trochanter; *b b*, a slip of wood placed beneath the luxated head of the femur; *c c*, a chain saw cutting the head of the bone, *d*, from within outwards.

METHODS OF OPERATING.

§ 1. *Exsection of the first metatarsal bone.*—The first metatarsal is the only bone upon which the operation of exsection is performed.

1st. *Exsection of the distal extremity of the first metatarsal bone.*—Blandin makes a quadrilateral flap, with its base posteriorly, on the inner side of the foot. This flap being dissected up, the lips of the wound are separated and the extensor tendon drawn aside; the metatarso-phalangeal articulation is then divided, and the head of the bone luxated, while with the bistoury it is separated from the adjacent muscles. The soft parts being properly protected, the diseased portion of the bone is removed by dividing it at right angles with its axis with a narrow bladed saw, or with the chain saw, if preferred. The incisions may be modified to suit special cases.

2d. For the extraction of the first metatarsal bone entire, the base of the quadrilateral flap should be carried up as far as the os scaphoides.

The metatarso-phalangeal articulation being more accessible, should be first divided, and the head of the bone being then raised up, it is denuded of its attachments, and the operation concluded by opening the articulation of the metatarsal with the cuneiform bone. Velpeau prefers sawing through the middle of the bone, and extracting the fragments separately.

§ 2. *Exsection of the bones of the tarsus.*—The cuneiform bones, the scaphoides, but more frequently the astragalus and os calcis have been exsected in cases of caries, luxation, and extensive injury. There are no fixed rules for these operations, they must be performed according to the nature of the case. To separate the bones from each other, it is sometimes necessary to use the gouge and mallet.

§ 3. *Exsection of the ankle joint.*—(Pl. 33, fig. 1, 2.)—*Roux's method.*—1st. Make on the outer side of the fibula a longitudinal incision three inches in length, commencing over the external malleolus, and carry it down to the bone. From the lower part of this incision, make a transverse section of the skin as far forwards as the tendon of the *peroneus tertius*. Dissect up the triangular flap thus formed, and opening the sheath of the *peroneus longus* and *brevis*, push them aside, and avoiding the vessels and nerves, denude the fibula of the soft parts, insinuate a chain saw between the tibia and fibula, and saw the bone from within outwards. This being effected, make use of the extremity of the fibula as a lever while it is being disarticulated.

2d. To exsect the tibia, make a longitudinal incision from three to four inches in length, along the inner margin of the bone, commencing over the internal malleolus, and carry it down to the bone. From the lower part of this incision, make a transverse section of the skin as far forwards as the tendon of the *tibialis anticus*. Dissect up the flap, and isolate the bone from the extensor tendons and anterior tibial vessels, pass a slip of wood beneath it to protect the soft parts, and complete its division with a small straight bladed saw. The chain saw can also be used to divide the bone without endangering the tendons. The tibia being sawn through, it is disarticulated in the same way as the fibula.

3d. *Extraction of the entire fibula.*—The central portion of the bone should be first denuded and cut through with the chain saw. The superior and inferior extremities are then successively extracted. If necessary, any part of this bone may be removed without opening either of its articulations.

§ 4. *Exsection of the knee joint.*—(Fig. 3.)—*Syme's method.*—1st. Flex the leg at a right angle with the thigh; make a curved incision above the patella with its convexity upwards from one lateral ligament to the other, and carry it directly into the joint; a second curved incision should then be made below the patella, with its convexity downwards, and its extremities should join the angles of the first. An elliptical flap is thus formed which removes the patella. The lateral and posterior ligaments are then to be divided, and carefully avoiding the popliteal vessels, separate the femur and tibia from the soft parts which surround them. Draw aside the soft parts with a split retractor, place a slip of wood or metal beneath the ends of the bones, and remove them with the saw. *Moreau's method* for exsecting the knee joint is analogous to that for the elbow. Two lateral incisions are carried so far up on the thigh as the point where the bone is to be divided. A transverse section below the patella unites them. The patella is extirpated while dissecting up the quadrilateral flap. The osseous extremities can then be easily exposed and exsected.

§ 5. *Exsection of the hip joint.*—*Velpeau's method.*—Make a curvilinear incision extending from the anterior superior spinous process of the ilium to the tuberosity of the ischium, which will form a large flap with its convexity downwards. Raise up the flap, divide the posterior half of the articular capsule, adduct and flex the thigh, cut the round ligament, carry the knife between the head of the femur and the acetabulum, and divide the remainder of the capsular ligament. The head of the femur is then forced out and sawn off.

Sedillot's method.—(Fig. 4.)—Make a semi-lunar flap, with its convexity upwards, which will circumscribe the great trochanter and open the articulation; the head of the bone is then forced out, and with a chain saw the operation is completed.

PLATE XXXIV.

EXSECTION OF THE SUPERIOR AND INFERIOR MAXILLARY BONES.

FIG. 1. *Removal of half of the lower jaw at the articulation.*—*Lisfranc's method.*—*a, b, c*, superior quadrilateral flap turned up; *d*, the inferior maxillary bone sawn through at the chin; *e*, half of the lower jaw luxated outwards; *f*, the internal maxillary artery; *g*, the submaxillary gland.

FIG. 2. *Exsection of the middle portion of the lower jaw.*—*Dupuytren's method.*—*a* and *b*, flaps turned outwards after a vertical incision through the median line of the lower lip; the surgeon standing behind the patient is sawing through the bone, *d*, with a Hey's saw, *c*.

FIG. 3. *Removal of the superior maxillary bone.*—*Velpeau's method.*—*a, b, c*, superior flap turned upwards; the superior maxillary bone, *d*, having been detached with the assistance of a chisel and mallet, the surgeon holding a bistoury, *e*, is dividing the soft parts which still adhere to it.

FIG. 4. *Appearance of the parts after the last operation.*—*a a a a*, points of twisted suture.

METHODS OF OPERATING.

§ 1. *Exsection and complete extirpation of the superior maxillary bone.*—*Gensoul's method, modified by Velpeau.*—The patient being seated upon a low chair, with his head thrown backwards and supported upon the breast of an assistant, make an incision with its convexity downwards, from the commissure of the lips to the temporal fossa. Dissect this large flap from below upwards, and turn it back upon the forehead. The maxillary bone being thus exposed, separate one after another its connections with the other bones of the face. 1st, cut through with the cutting forceps the external orbital process at its junction with the malar bone, the zygomatic arch, the os unguis, and the ascending nasal process of the upper jaw; 2d, divide the soft parts

PL 54.

Fig. 1.



Fig. 2.



Fig. 3.

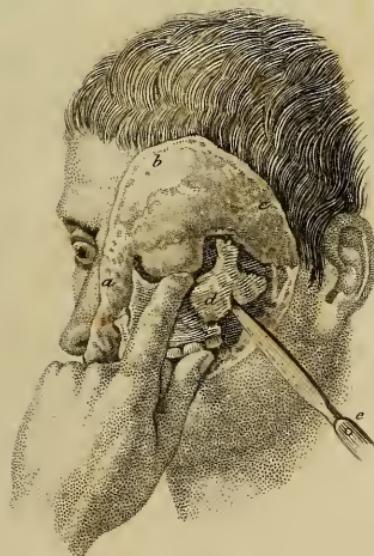
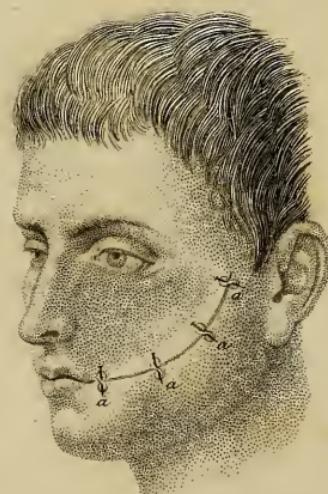


Fig. 4.





which connect the ala of the nose to the maxillary bone, and separate the two maxillæ in front with a chisel and mallet, or a small saw. Detach the soft parts from the floor of the orbit, and with flat cutting forceps, carried from above downwards, and from before backwards on the floor of the orbit, divide at once the superior maxillary nerve, and the connections of the bone with the pterygoid process. Conclude the operation by cutting through with the bistoury, or curved scissors, the velum of the palate, and the remaining soft parts which still adhere to and retain the bone.

§ 2. Exsection and removal of the lower jaw.—1st, *Removal of the central portion of the bone.*—*Dupuytren's, or the ordinary method* (fig. 2).—Seat the patient in a slightly elevated chair, with his feet raised so that they will have no purchase on the floor.* An assistant standing behind the patient holds his head firmly against his breast, and compresses at the same time the two facial arteries at the point where they cross the lower jaw. The surgeon, standing in front, seizes with his left hand one of the angles of the lower lip, while an assistant holds the other angle from the bone, and the whole in a state of tension. With a vertical incision he divides the lip through the median line at once to the bone, and afterwards prolongs it through the skin and subcutaneous cellular tissue down to the os hyoides. Keeping as close as possible to the bone, he then dissects back the two flaps, and the bone being sufficiently denuded, incises the periosteum and extracts a tooth opposite to each point where it is to be sawn through. When dividing the bone, Dupuytren stood behind the patient and used a small Hey's saw; if the chain saw is used, the surgeon stands in front of the patient. The bone being sawn through on both sides, an assistant pushes back the tongue with a spatula, to protect it from the knife, and the surgeon holding the bone with his left hand, with a probe pointed bistoury, held perpendicularly, divides the muscles attached to it, as closely as possible to their insertion, carrying the knife along its concave surface. After the division of its attachments, the tongue will

* In all the operations about the mouth and jaws, the employment of anaesthetic agents, if adopted by the surgeon, will render it necessary for the patient to be placed in a different position from those indicated above. A patient under the full influence of chloroform or ether cannot with propriety, even if it were possible, be supported in a sitting posture. He should be placed upon his back on a table of proper dimensions, with the head and shoulders so far elevated that the blood can be made from time to time to flow from the wound, otherwise there would be danger of suffocation from its accumulation in the mouth and throat.—Ebs.

sometimes fall backwards, threatening suffocation. This is to be remedied by holding the head forward, when the tongue will naturally fall into the same position.*

2. *Exsection and disarticulation of one-half of the lower jaw.*—1st. Make a horizontal incision along the inferior border of the bone, extending from the symphysis to the angle of the jaw; make a vertical section at each extremity of this incision; the internal, dividing the lower lip through the median line; the external, carried from the zygomatic arch behind the ramus of the jaw. This makes a quadrilateral flap, which is to be dissected and turned up. Saw through the jaw at the median line, and keeping close to the bone, detach with the bistoury all the soft parts adhering to its posterior surface as far as the angle of the jaw. Carry a probe pointed bistoury beneath the zygomatic arch and behind the coronoid process, and with it divide the tendon of the temporal muscle while depressing the bone to disengage the process and luxate the condyle. Pull the bone strongly outwards, as far as possible from the vessels, in order to avoid especially the internal maxillary artery, and complete the operation by dividing the pterygoid muscles and the articular ligaments.

The whole, or only a part, of the horizontal portion of the lower jaw may be removed, according to the exigencies of the case.

Walther, of Bonn, has even successfully removed the whole of the lower jaw. †

EXSECTION OF THE BONES OF THE TRUNK.

§ 1. *Exsection of the ribs.*—The patient lying down in a convenient position, an incision is made appropriate to the extent of the disease in the bone. The pleura should now be carefully separated from the inner face of the rib with the point of a director, and a protecting compress passed beneath it, and the bone sawn through with Hey's saw, or divided with the bone nippers. The divided end of the rib is then raised with a blunt hook, and the intercostal muscles are cut close to the bone to avoid wounding the intercostal artery and the pleura.

§ 2. *Exsection of the sternum.*—No fixed rules can be given for this operation, on account of the variety of pathological conditions

* Or still better, seize the extremity of the tongue with a firm pair of hooked forceps, and draw it forcibly forwards.

† This formidable operation has also been recently performed, with success, by Prof. Carnochan, of this city.—EDS.

which may require it. Trephining is usually combined with exsection. It is essential to avoid injuring the mammary vessels along the sides, and the pleura beneath the bone.

§ 3. *Exsection of the spinous processes of the vertebrae, and of the bones of the pelvis.*—For the exsection of the spinous processes, an incision should be made sufficient in extent to expose the vertebrae and the muscles lying in the grooves external to the transverse processes; the bone being denuded, the diseased portion is removed with Hey's saw.*

Portions of the bones of the pelvis may be removed; the surgeon must choose his method of operating, according to the nature of the case.

* An interesting case in which this operation was successfully performed by Dr. D. L. Rogers for the removal of the spinous process of the first lumbar vertebra, depressed upon the spinal cord, and causing paraplegia, is to be found in his "Surgical Essays and Cases," p. 45.—Eds.

PLATE XXXV.

TREPANNING OF THE BONES OF THE CRANUM.

SURGICAL ANATOMY.

FIG. 1. *Vertical section of the cranium.*—The corresponding cerebral hemisphere is here shown covered by its membranes, to exhibit the ramifications of the middle meningeal artery, and the sinuses of the dura mater.

a a a, branches of the middle meningeal artery.—This artery enters the cranium through the foramen spinosum of the sphenoid bone. The anterior branch, which is the largest, winds along through the groove in the anterior inferior angle of the parietal bone. Occasionally this groove is a complete bony canal an inch or two in length. The posterior branch winds along the squamous portion of the temporal bone. Laceration of the middle meningeal artery usually takes place at the anterior inferior angle of the parietal bone.

b b b, dotted course of the superior longitudinal sinus.—This sinus is lodged between the two cerebral hemispheres, and is formed by a duplicature of the falx cerebri, whose course it follows; its posterior fifth is received into a bony groove. It commences at the *crista galli* of the ethmoid bone, and terminates at the internal occipital protuberance, *c*, at which point is situated the *torcular Herophili*.

d, the right lateral sinus.—The lateral sinuses are partly received in the grooves which separate the superior and inferior occipital fossæ. They commence at the internal protuberance, *c*, and pass along horizontally towards the base of the petrous portion of the temporal bone. They run superficially for an inch and a half or two inches, after which they turn inwards and downwards and pass through the posterior *foramen lacerum*.

FIG. 2. *Application of the trephine.*—*a a a a*, four flaps formed by a crucial incision of the integuments; *b*, the trephine in operation.

FIG. 3. *Exsection with cutting forceps, a,* of the bony angles left between the circular openings.

FIG. 4. *The surgeon, with a lenticular knife, a,* is smoothing the edges of the opening in the bone.

Pl. 35.

Fig. 1.

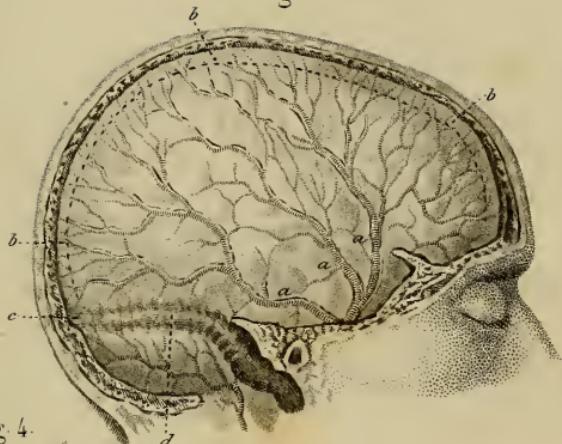


Fig. 4.



Fig. 3.

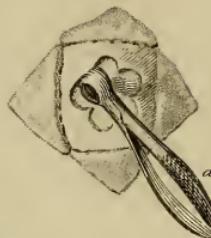
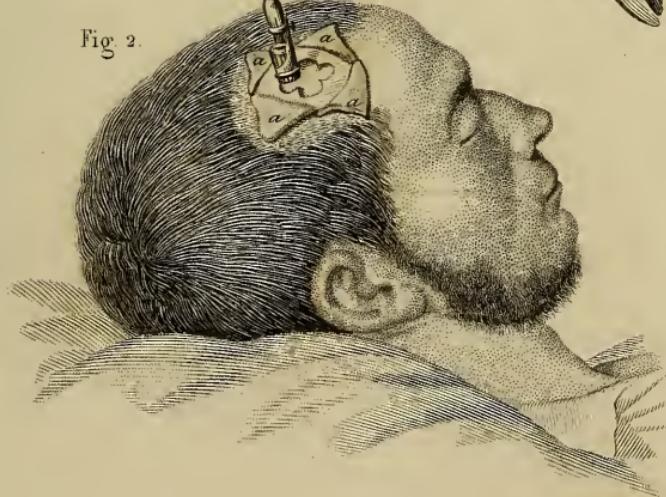


Fig. 2.



MODE OF OPERATING.

The patient should be placed in a horizontal position, with his head resting upon a board covered with a pillow, and firmly held in this position by assistants. The surgeon should then make a crucial, a V, or a T shaped incision through the integuments, and the flaps are dissected up and held aside. The periosteum is then rasped up, previous to applying the centre-bit or French trepan, or better still the English trephine. If the trepan is used, its crown and perforator must be first attached; then holding it in the right hand like a pen, the point of the perforator is placed upon the denuded bone, the ebony knob on the top of the trepan is held between the thumb and forefinger of the left hand, and the chin pressed firmly upon it, while with the right hand the handle of the instrument is turned from right to left. The perforator having entered the bone, the teeth of the crown soon make a circular groove. When this is sufficiently deep to support the crown, the perforator is removed, and replaced by the screw elevator. The movements of rotation are continued, the instrument being occasionally withdrawn to clean its teeth with the brush, and sound with the style if it acts equally upon all parts of the circle, or if the bone is already sawn through in some places. When this is found to be divided throughout its whole circumference, loosen the osseous disc, and raise it with the elevator. When the operation is concluded, if the section is not smooth, the projecting points should be removed with the lenticular knife.

With the trephine, the operation is more simple. The instrument is first applied, with its perforator projected, to the denuded bone, and it is rotated from right to left, and from left to right, with the proper degree of pressure, until a channel is traced by the teeth of the crown. The perforator should then be withdrawn, and following the same rules as given above, the operation is continued until the bone is sawn through.

When it is necessary to apply the trephine several times, the sections of the bone may be made at certain distances from each other, and the bony intervals divided through with Hey's saw. If the sections cut into one another, the bony angles which remain may be removed by cutting nippers.

If the operation of trepanning is performed for depressed bone alone, the elevator should be slipped between the cranium and dura mater, without injury to the latter. A longitudinal or crucial incision with the point of the bistoury should be made, if there is any liquid which requires exit from beneath the dura mater.

OPERATIONS UPON THE EYE AND ITS APPENDAGES.

OPERATIONS UPON THE EYELIDS.

SURGICAL ANATOMY.

Eyelids.—The structure of the eyelids presents to us the following elements for consideration :

1st. *The skin*, fine, soft, elastic and loosely attached to the subjacent tissues ;

2d. *A layer of lamellated cellular tissue*, uniting the skin to the muscular layer. This tissue, very loosely connected, is from the nature of its structure favorable to the development of encysted tumors ; it is frequently the seat of serous infiltrations and erysipelatous inflammations, which are occasioned by traumatic lesions of the eyelids or the face ;

3d. *The muscular layer*, composed of concentric fibres of the *orbicularis* muscle, which form pale and thin arches upon each lid, and are only united at the external commissure. The upper eyelid has a muscle peculiar to itself, situated behind the orbicularis, called the *levator palpebræ*. This muscle arising from the most internal portion of the orbit, is attached by an aponeurotic membrane to the tarsal cartilage. It receives nervous filaments from the *motores oculorum*, or third pair of nerves, and its office is to elevate the upper lid, the movements of depression of the lower lid depending upon the facial nerve. Blepharoptosis usually depends upon the paralysis of this muscle.

4th. *The tarsal cartilages*, situated beneath the muscular layer, are composed of thin fibrous lamellæ which give support to the eyelids, and prevent their wrinkling or folding vertically. The cartilage of the upper lid is about double the width of that of the lower. These cartilages are united internally and externally by a palpebral ligament, given off by the orbital aponeurosis.

5th. *The Meibomian glands* are situated between the tarsal cartilages and the conjunctiva, and open by minute foramina upon the

edges of the lids. When hypertrophied, they form the small tumors which are frequently observed on the conjunctiva.

6th. *The conjunctiva* is a mucous membrane which covers the inner surface of the lids, and is reflected over the globe of the eye. It is very vascular, particularly where it is folded upon the eyeball.

All the anatomical elements entering into the composition of the eyelids are intimately united at their free borders ; but in proportion as we leave their edges, they are much more loosely connected.

The arteries which supply the eyelids are found at some distance from their free borders, lying beyond the tarsal cartilages. A semi-lunar flap can therefore be removed from their edges, without causing much hæmorrhage.

PLATE XXXVI.

OPERATIONS UPON THE EYELIDS.

FIG. 1. *Symblepharon*.—*Von Ammon's method*.—The portion of the eyelid adhering to the globe is included between the two incisions *a b*, and *c b*, which separate it from the rest of the lid.

FIG. 2. The same operation terminated. The edges of the incision united by three points of twisted suture, while the little triangular flap, *a*, still adheres to the globe.

FIG. 3. *Epicanthus*.—*a b c d*, an elliptical wound caused by the removal of a fold from the skin at the root of the nose.

FIG. 4. *Blepharoptosis*.—*Ordinary method*.—*a*, self closing forceps holding a fold of the skin, *b*, of the upper lid; *c*, scissors excising the fold.

FIG. 5. *The same operation*.—*Hunt's method*.—*a b c*, position and appearance of the wound, after the removal of the flap.

FIG. 5 bis. The operation terminated. The edges of the wound united by points of twisted suture.

FIG. 6. *Entropium*.—*Janson's method*.—The surgeon seizes, with Adams' forceps, *a*, a vertical fold of skin and excises it with the flat curved scissors, *b c d*, the same operation after its performance at the outer angle of the eye; the edges of the wound united by three points of twisted suture.

FIG. 7. *Entropium*.—*Crampton's method modified by Guthrie*.—*a* and *b*, vertical incisions through the entire thickness of the lid; *c d*, transverse incision half through the lid. The edges of this incision are brought together by points of suture, *e e e e*; an adhesive strap, *f*, fastens the threads to the eyebrow.

FIG. 8. *Ectropium*.—*Adams' method*.—*a*, the first incision through the lower lid; the surgeon seizes the edge of the lid with the forceps, *b*, and with the scissors, *c*, excises a small triangular flap.

FIG. 9. *The same operation*.—*Dieffenbach's method*.—*a b*, an incision in the lower lid; the surgeon with the forceps, *c*, draws out a fold of the conjunctiva, and excises it with the scissors, *b*.

Fig. 1.

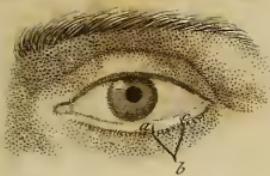


Fig. 2.

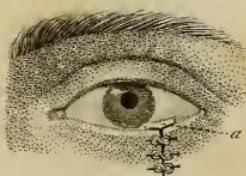


Fig. 3.



Fig. 4.

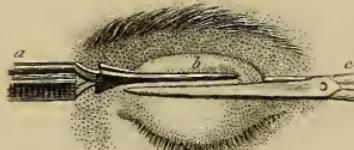


Fig. 5.

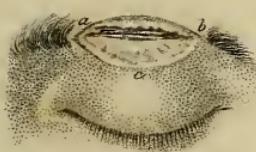


Fig. 5 bis.

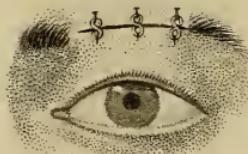


Fig. 6.

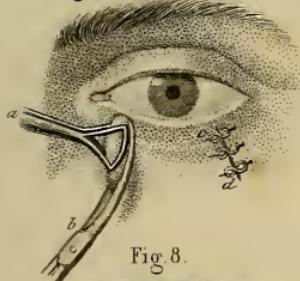


Fig. 7.

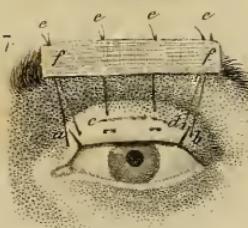


Fig. 8.

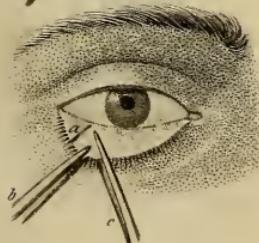
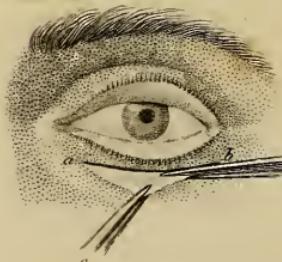
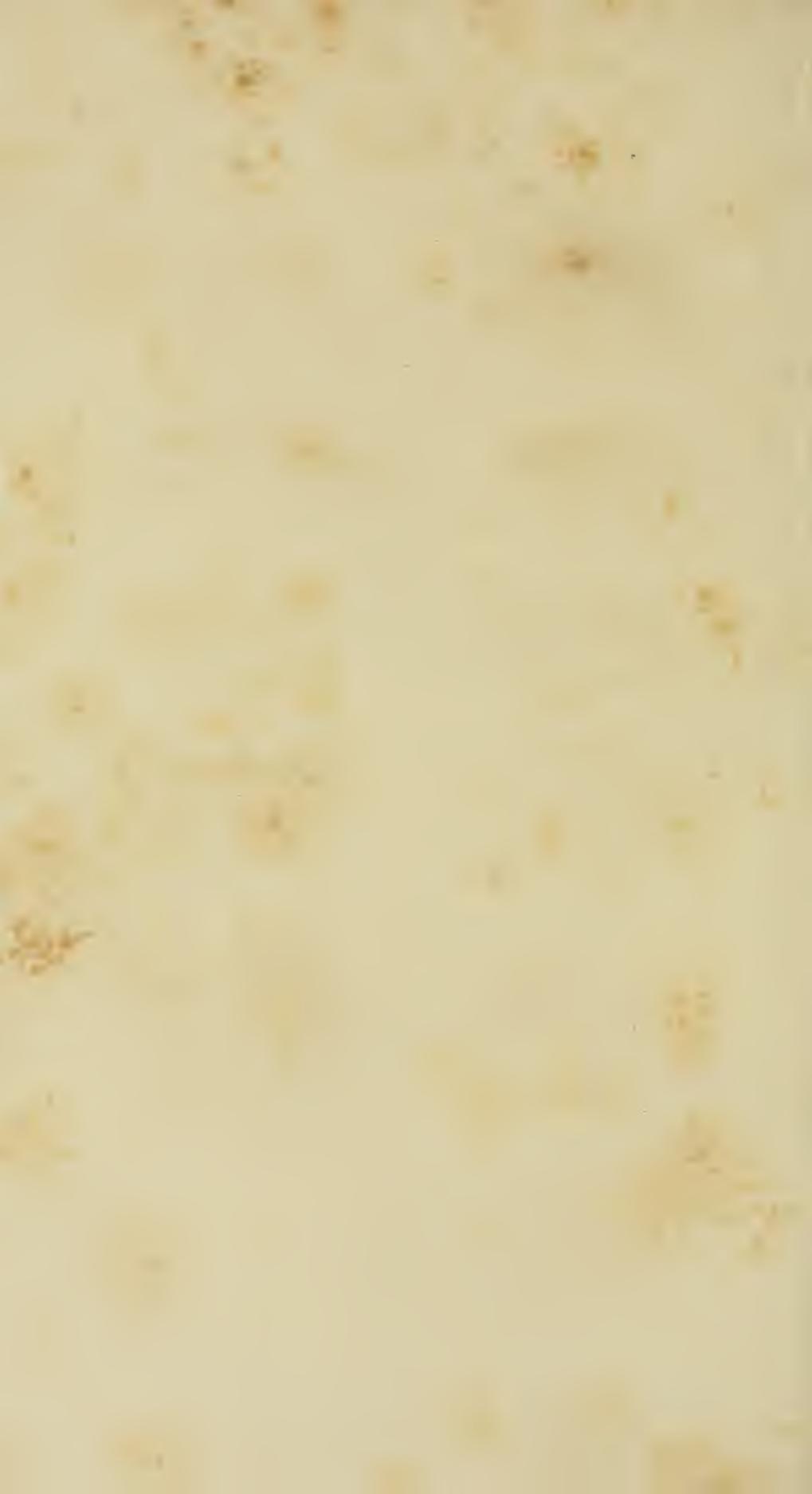
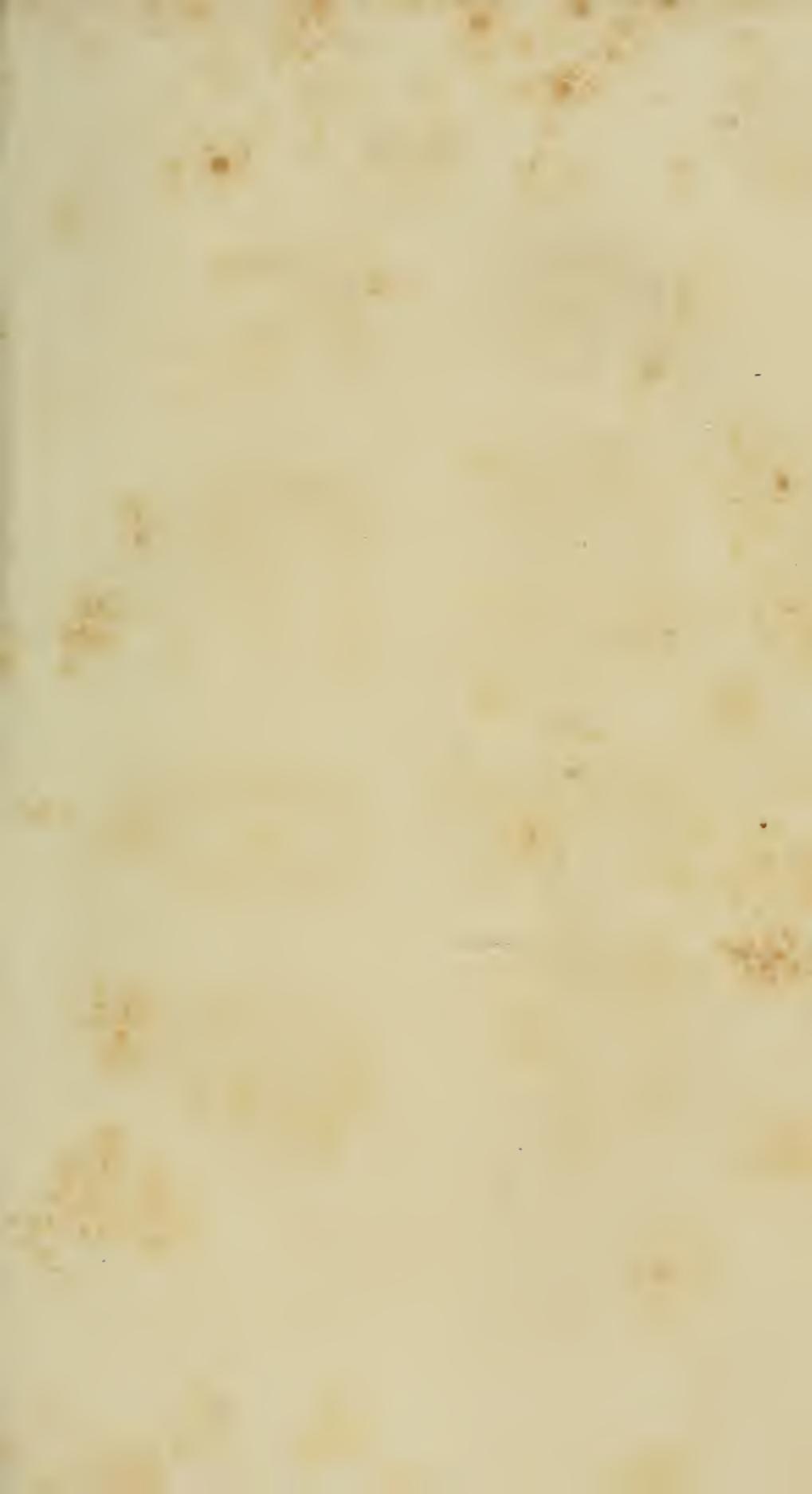


Fig. 9.







PL. 37.

Fig. 1.

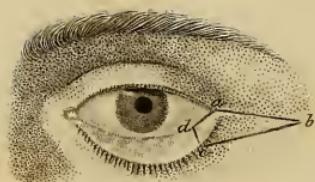


Fig. 2.



Fig. 5.

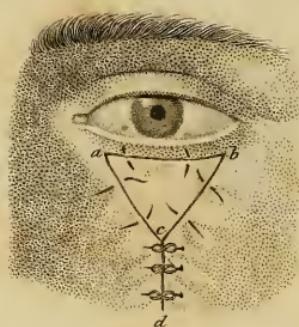


Fig. 4.

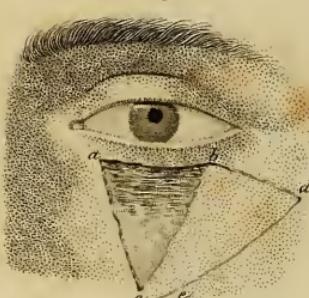


Fig. 5.

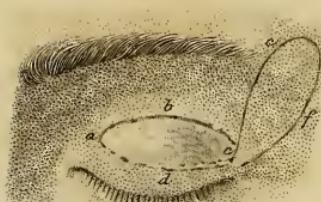


Fig. 7.

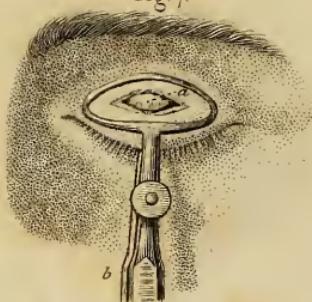


Fig. 8.

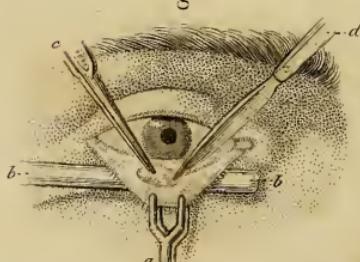


PLATE XXXVII.

OPERATIONS UPON THE EYELIDS CONTINUED.

FIG. 1. *Ectropium*.—*Desmarres' method*.—*a b*, first incision commencing at the external angle of the eye; *b c*, second incision commencing at the free edge of the lower lid and joining the first at *b*; *c d* and *a d*, two incisions commencing at the internal extremities of the two first, and uniting at *d*, at the fold of the ocular and palpebral conjunctivæ.

FIG. 2. *The same operation concluded*.—The edges of the wound united by three points of suture, *a a a*.

FIG. 3. *Blepharoplasty*.—*Jones' method*.—*Operation concluded*.—*a b c*, a triangular flap drawn up to cover the denuded surface; *c d*, the integuments brought together to cover the wound caused by the displacement of the flap.

FIG. 4. *Blepharoplasty*.—*Dieffenbach's method*.—*a b c*, a triangular wound caused by the removal of a tumour; *b d* and *d e*, two incisions circumscribing the cutaneous flap which is to be drawn inwards to cover the wound, *a b c*.

FIG. 5. *Blepharoplasty by torsion*.—*a b c d*, an elliptical wound of the upper lid; *c e f*, an incision around the frontal cutaneous flap intended to cover the wound, *a b c d*.

FIG. 6. *The same operation concluded*.—The flap covers the wound; points of suture, *a a a*, fasten it to the eyelid, and the edges of the wound above, *b c*, are united by points of twisted suture.

FIG. 7. *Extirpation of tumours of the upper lid*.—The method of applying Desmarres' forceps (see Instruments, plate 8, fig. 2).

FIG. 8. *Extirpation of a tumour from the inner surface of the lower lid*.—An assistant, with a pair of double jawed forceps, *a*, everts the lower lid over a small rod, *b b*, while the surgeon with the forceps, *c*, and the small bistoury, *d*, removes the tumour.

METHODS OF OPERATING.

COLOBOMA.

Cololoma is a congenital, or an accidental division of the eyelid. If the cleft is congenital, the edges are cut away and brought together by two or three points of twisted suture. If the division is accidental and recent, the bleeding edges of the wound should be united in the same manner. The first pin should be placed through the free edge of the lid, and this as well as the others should be passed through the skin and tarsal cartilage alone, and not through the whole thickness of the lid, to avoid causing the inflammation which their contact with the globe would produce.

ANKYLOBLEPHARON.

Ankyloblepharon, or the adhesion of the edges of the lids to each other, is rarely congenital; it is frequently occasioned by ulcerations of the tarsal margins, and may be complete or partial. If it is partial, the adhesion may be divided with probe-pointed scissors, or by a bistoury carried along the groove of a director introduced between the eyeball and the lids. If the adhesion is complete, a small opening should be made at the external angle of the eye between the lids, and through this, a director being introduced, a bistoury passed along its groove divides the adhesions.

Before performing this operation, the surgeon should first assure himself that there is no adhesion between the lids and the globe. If there should be any fibrous bands uniting the palpebral conjunctiva to the ball, they can usually be destroyed with the director. The operation being concluded, it is necessary to prevent new adhesions. For this purpose, astringent lotions, foreign substances placed between the edges of the lids, their forced separation by means of adhesive plaster, and cauterisation with the nitrate of silver, have all been employed. If adhesions form in spite of these means, Amussat recommends their daily destruction by a probe. Von Ammon proposes to dissect up a flap from the conjunctiva and apply it over the wound.

SYMBLEPHARON.

Symblepharon, or *adhesion of the eyelids to the eyeball*, is very rarely congenital, but frequently results as a consequence of inflammations of the palebral, or ocular conjunction. This affection consists of adhe-

sions caused by filaments of fibrous tissue more or less numerous, which unite the conjunctiva of the lids to the globe of the eye; they cause immobility of the organ, and require division. If they are few and isolated, they may be cut through with probe pointed scissors, curved on their flat surface. To prevent the formation of new adhesions of the cut surfaces, the eyelids should be drawn outwards with strips of adhesive plaster, so as to prevent the contact of the cut surfaces. When the fibrous bands are numerous and close together, rendering the eyeball immovable, the following operation should be performed:—

Von Ammon's method.—(Pl. 36, fig. 1 and 2.)—Two incisions, *c b*, and *a b*, carried through the eyelid, should be made to circumscribe all that portion of the lid which adheres to the globe of the eye. The triangular flap thus isolated, accompanies the eye in all its movements. The lips of the wound in the lid must now be brought together by two or three points of twisted suture. This union is made in front of the triangular flap *a*, (fig. 2,) which still remains adherent to the eyeball. When the cicatrisation of the little wound in the lid is perfected, the triangular flap *a* is dissected off, the relapse which would have resulted from the contact of the two bleeding surfaces being no longer to be feared.

Dieffenbach's method.—To arrive at the same result, Dieffenbach produces an artificial entropium. A quadrilateral flap is formed by making two vertical incisions, one at each angle of the affected lid. The eyelashes are cut off, and the adhesions being destroyed, the quadrilateral flap is turned inwards, so that the external aspect of the lid is in contact with the wound of the eyeball, and cannot contract any adhesion with it. The wound of the ball having cicatrised, the eyelid is brought back to its natural position, and heals in its turn, without danger of adhesions forming between it and the eye.

EPICANTHUS.

Von Ammon gives the name of *epicanthus* to a crescentic fold of skin with its concavity external, which covers more or less the inner angle of the eye, (see pl. 36, fig. 3.) To remedy this deformity, a vertical fold of the skin of the nose, on a level with the epicanthus, is seized with the forceps, and cut off at once with scissors curved on their flat surface. The formation of this fold uncovers the inner angle of the eye, by drawing inwards the epicanthus which masks it. The result is an oval

wound, whose edges being brought together by sutures, causes the disappearance of the epicanthus. If the deformity affects both eyes, it may be remedied by a single operation. A fold of the skin on the dorsum of the nose, between the eyes, is cut out, and the edges brought together as above.

BLEPHAROPTOSIS.

(*Plate 36, fig. 4, 5, and 5 bis.*)

Falling of the upper lid has been named *Blepharoptosis*, *Ptosis*, and *Blepharoplegia*. It may be produced by a redundancy of the integuments, or by partial or complete paralysis of the *levator palpebrae superioris*. The surgical treatment of this affection consists in removing the superfluous position of the lid, thus equalising its extent with its functions.

Ordinary method (fig. 4).—Seize with the self closing forceps *a*, a transverse fold of the skin *b*, of the upper lid. It is essential that the fold of skin removed should be of such size that the patient may be enabled to close the eye after the operation; if the fold is too small, a second operation will be required; if too large, ectropium may be the result. The skin should be excised with a single cut of the scissors *c*. The result is an elliptical wound, whose edges should be brought together by two or three points of suture. Some surgeons introduce the threads into the fold of skin held by the forceps and afterwards excise it in front of them, by this means having the sutures ready placed in the edges of the wound. The adoption of this practice abridges the operation, and renders it less painful.

Hunt's method (fig. 5 and 5 bis).—After shaving the eyebrow, a semi-elliptical flap, *a b c*, is removed from it. The extent of the flap should depend upon the degree of the relaxation of the lid; the edges of the wound which results from its removal are to be brought together as above. By this means the upper lid is drawn up (see fig. 5 bis). In this operation the inferior fibres of the occipito-frontalis muscle are exposed, and the upper lip is attached to them. The cicatrix of the wound is concealed by the eyebrow. Sedillot proposes to make use of the *corrugator supercilii* by dividing its external insertion, and bringing it down upon the lid. By this method, the movements of the eyelid depend upon those of the corrugator muscle.

ENTROPIUM.

Entropium is the affection caused by inversion of the eyelids. The surgical treatment of this disease should depend upon the nature of the causes which produce it. Among these may be enumerated, diseased condition of the skin or of the mucous membrane lining the eyelids, contraction of the *orbicularis* muscle, alterations of the tarsal cartilage, &c. Entropium produced by relaxation of the skin, or spasmodic contractions of the *orbicularis*, may be successfully treated by astringent or antispasmodic lotions; adhesive straps holding the diseased lid temporarily everted, will often suffice to cure senile entropium. If these means should prove ineffectual, recourse may be had to blisters (Carron du Villards), or *cauterisation*, which will result in cicatrices, the contraction of which will produce an eversion of the lid. The blister should take the shape of the lids, and be kept open for several days. A visible cicatrix is the result. *Cauterisation* is effected with a red hot iron, or with sulphuric acid. In using the red hot iron, a Beer's spatula should first be introduced beneath the lid to support it and protect the globe of the eye; a small cautery iron heated to a white heat is then rapidly carried across the integument of the eyelid so as to leave a transverse eschar. Cauterisation with sulphuric acid, as proposed by Quadri, is less painful. After determining the position and extent of the eschar to be produced, the eyeball is protected by means of a strip of adhesive plaster applied over the fissure of the lids; a small quantity of sulphuric acid is then rubbed transversely over the lid with a glass rod, or a pencil of asbestos. After the acid has remained some ten or fifteen seconds, it should be wiped off. If the disease is not cured by the first cauterisation, it may be several times repeated, until the lid has resumed its natural position. It sometimes happens, that the operation is carried a little too far, causing eversion to succeed inversion. This is remedied by attaching a thread to the eyelashes and fastening it upon the cheek for the upper, upon the forehead for the lower lid.

Excision of the skin, proposed by Celsus.—This is performed in the worst cases of entropium; a transverse fold of skin is excised, whose size is proportioned to the extent of the inversion. The methods described for the operation for blepharoptosis (*see pl. 36, fig. 4, 5, and 5 bis*)—are also applicable to entropium.

Janson's method (see pl. 36, fig. 6).—Instead of a transverse, a vertical fold is seized with Adams's forceps *a*, and excised with the curved scissors *b*. The edges of the wound are united either by threads passed through the fold of skin before its excision, or by points of twisted suture *c d*. It is sometimes necessary to excise two or three folds, one not sufficing.

Crampton's method modified by Guthrie (see pl. 36, fig. 7).—Usually performed in cases of entropium, dependent upon a diseased or defective condition of the tarsal cartilage. The surgeon, with straight scissors, makes a vertical incision, *a*, through the entire thickness of the lid, a little external to the punctum. A similar incision, *b*, is made near the external angle; the flap between the two incisions is then turned up, and they are united by a transverse section through the mucous membrane only. The flap is then allowed to fall back, and a transverse fold of skin, *c d*, is cut from the integuments, the threads, *e e e e*, serve to unite the lips of the wound, and are fastened upon the forehead with the adhesive strap, *ff*. This painful and difficult operation causes a permanent deformity of the lid, and is now rarely employed.

Saunders' method consists in the removal of the tarsal cartilage. After introducing a Beer's spatula beneath the lid, an incision is made extending from one angle to the other, parallel to the edges of the lids, and one or two lines from the roots of the eyelashes; the skin is then dissected up to the orbital edge of the tarsal cartilage, which is seized with the forceps, detached from the conjunctiva, and removed.

TRICHIASIS.

Trichiasis, or inversion of the eyelashes upon the mucous membrane of the globe, differs from entropium, in the fact that in the former the tarsal cartilage retains its natural position.

The disease depends either upon an unnatural direction of the eyelashes, or upon an abnormal seat of growth. There are in the latter case sometimes two rows of ciliæ (*distichiasis*), or even three (*tristichiasis*).

Trichiasis is *complete* when all the ciliæ are inverted; *partial*, when a few only have this unnatural tendency. The same operations which have been already described for entropium, proportioning them to the gravity of the disease, may be performed for complete trichiasis, which depends upon simple inversion of the lashes alone. In partial trichia-

sis, Desmarres seizes with a double strabismus hook, a small transverse fold of skin, near the edge of the lid where the eyelashes are inverted, and excises it with a cataract knife; the result is a small wound, which in healing, draws back the ciliæ to their normal position.

The ciliæ may be made to turn outwards and resume their natural direction of growth, by evertting and fastening them to the integument of the lid by means of adhesive plaster, or by the skilful application of collodion. Teaching the patient to employ the finger, previously moistened in the mouth, to turn the eyelashes outwards frequently during the day, will also answer the same purpose. These methods of cure are only applicable in cases of partial trichiasis.

Extraction may be performed alone, or united with *cauterisation*. Each lash must be extracted by itself with depilatory forceps. The operation requires to be frequently repeated, and to prevent the hairs from growing again, cauterisation has been connected with it. Champmesme uses a small cautery iron terminated by a ball, from which a fine needle projects. The ball is heated to a white heat, and the point of the needle introduced into each bulb. The operation is tedious, painful and difficult. Carron du Villars introduces a long pin into each bulb; the pins then united in a bundle, and grasped between the jaws of a pair of curling tongs heated to a white heat. The heat is instantly communicated to the pins, and all the bulbs are cauterised at the same time.

In *extirpating* the bulbs, as proposed by Vacca Berlinghieri, an ivory spatula is introduced beneath the eyelid, and an incision made parallel to its edge, and carried as far as the disease extends. Two small incisions are made at right angles with, and at the extremities of the first; the small cutaneous flap thus formed is then raised and the bulbs exposed, which one by one are dissected out. Petrequin, of Lyons, removes the cutaneous flap entirely, and the cicatrisation of the wound produces a favorable eversion of the border of the lid.

Excision of the edge of the lid is performed with scissors, care being taken not to injure the puncture. In partial trichiasis, Schreger excises a V shaped flap, the same as in Adams' operation for ectropium.

ECTROPIUM.

(*Plate 36, fig. 8 and 9, and Plate 37, fig. 1 and 2.*)

Ectropium, or eversion of the eyelids, is frequently produced by the same causes as entropium.

Diseases of the conjunctiva, deformities of the tarsal cartilage, contraction of the skin, and the affections which give rise to it, disease of the orbicularis muscle, &c., are among the causes which produce the several varieties of ectropium, requiring different methods of treatment.

Ectropium caused by diseases of the conjunctiva.—If acute inflammation of the conjunctiva produces a temporary puffy swelling, the ectropium which results from it may usually be remedied by scarification or the application of the nitrate of silver. But should the conjunctiva become hypertrophied and covered with fungous granulations, cauterisation will be insufficient; the swelling caused by the protruding mucous membrane must be excised. The conjunctiva should be seized with the forceps, or a double hook, and the exuberant growth cut off with the curved scissors; the eyelid is then turned back, and kept in apposition with the globe by a compress and bandage.

Antyllus removed a triangular flap, with its base towards the edge of the lid, from the mucous membrane. This difficult operation offers no advantages over the former.

Dieffenbach's method.—(Pl. 36, fig. 9.)—Make a transverse incision, *a b*, upon the skin of the eyelid, beyond the tarsal cartilage, and carry it through the lid to the conjunctiva. Seize the mucous membrane with the forceps, *c*, and draw it through the wound until the eyelid is inverted. Cut off this portion of the membrane with fine scissors, and unite the lips of the wound in the conjunctiva to the inferior lip of the wound in the integuments by a few points of suture.

Adams' method (pl. 36, fig. 8).—This operation should be performed when the ectropium is caused by too great length of the lid. A triangular flap extending through the entire thickness of the lid is removed. The base of the flap should be at the border of the eyelid, and proportioned in size to the amount of relaxation. The edges of the wound are brought together by points of twisted suture, as in the operation for coloboma.

Desmarres' method (pl. 37, fig. 1 and 2).—Desmarres, to avoid the unseemly scar produced by Adams' method, performs the following operation: he makes a transverse incision, *a b*, from the external angle of the eye; a second, *c b*, is carried from the edge of the everted lid to join the first at *b*. Two others, *c d*, and *a d*, form a small triangular flap upon the conjunctiva, whose base coincides with the base of the first flap *a b c*. He then excises the tissues between these incisions, and unites the edges of the wound, *a b*, and *c b*, with points of suture, (fig.

2,) *a a a.* The cicatrix is concealed in the wrinkles at the external angle of the eye.

Ectropium caused by the elongation or malformation of the tarsus.—This may be remedied by excision of the cartilage. After removing the granulations upon the conjunctiva, Weller excsects a strip of the tarsal cartilage one or two lines in width, taking care not to injure the external border of the eyelid. The wound requires no treatment.

Under the name of *tarsoraphy*, Walther describes an operation which consists in removing the two external extremities of the tarsal cartilages in one triangular flap. The base of the flap comprises the whole of the external angle of the eye, and its summit is directed towards the temple. The lips of the wound are brought together with a few points of twisted suture.

Ectropium from contraction of the skin.—Cicatrices following burns, or wounds with loss of substance, are the most frequent causes of this variety of ectropium. In some of these cases, Adams' method may be adopted (pl. 36, fig. 8), one of the incisions being prolonged beyond the apex of the triangle formed by the union of the two.

If the cicatrices are of small extent, and have contracted no adhesions with the subjacent bones, they may be divided transversely, and cicatrification promoted whilst the lips of the wound are kept apart by means of strips of adhesive plaster, or by the introduction of foreign bodies which will prevent immediate union. Amussat advises the daily destruction of the inodular tissue as it forms in the bottom of the wound.

If the cicatrix adheres to the borders of the orbit, it should be circumscribed by two incisions, and the lips of the wound thus formed dissected up for some distance and brought together by points of suture over the adherent cicatrix. This operation has been successfully performed by Von Ammon and Desmarres.

The operation of blepharoplasty should be performed when the cicatrices are too extensive for the employment of the methods above described. (See pl. 37, fig. 3, 4, 5 and 6.)

The *diseases of the orbicularis muscle* which produce ectropium are: spasmodic contractions, and displacement of its muscular fibres. In the first, the usual medical remedies should be employed; if they fail, the fibres of the muscle may be cut across beyond the border of the tarsal cartilage; in the second, Desmarres recommends cauterisation with sulphuric acid, or the excision of a fold of skin near the ciliary

border of the eyelids. The removal of this fold of skin tends to approximate the muscular fibres which are at too great a distance from the free border of the tarsal cartilage.

TUMOURS OF THE EYELIDS.

1st. *Encysted tumours*.—These are found upon the free borders and the surface of the eyelids, and are indolent, circumscribed, and very moveable. According to their situation, they are: 1st. subcutaneous; 2d. submuscular, lying beneath the *orbicularis* muscle, and consequently less moveable than the first; 3d. submucous, lying between the tarsal cartilage and the conjunctiva.

The surgical means employed for their removal are: *incision, cauterisation* and *excision*. They may be operated upon from the external or from the conjunctival aspect of the lids; their situation furnishes the indications of the method to employ. Their extirpation from the conjunctival aspect of the lids has the advantage that it leaves no visible cicatrix, and is less liable to be followed by erysipelas. *Incision* alone rarely suffices to prevent relapses. It is to be preferred in tumours seated between the conjunctiva and the tarsal cartilage and adhering to the latter, whose extirpation would require wounds, which in cicatrising might finally cause entropium.

Incision accompanied by cauterisation with the nitrate of silver is more effectual; it is followed by adhesive inflammation of the parietes of the cyst.

To perform the operations of incision, or excision, of these cysts through the conjunctiva, an assistant should hold the lid, either with his fingers or with a pair of double jawed blunt forceps, everted over a small rod, (see pl. 37, fig. 8); the surgeon, armed with a pair of forceps and a bistoury, then makes an incision through the conjunctiva extending a little beyond the tumour to the right and left; the cyst should then be dissected up and removed without cutting into it. In removing cysts through the integuments, the lid should be held by the fingers, and the dissection performed as described above. In all these operations, the tumour is to be isolated from the tarsal cartilage with much care.

Desmarres' method (pl. 37, fig. 7).—This method has the advantage of facilitating the operation, as the eyelid is supported, and the hemorrhage arrested by means of compression around the tumour. A pair of forceps, (see Instruments, pl. 8, fig. 2), one of whose branches is terminated by a plate, and the other by a ring, is used to hold the

lid. The instrument being closed by means of a screw, the haemorrhage is arrested by the compression of the ring upon the parts surrounding the tumour. The forceps are held by an assistant, and the surgeon extirpates the tumour after the method which has been described above.

2d. *Chalazion* is a small indolent slightly moveable tumour situated on the free border of the lids. A series of them, having the appearance of a string of beads extending from one angle of the eye to the other, is of by no means rare occurrence. The various operations described for the removal of encysted tumours are also applicable to this affection.

3d. *Erectile tumours*.—Compression, ligature and cauterisation have all been successfully employed for their removal. The form and extent of the tumour should indicate the method to be adopted. Caron du Villars passes a number of needles through the tumour, which he afterwards attaches to a metallic ball. This ball is heated to a white heat, and the cauterisation which ensues is followed by suppuration, which destroys the tumour.

4th. *Cancerous tumours*.—No general rules can be given for their removal; they may be circumscribed by a curved, or included in a V shaped incision. The lips of the wound, when its form and extent will permit, should be brought together by points of suture.

5th. *Encaanthis*, or tumour of the caruncula lachrymalis, may be treated by caustics, or extirpated. The latter is to be preferred. The tumour should be drawn upward and outward with a hook or forceps, and then excised with the bistoury or curved scissors.

BLEPHAROPLASTY.

(Plate 37, Fig. 3, 4, 5 and 6.)

Blepharoplasty is an operation, by which the eyelids, which have sustained a partial or total loss of substance, are restored at the expense of the adjacent parts.

There are three methods described for attaining this end, *extension* or *sliding*; *displacement* (French method); and *twisting of the flap* (Indian method).

1st. *Method by extension*.—*Jones' operation* (pl. 37, fig. 3).—After freshly excising the margins of the opening occasioned by a loss of substance which is to be restored, two incisions, *a d*, and *b d*, are made

from its extremities, which form a V shaped flap, on the forehead for the upper, on the cheek for the lower lid, the base of this triangular flap being intended to repair the injured eyelid. This first stage of the operation being finished, the triangular flap is then to be dissected up and partly detached, commencing at its apex; by gentle traction, it is then made to advance or slide along until its base covers the opening created by the loss of substance, which it is intended to repair; it is retained in its place by points of suture, and the edges of the wound, *c d*, which the change of position of the apex of the flap has left behind it, are brought together in the same way. The figure 3 represents the operation concluded, the flap *a b c* being drawn up to cover the opening caused by the loss of substance.

2d. *Operation by displacement.*—*Dieffenbach's method.*—Dieffenbach having removed a triangular flap *a b c* (fig. 4), to repair the wound thus caused, makes an incision from the external angle *b*, to the point *d*, and carrying it from thence to *e*, forms the flap *c b d e*, which adheres by the pedicle *c e*. This flap being dissected up is carried over the wound *a b c*, and fastened there by points of suture; the wound which remains being of a healthy character, rapidly heals.

3d. *Method by twisting the flap.* (Graefe and Tricke), fig. 5 and 6.—The morbid cicatrices are removed by the two incisions, which form an elliptical wound, *a b c d*; a flap is then cut from the temporo-frontal region for the upper, and from the cheek for the lower lid. This flap should be made one or two lines larger and of the same shape as the wound which it is to fill. It is made by carrying an incision from the point *c*, along the line *ef*, which is to be brought back to the level of and a little external to its starting point *c*; the flap being dissected up, must then be twisted upon its pedicle and placed horizontally upon the wound, *a b c d*, where it is retained by the points of suture, *a a a*, (fig. 6); the edges of the resulting wound *c b* are then brought together by three points of twisted suture.



Fig. 1

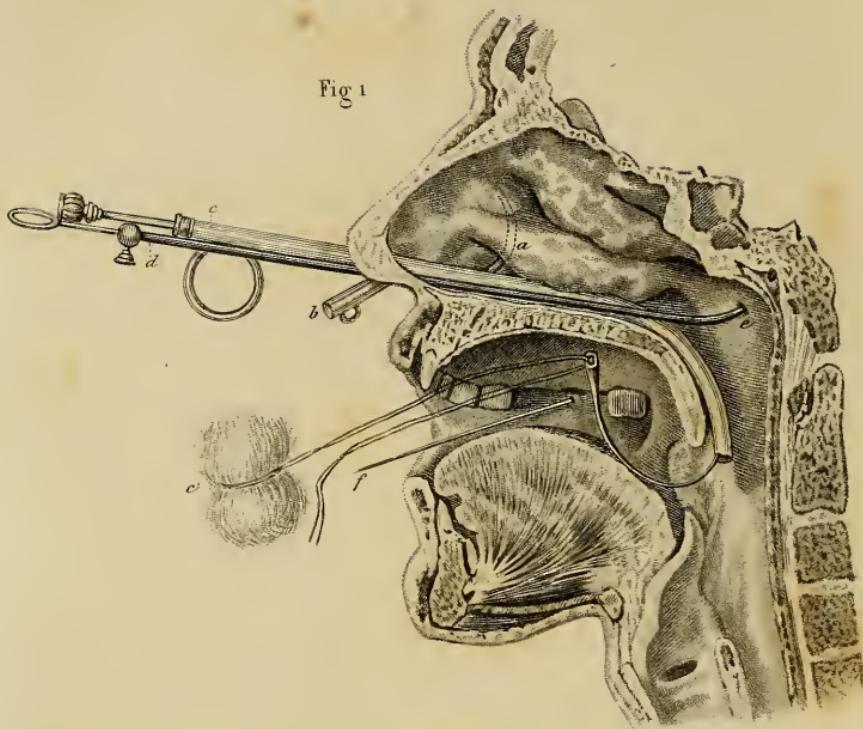


Fig. 2.

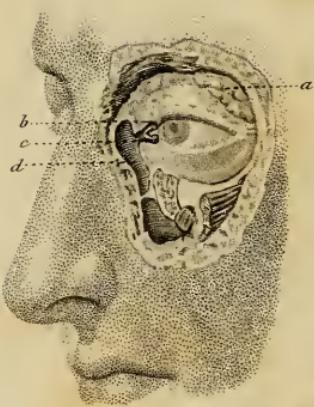


Fig. 3.

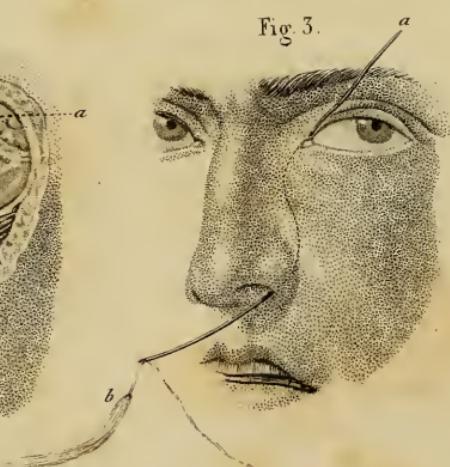


PLATE XXXVIII.

OPERATIONS UPON THE LACRYMAL APPARATUS.

SURGICAL ANATOMY.

FIG. 1. *Vertical section from before backwards, showing the arrangement of the nasal fossæ, the mouth and the pharynx.*—*a*, the inferior turbinated bone; *b*, Laforest's sound introduced into the nasal duct by the inferior meatus; *c*, Belloc's sound for plugging the posterior nares; *d*, Deleau's catheter, introduced into the Eustachian tube *e*; *f*, probe introduced into the orifice of Steno's duct.

FIG. 2. *Anatomy of the lacrymal apparatus.*—The lacrymal gland and its excretory ducts, the puncta lacrymalia and the lacrymal canals, the lacrymal sac and the nasal duct constitute the lacrymal apparatus.

The *lacrymal gland*, *a*, is composed of two distinct portions lying close to each other. The largest, or orbital portion, is situated in the small fossa of the arch of the orbit, to which it is closely attached by fibrous connections; its anterior border lies close to the edge of the roof of the orbit. The smaller, or palpebral portion, is situated a little lower and more external than the former; it is covered by a dense fibrous membrane and by the upper lid; its inferior margin frequently extends as far as the superior border of the tarsal cartilage.

The *puncta* are the external orifices of the lacrymal canals, *b*, and *c*. Situated upon the free border of the eyelids, a line and a half or two lines to the outside of the internal commissure, they present the appearance of narrow open channels upon the top of two small conical tubercles. The inferior looks upwards, and the superior, downwards. Their calibre allows the introduction of a hog's bristle. Among the inhabitants of the tropics, their diameter is greater, permitting the easy introduction of a small probe. According to Janin, the diameter of the inferior punctum is much greater than that of the superior, an anatomical arrangement which is taken advantage of in performing catheterism of the lacrymal passage.

The *lacrymal canals*, *b* and *c*, perforating the substance of the eyelids, conduct the tears into the lacrymal sac. The angular direction which they take should be borne in mind in performing the operation of catheterism. After leaving the puncta, they take a perpendicular direction, the superior upwards, the inferior downwards into the eyelid; after a short passage of about a line, they make a sudden curve inwards; the superior a little obliquely from above downwards, the inferior from below upwards. The lacrymal canals, thus taking a direction towards each other, open into the lacrymal sac sometimes by the same duct, but usually they are separated by a partition. Their texture is loose, and by a slight traction outwards of the edges of the lids, we can give them such a direction as will permit the introduction of straight probes. Their calibre, which is greater than that of the puncta, is always maintained uniform by the elasticity of their walls.

The *lacrymal sac*, *d*, and the nasal duct, by their union form a single canal through which the tears pass to be discharged beneath the inferior turbinated bone of the nasal fossæ. The *lacrymal sac*, which is at the upper portion of this canal, has the shape of a small oblong, vertical reservoir, into which the lacrymal ducts open. Terminated superiorly by a *cul-de-sac*, it continues inferiorly with the nasal duct. It is lodged in an osseous groove, formed within and behind by the *os unguis* and the ascending nasal process of the superior maxillary bone. Its external half is membranous, and covered by the tendon of the *orbicularis* muscle, which is overlapped above and below by the lacrymal sac. This relation it is important to recollect, as the tendon of the *orbicularis* serves as a guide when opening into the sac. However, the insertions of this tendon sometimes vary, so that surgeons have been forced to have recourse to other guides; the superior orifice of the nasal duct is situated behind the bony ridge which is met with on the inner side of the base of the orbit by passing the finger from without inwards along the inferior orbital ridge. This osseous projection, which is the limit of the lacrymal groove below, is the most certain landmark.

The *nasal canal*, the continuation of the lacrymal sac, is formed in its osseous portion, in front by the ascending nasal process of the superior maxillary bone, within and behind, by the *os unguis* and the small hook-like process of the inferior turbinated bone, and outwardly, by the inner wall of the antrum. Through the posterior wall of the nasal canal, we may penetrate either the nasal fossæ or the maxillary sinus.

The length of the canal varies from four to six lines; its superior orifice is elliptical from behind forwards, and its antero-posterior diameter varies from two to three lines. The inferior orifice, situated beneath the inferior turbinated bone, is funnel shaped from within outwards and is excavated from the external parietes of the nose; in front it is provided with a small valve-like projection, which is frequently so large as to prevent the introduction of instruments except from behind forwards.

FIG. 3. *Catheterism of the lacrymal passages by the punctum in the upper lid.—a, Mejan's probe; b, seton.*

PLATE XXXIX.

OPERATIONS UPON THE LACRYMAL APPARATUS,
CONTINUED.

FIG. 1. *Catheterism of the lacrymal passages by the inferior opening of the nasal duct.*—*Laforest's method.*—*a*, first position of the sound; *b*, second position of the sound; its point is within the inferior orifice of the nasal duct; *c*, third position of the sound introduced into the nasal duct.

FIG. 2. *Temporary dilatation of the lacrymal passages.*—*J. L. Petit's method, modified by Desmarres.*—*a*, the finger of an assistant drawing outward the external angle of the eyelids, to render prominent the tendon of the orbicularis; the surgeon has made a puncture of the lacrymal sac with the bistoury, *b*, and inserted the probe, *c*, into the opening.

FIG. 3. *Third step of the operation.*—A grooved director, *a*, is introduced into the lacrymal canal; it serves as a guide to the catgut, *b*, with which it is intended to produce the temporary dilatation.

FIG. 4. *Permanent dilatation; introduction of the canula.*—The canal having been opened by the bistoury, *a*, which is pressed against the posterior lip of the wound, the surgeon is introducing the canula, *b*, by aid of the style-forceps, *c* (see Instruments, pl. VIII, fig. 5).

LACRYMAL TUMOUR AND FISTULA.

MODES OF OPERATING.

The various affections to which the lacrymal apparatus is subject, may give rise to a mechanical stoppage of the flow of the tears, or cause an accumulation of fluid in the lacrymal sac, which will distend it and produce what is called the *lacrymal tumour*. If this tumour is not properly treated, it increases in size, the skin inflames, ulcerates, and the fluid contained in the sac is discharged through this accidental opening, producing *fistula lacrymalis*. In the surgical treatment of

Pl. 39.

Fig. 1.



Fig. 4.

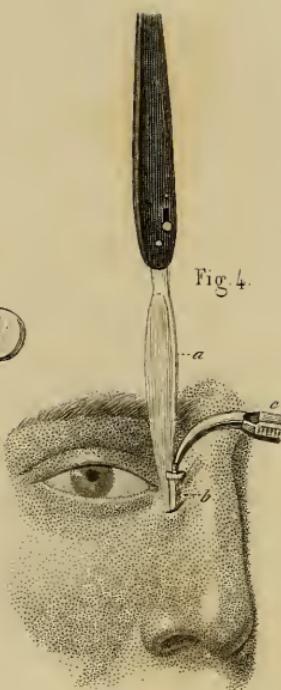


Fig. 2.

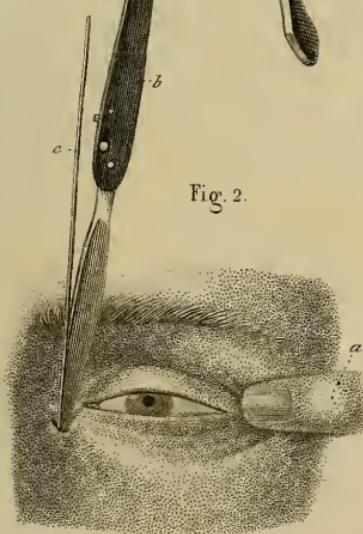
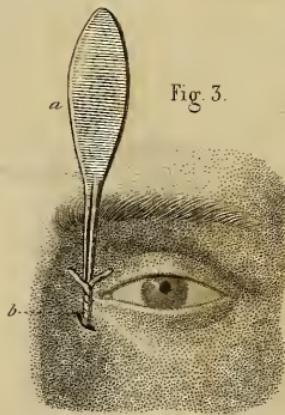


Fig. 3.





these affections, one of the three following ends is to be attained : 1st, the re-establishment of the natural passages for the tears ; 2d, the formation of new passages ; 3d, the obliteration of the natural passages.

§ 1. Re-establishment of the natural passages.—The means employed for this purpose are—*injections*, *catheterism*, *dilatation* and *cauterisation*.

1st. Injections.—Injections are frequently used with success for the removal of obstructions ; medicated fluids can at the same time be conveyed into the interior of the lacrymal passages. Anel's syringe is usually employed (see Instruments, pl. VIII, fig. 11). The patient being seated in a chair, with his head firmly held by an assistant, the surgeon holding the instrument in his right hand, stands in front if he operates upon the left eye, and if he is not ambi-dextrous, behind the patient when he operates upon the right eye. The fingers of the hand which is disengaged slightly evert the lower lid, so as to cause the opening in its punctum to project a little ; the punctum of the lower lid is preferred for the operation because it is larger and its canal shorter than that of the upper lid. The extremity of the syringe should be entered perpendicularly to the border of the lid. It occasionally happens that the punctum contracts so that the instrument cannot be introduced ; this momentary spasmodic resistance is in general easily overcome by moderate and well managed pressure. The extremity of the instrument being introduced to the depth of a line or a line and a half, the syringe should then be inclined outwards so as to give the pipe the direction of the horizontal portion of the canal. Having at length entered the lacrymal sac, the surgeon forces out the liquid little by little, so as to overcome the obstructions in the duct. This being effected, the fluid will flow freely into the nostril.

2d. Catheterism.—Catheterism is performed with silver probes sufficiently fine to pass through the puncta. They are usually introduced through the superior lacrymal canal. A slight traction outwards of the upper lids straightens the angular direction of the canal into which the probe is to be introduced. It is then pushed into the nasal duct.

Catheterism by the inferior orifice of the nasal duct.—Laforest's method.—This is performed with either hollow or solid sounds, which should be curved in the same shape as the canal. The patient being seated with his head slightly thrown back, an assistant holds it firmly in this position ; the surgeon then carries the extremity of the sound into the nostril in such a way, that by a movement of rotation given to the instrument its point will pass beneath the inferior turbinated bone

of the nasal fossæ (see pl. 39, fig. 1, *a*). This movement of rotation being performed, it is now necessary to direct the point of the sound into the inferior orifice of the nasal duct. This is effected by giving the instrument a slight movement forward and backward, for the inferior meatus is usually entered from behind forward; *b*, represents this second position of the sound. Giving the instrument a half turn, by which the handle is carried inwards and downwards (see *c*), it passes through the nasal duct and enters the lacrymal sac. Solid sounds are the best for the removal of obstructions, but the passage once free, the hollow instruments of Gensoul, by which fluids can be injected from below upwards, are to be preferred (see Instruments, pl. VIII., fig. 8).

3. *Dilatation.*—*Mejean's method*.—This consists in performing catheterism, through the punctum of the upper lid, by means of a probe whose superior extremity has an eye, through which a thread of silk is passed. The probe is carried through the nasal duct, and brought out by the inferior meatus with the thread attached to it. To the inferior extremity of this thread, a few filaments of silk are fastened, forming a small seton, which is introduced from below upwards into the lacrymal sac, by pulling upon the superior extremity of the thread which hangs from the punctum of the upper lid. Or, the eyed probe may first be introduced and passed through the nasal duct, the thread and seton then attached to it, and all drawn through together (see pl. 38, fig. 3). By adopting the last method, the punctum runs less risk of being chafed.

4. *Dilatation by an artificial opening.*—J. L. Petit first performed the operation of opening the lacrymal sac, for the purpose of introducing into it foreign bodies for its dilatation. He made the incision with a grooved bistoury, along which he passed a bougie which was changed every day until the canal was sufficiently dilated. The external wound healed spontaneously.

Scarpa introduced leaden styles into the nasal duct (see Instruments, pl. VIII., fig. 13).

Lecat opened the sac in the same way; but instead of a bougie or other solid body, he introduced a fine catgut or eyed probe into the lacrymal passages, by means of which he drew a tent from below upward into the nasal duct. This method differs from that of Mejean only in the fact that the artificial opening facilitates the passage of the probe.

Pouteau, to avoid leaving an unseemly scar, made an opening into the sac from the internal aspect of the eyelid.

Jurine first introduced a canula, along which he passed a curved probe, which is brought out at the nostrils; to this probe a thread is attached by which the tent is drawn up.

Pamard (see Instruments, fig. 15) passed through the canula a watch spring, which from its elasticity emerges at the nostril, and to it the thread with the tent can be tied.

Fournier attached a small piece of lead to the thread, to carry it through by its weight.

Cabanis introduced under the inferior turbinated bone a perforated disk, on which the inferior extremity of Mejean's style when passed through the duct is received. A second disk, slid upon the first, seizes this extremity of the style, which is then easily drawn out.

M. Manec introduces into the nasal duct from below upward a sound with a concealed point. This instrument, when inserted, is made to pierce the anterior wall of the lacrymal sac from behind forwards; a thread is passed through an eye in the sound, which is then drawn out below, and by means of this thread a tent can be carried into the passage.

M. Morel Lavallée uses with advantage a style slightly curved in the shape of a bow; a small groove in the extremity of the instrument serves to retain a thread, which is easily seized below the turbinated bone with the forceps, and thus drawn out.

These are the principal modifications of the modes employed by *J. L. Petit* and *Lecat* for carrying a tent through the *ductus ad nasum*. Whatever method is adopted, the rules for opening the sac are the same.

Desmarres' method (see pl. 39, fig. 2 and 3).—The instruments required are a bistoury, a conducting probe, a groove director, and a piece of catgut.

1st step.—Incision.—An assistant firmly holds the head of the patient, and at the same time draws out with his finger the external angle of the eye in order to render the tendon of the orbicularis muscle more prominent, which serves as a guide for finding the superior orifice of the nasal duct (see *Surgical Anatomy*, p. 128). The surgeon holding the bistoury in his right hand, with the little finger resting upon the cheek for a support, plunges it into the lacrymal sac, from before backward, in the direction of the *os unguis*; he then carries the handle of the instrument a little inward and backward, until it touches the eyebrow, and now gently pushing the blade onward for about two-

thirds of an inch into the lacrymal sac and nasal duct, he finds that the bistoury, if it has been properly directed, will support itself. Should a fistula exist, whose opening is distinct from the point of puncture, the septum of soft parts separating them should be cut through, so that the fistulous track may be completely laid open.

2d step.—Introduction of a probe upon which a grooved director is passed.—The bistoury is partly withdrawn, and a probe is slid along its blade and pushed into the nasal duct (fig. 2). This probe serves as a conductor for a grooved director.

3d step.—Introduction of a catgut (fig. 3).—The director being in the nasal duct, a piece of catgut intended for dilatation is passed along its groove; pressing on the extremity of the catgut to retain it in its position, the director, now useless, should be slowly withdrawn. The catgut is provided with two little projections which prevent its falling into the nasal duct. It should be changed daily for another somewhat larger, and after a short time Scarpa's style may be substituted. The introduction of the catgut is frequently followed by a very severe inflammatory reaction, caused by its swelling in the interior of the duct; should this be the case, it must be removed in twenty-four hours, and a very fine Scarpa's style introduced in its stead, which is to be replaced day by day by others, gradually increasing in size.

5th. Permanent dilatation.—Introduction of the canula.—Vesalius first applied the canula to the treatment of lacrymal affections. This method, practised a long time after by Foubert, Wathen and Pellier, was again brought into use and modified by Dupuytren.

Dupuytren's mode of operating consists of two steps: puncture of the sac, and introduction of the canula. The first step is the same as that for temporary dilatation described above (Desmarres' method). In introducing the canula, the lips of the wound are kept separated by pressing upon the posterior wall with the blade of the bistoury; the canula being first slid upon its stylet is then passed into the sac and duct; the instrument, canula, being fairly entered into the duct, the bistoury is withdrawn, and the tube pushed onward until its superior extremity has disappeared in the lacrymal sac. The stylet is then withdrawn. In order to ascertain the situation of the canula in the sac and duct, the following test may be resorted to: the mouth and nose of the patient being closed, the surgeon requests him to make a strong expiration; if the tube is properly placed, a small quantity of blood mixed with air will be thrown out of the external wound. A piece of court plaster may be placed over the wound for a dressing.

Berard and Cloquet dilate the duct with tents, before introducing the canula. This precaution is useful; the parietes of the canal by this means become accustomed to the contact of foreign bodies, and consequently are much less exposed to the inflammatory excitement so common immediately after introduction of the canula.

The form of the canula has undergone numerous modifications. *Pellier's* had two rims, one at its upper extremity, the other in the middle; *Dupuytren's* instrument has a rim above, with a circular groove within to facilitate its extraction; *Gerdy* adds lateral projections, by which the canula is prevented from slipping out. To attain this latter object *Riterick* of Leipsic, and more recently *Petriquiu* and *Lenoir* make use of a canula split longitudinally, so that its two sides, by their elasticity, tend to keep the instrument in its place. *Lenoir* has invented an ingenious handle by which this canula is introduced into the duct, its two valves being compressed in a cylinder, which being withdrawn, they separate by their elastic spring, and press against the sides of the passage. The introduction of the canula is not always exempt from danger; it is frequently followed by an inflammation so severe in character, that the surgeon is forced to extract the instrument. Several of the stylets invented for extracting canulae from the nasal duct are represented in the plates. (See Instruments, pl. VIII, fig. 5 and 14.)

6th. *Cauterisation*.—*Harveng* opened the sac in the ordinary way and cauterised its interior, either with a small cautery iron, or by introducing a tent covered with the nitrate of silver from below, through a canula.

Gensoul cauterises the canal from below upwards by means of curved sounds armed with nitrate of silver.

Lallemand (of Montpellier) opens the sac, and introduces into it a fragment of crystallised nitrate of silver of the size of a flax seed, and then closes the wound with a piece of court plaster; an eschar is produced in the interior of the sac and duct, which is discharged from its lower outlet.

Lallemand has employed this method successfully in the treatment of many obstinate cases.

The caustic holders and their conducting canulae are represented in the plates of instruments (see pl. VIII, fig. 10).

§ 2. *Opening of an artificial canal*.—The methods which we have described above are frequently inefficient. A new passage may then be opened for the tears.

Wolhouse, by means of a semi-elliptical incision, made a large opening into the lacrymal sac, and extirpated it; he then perforated the os unguis with a pointed probe, and afterward introduced a small canula or a tent of lint to keep the perforation open.

Hunter used a cutting punch to perforate the os unguis. His method requires instruments made for the purpose, and is no longer employed.

Wathen made, with a drill, a new canal in the same direction as the natural duct, and introduced into it a permanent canula.

Laugier has proposed to perforate the maxillary sinus with a curved trocar (see Instruments, plate VIII., fig. 12), and place a canula into the opening.

§ 3. *Obliteration of the lacrymal passages.*—1st, *Nannoni* destroyed the sac. To effect this, he made a large opening into it, filled it with lint, and afterwards applied either caustic, or the actual cautery.

Bosche, relying upon the fact that the puncta are sometimes obliterated congenitally, without the individuals thus affected suffering much inconvenience from the flow of the tears over the cheek, cauterised the puncta by introducing into them a small quantity of nitrate of silver.

2d. *Removal of the lacrymal gland.*—*Paul Bernard* performed this operation successfully in a case of chronic flow of tears over the cheek, which he attributed to an excessive secretion from the lacrymal gland. The operation is performed in the following manner: a vertical fold is taken up beneath the orbit and on a level with the gland; this fold, being transfixated at its base with a fine bistoury, is cut completely through, leaving a longitudinal wound of about eight lines in length, through which the orbital cavity is entered. The lacrymal gland is then easily detached and removed by the use of hooks and scissors.

Summing up.—The obliteration of the lacrymal passages, or the removal of the lacrymal gland, ought not to be resorted to until after attempting a cure by the means described above. These two methods must be considered as offering the last resources in the treatment of obstinate cases which have resisted all the other efforts of the surgeon.



Pl. 40.

Fig. 1.

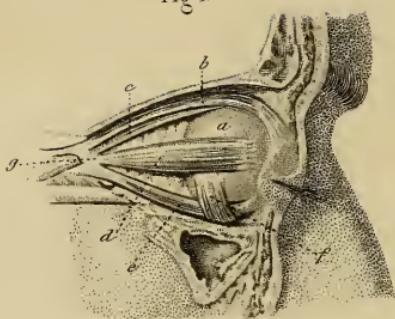


Fig. 2.

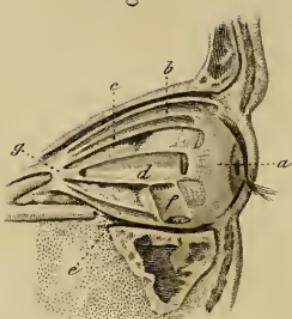


Fig. 4.

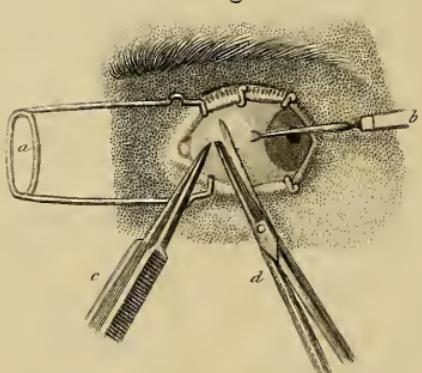


Fig. 5.

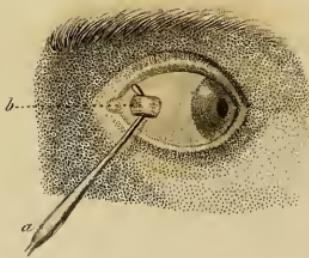


Fig. 3.

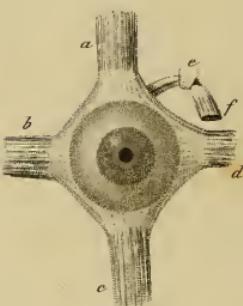


Fig. 6

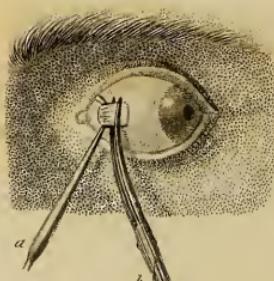


PLATE XL.

OPERATIONS UPON THE MUSCLES OF THE EYE.

SURGICAL ANATOMY.

FIG. 1. *Antero-posterior vertical section of the orbit, exposing the muscles of the right eye; external aspect.*—*a*, globe of the eye; *b*, levator muscle of the upper eyelid; *c*, superior rectus muscle; *d*, rectus externus; *e*, inferior rectus; *f*, inferior oblique muscle; *g*, origin of the muscles of the eye.

FIG. 2. *Represents the aponeurotic sheaths formed by the orbital aponeurosis.*—*a*, globe of the eye; *b*, sheath of the levator of the upper lid; *c*, sheath of the superior rectus; *d*, sheath of the external rectus; *e*, sheath of the inferior rectus; *f*, sheath of the inferior oblique muscle.

FIG. 3. *Arrangement of the muscles and their insertion upon the sclerotica; front view of the eye, with the muscles brought from behind forward.*—*a*, superior rectus; *b*, external rectus; *d*, internal rectus; *c*, inferior rectus; *f*, the superior oblique with its tendon passing through the pulley, *e*.

FIG. 4. *Operation for strabismus.—Sédillot's method.*—The eyelids are kept apart by an instrument made for the purpose, *a*; *b*, a double hook held by an assistant; *c*, forceps holding up a fold of the conjunctiva; *d*, scissors incising this fold to expose the muscle.

FIG. 5. A blunt hook, *a*, carried under the muscle, *b*.

FIG. 6. *a*, blunt hook; *b*, scissors cutting the internal rectus muscle.

The movements of the globe of the eye are performed around three axes, an antero-posterior, a transverse and a vertical. These motions are effected by six muscles, four straight and two oblique. The four straight muscles arise around the foramen opticum behind the globe, and enveloping it pass forward and are inserted into its anterior hemisphere, about one or two lines from the circumference of the cornea, a favorable arrangement for the movements of rotation, which they are destined to effect. These four muscles are:

1st. The *superior rectus*, situated at the upper part of the orbit, beneath the levator palpebræ superioris; it raises the pupil by turning the eye upon its transverse axis;

2d. The *inferior rectus*, diametrically opposed to the preceding, also turns the eye upon its transverse axis, by drawing down the pupil. It passes between the globe and the inferior oblique which is inserted above its external border;

3d. The *internal rectus*, situated along the internal wall of the orbit, turns the eye on its vertical axis, and draws the pupil inward;

4th. The *external rectus*, lying along the external wall of the orbit, is the antagonist of the preceding; its insertion into the scleroteca is a little nearer the cornea than that of either of the other recti muscles.

The two oblique muscles turn the eye around its antero-posterior axis.

1st. The *superior oblique* arises around the optic foramen; from thence it passes forwards and inwards to the internal orbital process of the frontal bone, where it passes through a fibrous ring, which forms a species of pulley. After leaving this ring, it passes from within outwards beneath the superior rectus, and is inserted into the posterior hemisphere of the globe; when it contracts, it draws the pupil downwards and outwards.

2d. The *inferior oblique* arises along the inner edge of the border of the orbit; it passes beneath the globe from within outwards, and is inserted by a large tendon into the posterior hemisphere of the eyeball, below the insertion of the superior oblique, to which muscle its action is opposed.

Three different nerves supply these muscles: the *motores oculorum*, or third pair, give branches to the superior, internal, and inferior recti, and the inferior oblique; the *pathetici*, or fourth pair, supply the superior oblique alone, and the *abducentes*, or sixth pair, the external rectus.

Orbital aponeurosis.—The eyeball is retained in the middle of the orbit by the orbital aponeurosis. Suspended in this fibrous capsule, it executes with rapidity its movements of rotation, without sustaining any general displacement, which would destroy in the two globes that simultaneousness of motion so necessary to distinctness of vision. This aponeurosis, after lining the orbit and supplying the palpebral ligaments, is reflected upon the globe, envelopes its two posterior thirds, furnishes sheaths for its muscles, and finally terminates posteriorly upon the neurilemma of the optic nerve.

It is adherent anteriorly to the muscles at the point where they leave it to be inserted into the sclerotica. This arrangement does not always allow each muscle to act independently ; it accounts for those movements which still continue after the section of the muscle itself, the movements of the eyeball depending in these cases upon those of the orbital aponeurosis.

STRABISMUS.

MODES OF OPERATING.

Strabismus consists in a loss of parallelism between the two axes of vision.

There are four varieties of strabismus: the *internal* or *converging*; the *external* or *diverging*; the *superior* or *ascending*; the *inferior* or *descending*.

The indications for and against the operation are derived from the causes which produce the disease, the most frequent of which is, perhaps, contraction of the muscle corresponding to the direction of the squint. When the sound eye is covered, in the great majority of cases of strabismus, the affected eye immediately resumes its normal direction and motions; this affords evidence that the squint is not dependent upon tumour of the orbit, or of the globe, or upon paralysis of the third or sixth pair of nerves, or adhesions between the globe and eyelids, &c. The operation should not be performed, also, where there is artificial pupil, amaurosis, or cataract, or where the disease has been caused by nebulae upon the cornea, &c.

When the strabismus depends upon paralysis of the sixth pair, the eye is turned inwards and cannot be directed outwards; in paralysis of the third pair the reverse is the case, and the upper eyelid is either totally or partially paralysed; double vision also exists.

The operation should not be performed without hesitation either upon old persons, or very young children; in the former the chances of success are very limited on account of the duration of the deformity and the rigidity of the tissues; in the latter the deformity is frequently relieved by simple means, or even outgrown.

Stromeyer's method.—We borrow from the author himself the following simple and precise description of the operation which he recommended in the year 1829 for the cure of strabismus: "The sound eye being closed, the patient is directed to carry the affected eye as far as possible in the direction opposite to that which it usually retains. If

the strabismus is inwards, a fine double hook should be inserted into the inner margin of the ocular conjunctiva, and confided to an intelligent assistant, who draws the eye outwards; the conjunctiva being raised up with the forceps, should be divided with a cataract knife, the incision being directed towards the inner angle of the eye; the traction outwards is then increased until the internal rectus muscle appears; a fine probe is then passed beneath the latter, and it is divided with the curved scissors, or with the knife with which the conjunctiva was opened."

Dieffenbach's method.—“The instrumental apparatus is very simple: Pellier's elevator; a blunt double hook for drawing down the lower lid; two small sharp-pointed hooks, for the conjunctiva; a pair of scissors curved on their flat-surface for cutting the conjunctiva; a simple blunt hook to be passed beneath the muscle, while it is being cut with the scissors which were used to incise the conjunctiva; a small sharp hook for the sclerotica, in case the eye should turn spasmodically in such a manner as to interfere with the operation; a sponge, and a little cold water.

“Two assistants are necessary, even when the operation is performed upon a quiet patient; more are required when the contrary is the case. The patient should be seated in a low chair, as in the operation for cataract, opposite to a window furnishing a good light, and the surgeon seated in front of him upon a chair somewhat higher. One of the assistants stands behind the patient, and supports his head steadily against his chest. Pellier's elevator is then introduced beneath the upper lid and committed in charge to this assistant; and a second assistant depresses the lower eyelid with the proper instrument, and at the same time keeps charge of the patient's hands; the sound eye is covered. (The case is supposed to be one of converging strabismus in the right eye). The surgeon now inserts one of the small sharp hooks into the conjunctiva near the caruncula lacrymalis and draws the eye outwards; if it resists, a second hook is inserted a line or two from the main edge of the cornea, the first being committed to an assistant. A fold of the mucous membrane being thus lifted up between the two hooks, the surgeon divides it freely with the curved scissors until the muscle is brought in sight; he then lays aside the scissors, takes the blunt hook, and passes it beneath the muscle, between it and the sclerotica, withdraws the sharp hook so as to free his left hand, which then takes charge of

the blunt one, and finally divides the muscle entirely across with the curved scissors first employed. When the muscle is properly divided, the eye generally resumes immediately its natural position.

"For the left eye the operator carries his left arm across the patient's forehead, and manages with his left hand the sharp hook first inserted into the conjunctiva, whilst the assistant who stands behind the patient holds the elevator in his left hand, and the other sharp hook in his right."

In cases of slight strabismus Dieffenbach has proposed to excise with the curved scissors a small flap including both the conjunctiva and the contracted muscle. Cullier advises the addition of sutures to excision, and employs the ordinary probe-pointed eye-scissors.

Phillips excsects the tendinous portion of the muscles.

Bonnet raises the conjunctiva with the forceps, and after dividing it, cuts the muscle with a small scalpel introduced between it and the sclerotica.

Velpeau seizes up with mouse-teeth forceps a large fold of the conjunctiva, together with the insertion of the muscle, into the sclerotica ; if the operation is being performed upon the right eye, the surgeon holds the forceps himself; if upon the left, they are taken by an assistant. With another pair of mouse-teeth forceps a second fold is then taken up a short distance from the first. This second pair of forceps are held by an assistant. The fold between the two forceps should then be freely divided with blunt pointed straight or curved scissors. The operation may be finished with a single incision.

Lucien Boyer having noticed that after the vertical section of the conjunctiva the caruncula lacrymalis is drawn very deeply inward, proposes to make the incision in the conjunctiva horizontally, and above the transverse diameter of the cornea.

Sedillot's method.—*Sedillot* thus describes his method :

"In converging strabismus, to turn the eye outwards, we take up the conjunctiva with a simple hook ; another hook is then introduced along the border of the sclerotica, and a little within the cornea ; an assistant takes charge of this last hook while the surgeon withdraws the first. Raising up a fold of the conjunctiva a little to the inner side of the hook with a pair of ordinary forceps, we divide it with a single cut of the scissors, and then cutting one after another the fibro-cellular filaments which present themselves, we soon come to the muscle, whose reddish color contrasts strongly with the sclerotica. After carefully iso-

lating the muscle, we slip a blunt hook beneath it, and raising it slightly, divide it with the scissors.

"In slight cases of strabismus, we have intentionally left a portion of the muscular fibres undivided, and yet obtained a successful result, by covering the sound eye for four or five days, and forcing the patient to turn the operated eye outwards, to see objects through a circular opening in a piece of plaster."

Sub-conjunctival operation.—Guérin's method.—Take up with the hooks a fold of the conjunctiva, and entering a Z shaped tenotomy knife at its base, introduce it between the muscle and the sclerotica; turn the cutting edge of the knife from behind forward, and divide the muscle with a slight sawing motion. By this method, Guérin proposes to prevent the contact of the air with the wound, and to procure for it, as for all sub-cutaneous wounds, the benefits of an immediate and rapid reparation.

PLATE XLI.

OPERATION FOR CATARACT BY DEPRESSION.

FIG. 1. *Antero-posterior section of the eyeball.*—*b*, transparent cornea; *c*, the anterior chamber; *d*, the iris; *e*, the crystalline lens; *f*, the capsule of the crystalline lens; *g*, the vitreous humor.

FIG. 2. *Depression of the cataract.*—First stage (right eye).—*a*; *a*, the fingers of an assistant holding up the upper lid; *b*, *b*, the fingers of the surgeon depressing the lower lid; *c*, the instrument held in the left hand and plunged into the sclerotica. Two of the fingers of the surgeon rest upon the cheek for support.

FIG. 3. *The same operation.*—Second stage.—The *needle*, *a*, is carried between the crystalline lens and the iris; the concavity of its point is brought in contact with the superior border of the crystalline lens.

FIG. 4. *The same operation.*—Third stage.—*Depression.*—The handle of the needle raised, *a b*, by a lever-like motion, so that its point depresses the crystalline lens into the vitreous humor.

FIG. 5. *The same operation upon the left eye.*—*a*, position of the needle in the first stage; *b*, position of the needle in the second; *c*, position of the needle in the third.

FIG. 6. *Reclination.*—The crystalline lens, *a*, thrown directly backwards, *b*, into the vitreous humor.

PL. 41.

Fig. 1.

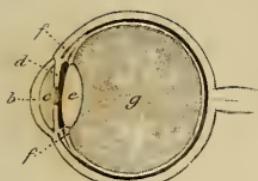


Fig. 2.

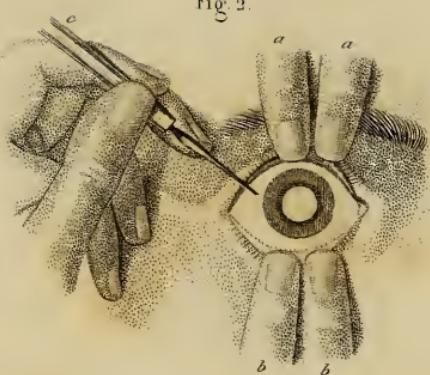


Fig. 5.

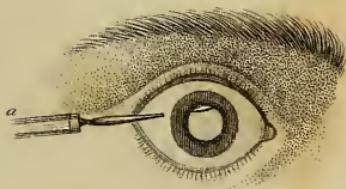


Fig. 4.

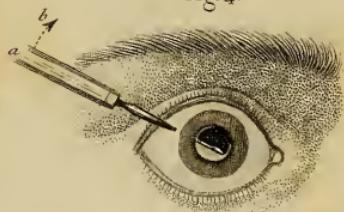


Fig. 5

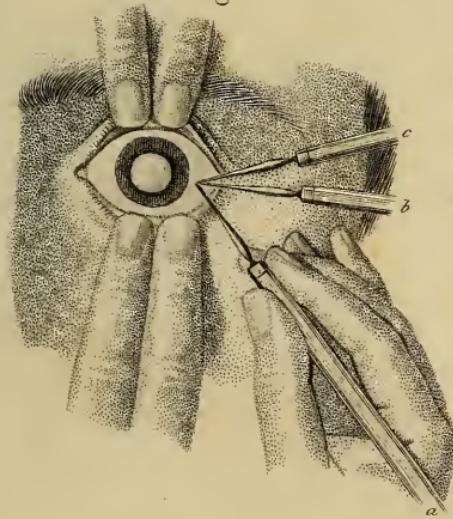
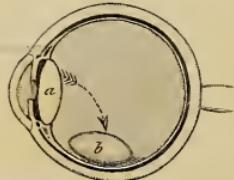


Fig. 6.





Pl. 42.

Fig. 1.

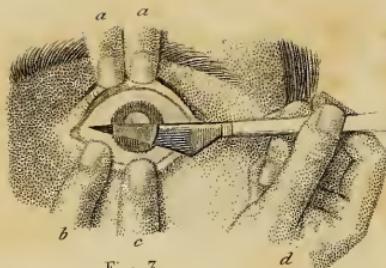


Fig. 2

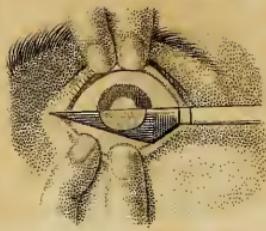


Fig. 3.

d

Fig. 4.

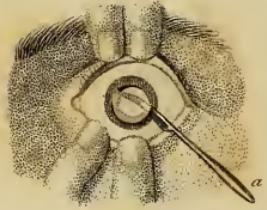


Fig. 5.



Fig. 6.

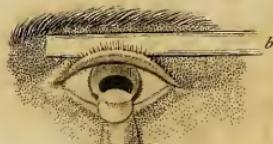


Fig. 7.

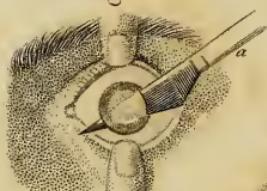


Fig. 8.

Fig. 10.

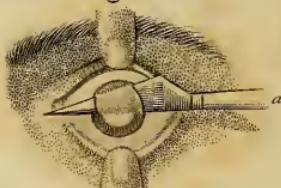


Fig. 12.



Fig. 11.

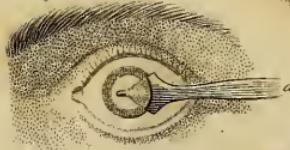


Fig. 9.



Fig. 13.

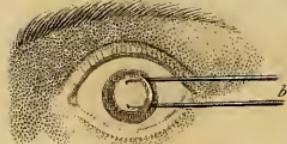


PLATE XLII.

CATARACT AND ARTIFICIAL PUPIL.

FIG. 1. *Extraction of the cataract.*—First stage.—*Inferior section.*—*a, a*, the fingers of an assistant raising up the upper lid; *b* and *c*, the middle and index fingers of the surgeon depressing the lower lid; *d*, the right hand of the surgeon holding the cataract knife. The figure represents the point of the instrument immediately after it has passed through the cornea.

FIG. 2. *The same operation.*—The inferior flap cut out.

FIG. 3. *The same operation.*—Second step.—Incision of the capsule with the capsular knife, *a*.

FIG. 4. *The same operation.*—Third stage.—*Expulsion of the cataract.*—The handle of instrument, *b*, presses lightly upon the upper lid, while the surgeon compresses with his finger, *a*, the lower lid from below upward.

FIG. 5. *A finger armed with the claw.*—The claw of Desmarres for fixing the globe of the eye. *a*, the ring; *b*, small claws which are introduced into the sclerotica.

FIG. 6. *Oblique section.*—The knife, *a*, plunged obliquely from above downwards and from without inwards.

FIG. 7. *Superior section.*—The knife, *a*, carried transversely from without inwards; its edge, turned upwards, is cutting the superior flap.

FIG. 8. *Method of Furnari.*—*a*, the instrument of Furnari introduced into the anterior chamber, from without inwards.

FIG. 9. *The same method.*—Small hook like forceps seizing the opaque lens.

FIG. 10. *Artificial pupil.*—*Mulder's method.*—Crucial incision of the iris, and excision of the four small angles resulting from the incisions by means of scissors with an elbow at their joint.

FIG. 11. *The same operation.*—*Beer's method.*—A minute incision is made in the cornea; a small hook is tearing the iris and drawing it into the wound in the cornea.

FIG. 12. *The same operation.—Incision of the iris.*—*Velpeau's method.*—A lance-shaped knife, *a*, pierces first the cornea, then the iris from before backward; it is again thrust through the iris and cornea from behind forward. The edge of the instrument, looking downwards, cuts a flap in the iris and cornea.

FIG. 13. *The same operation.—Detachment of the iris.*—*Scarpa's method.*—A needle, *a*, introduced through the sclerotica is detaching the iris from above downwards.

OPERATIONS UPON THE GLOBE OF THE EYE.

SURGICAL ANATOMY.

We shall confine ourselves to a concise description of those parts composing the globe of the eye, which are important in reference to the operations which are performed on this organ. Proceeding from the periphery towards the centre of the eye, we meet with:

The *conjunctiva*, a delicate and vascular membrane, which after lining the inner aspect of the eyelids, is reflected over the globe of the eye, and covers all the visible portion of the sclerotica and cornea. At the internal angle of the eye, it forms a cul-de-sac of some depth before it is reflected upon the sclerotica. The transparent *cornea* is intimately united to the sclerotica. It is composed of laminæ laid one upon the other, between which the points of instruments may become engaged when they are not plunged at once through the cornea. The *conjunctiva* is tough and resisting, and the instruments which are used for cutting it should be of very superior quality.

The *sclerotica* extends from the optic nerve to the cornea. This envelope is of a pearly white colour; it is elastic and dense, so much so that in penetrating it, the point of the instrument should be introduced with a sudden and vigorous thrust, and at right angles with the membrane. The muscles of the eye are inserted into the sclerotica.

The *choroid* lines the internal aspect of the sclerotica, to which it slightly adheres. This membrane is composed of two distinct laminæ; one, internal, consists entirely of the coloring matter; the other, external, is essentially vascular. The ciliary vessels and nerves ramify between the choroid and sclerotica.

The *long ciliary arteries* which supply the iris are two in number, one internal, the other external. They are found between the choroid and sclerotica, in the plane of the transverse diameter of the globe, and

take their course horizontally from behind forwards. To avoid injuring them, the sclerotica should be punctured above or below the transverse diameter of the eye.

Between the choroid, sclerotica and iris, and directly opposite to the circumference of the cornea, is situated the *ciliary circle* or *ligament*, presenting the appearance of a greyish coloured ring. It is essentially vascular and interwoven with nervous filaments anastomosing with each other. In performing operations upon the eye, it should be carefully avoided.

The *ciliary processes*, folds formed by the internal lamina of the choroid, float behind the iris and surround the circumference of the crystalline lens, without possessing any intimate adhesions with it.

The *iris*, a diaphragm situated between the transparent cornea and the crystalline lens, separates this anterior portion of the globe of the eye into two chambers: one, *the anterior*, between the cornea and the iris; the other, *the posterior*, between the iris and the crystalline lens. The distance between the cornea and the iris is, at the centre, between a line and a line and a half. The distance between the iris and the lens is half a line, and not unfrequently they are in contact, which renders the passage of instruments between these two organs very dangerous for both.

The two chambers communicate with each other by the *pupil*, a circular opening in the centre of the iris. The greater circumference of the iris is in connection with the ciliary ligament, from which it can be easily separated. This anatomical arrangement is made use of in the operation for artificial pupil. The iris floats freely in the middle of the eye, as soon as instruments by their presence have destroyed the equilibrium of the pressure of the fluid by which it is maintained in its place. It is very necessary to avoid injuring this membrane, and to penetrate the anterior chamber very cautiously when operating for cataract by extraction.

The movements of the pupil have been variously explained by means of theoretical ideas concerning the structure of the iris. We refer to those theories which have originated particular methods for the operation of artificial pupil. The action of light and belladonna upon the iris are well known; we will point out the cases in which these two agents may be made useful.

The *crystalline lens*, situated behind the iris, is a double convex lens, formed by concentric layers of unequal density, but which increase in

solidity as we approach its centre. The most external layer is almost liquid and has received the name of liquor Morgagni. The most concentric layer, or the *nucleus*, is of a gummy consistence, and easily crushed with the finger. On pressure, the lens easily separates into triangular segments, with their apices towards its centre. Each of these segments may be opaque of itself, or as a whole they may present different degrees of opacity, which gives to certain varieties of cataract their stellated or marbled appearance. The facility with which the crystalline lens is divided increases the difficulties in the operation by depression.

The crystalline lens is enveloped by a membrane or capsule, which, by its connections with the hyaloid membrane, and its contact with the ciliary processes, maintains the lens in its place. These relations often render the depression in mass of the crystalline apparatus very difficult, in cases of general cataract. In milky or lenticular cataract, it suffices to lacerate the capsule and permit its contents to escape.

Behind the crystalline lens is placed the *vitreous humour*, a gelatinous mass which fills the four posterior fifths of the globe of the eye. A very delicate membrane, the *hyaloid*, envelopes the vitreous humour, and by its numerous processes divides it into isolated cells of variable forms. To facilitate the operation for cataract by depression, it is frequently necessary to rupture with the needle some of these hyaloid cells.

CATARACT.

Cataract is a partial or total opacity of the crystalline apparatus. The different sources of the disease give rise to numerous varieties of cataract. We shall only mention those whose characters furnish indications for the choice of methods of operating.

According to its seat, the opacity may affect singly : 1st. the crystalline membrane, causing *capsular* or *membranous cataract* ; 2d. the liquor Morgagni, giving rise to *milky cataract* ; 3d. the crystalline lens, *lenticular cataract* ; 4th. the lens and its capsule, *capsulo-lenticular cataract*.

Cataracts may be either *hard, soft or liquid*. Lenticular cataracts are usually hard and dark ; they are common in old persons, and the operation by extraction is best calculated for their cure. Capsular cataracts are softer and clearer than the former. Milky cataracts are liquid, and are less opaque in the superior than in the inferior half of the capsule, their opaque particles obeying the law of gravity. Soft and liquid cataracts, being easily absorbed, constitute the varieties to which the operations of breaking up, and depression, are applicable. They are usually found in young persons ; in the course of time the lens itself is liable to become opaque, and it is therefore advisable to operate for congenital cataract in infancy.

The *depth* of the cataract is indicated by the greater or less amount of shadow cast upon the opaque crystalline lens by the iris. In capsular cataracts, this shadow is slightly marked, and if it is entirely wanting, we may conclude that there is either contact or adhesion between the iris and the hypertrophied, or displaced crystalline apparatus.

Operative indications.—The general conditions of success are the following : satisfactory general health ; healthy condition of the eye ; absence of even slight inflammation of any of its tissues ; cornea unblemished ; moveable pupil ; non-adherent iris ; sensible retina ; maturity of the cataract, proved by the entire loss of sight ; existence of cataracts on both eyes, in order that the sound eye may not be endangered by the unforeseen and frequently unfavorable consequences of the operation when performed upon the diseased eye ; operate upon children in infancy ; a moderate atmospheric temperature ; excessive heat or extreme cold are frequently prejudicial.

MODES OF OPERATING.

The object of the operation for cataract is to remove from the pupil the opaque body which prevents the rays of light from reaching the retina. The various methods by which this result is obtained may all be arranged under three principal heads : 1st. By *depression* : the opacity is simply displaced or broken up ; 2d. By *extraction* : the opacity is removed from the eye ; 3d. The *mixed method*, or the *operation of Quadri*.

General arrangements relative to the patient and the surgeon.—These are applicable to all cases, whatever may be the mode of operating adopted. The patient should be subjected for some time beforehand to a severe and debilitating regimen ; all irritating causes which might give rise to an inflammatory state of the eye should be removed ; light purgatives should be occasionally administered, in order to prevent cerebral congestion by creating a derivation towards the intestines ; on the evening before the day fixed upon for the operation, a few drops of a solution of belladonna or atropine should be applied to the eye for the purpose of dilating the pupil, and if this dilatation should not continue until the moment of operating, a few drops more should be applied an hour or two before the operation. The use of belladonna is only absolutely necessary when the operation by extraction is to be performed. The patient being seated upon a low chair, the surgeon takes his place in front of him upon a little more elevated seat ; an assistant standing behind, holds the head of the patient firmly, by passing one hand under his chin, and the other across his forehead. With the index and middle fingers of the hand upon the forehead, the assistant also raises the upper lid. This part of the assistant's duty is somewhat delicate ; no pressure should be made upon the globe of the eye, and yet the lid must be so supported that it will not slip away and fall upon the instruments of the surgeon at the moment of operating ; Desmarres advises rubbing the fingers with a little chalk to prevent the lid from slipping. The instruments used for elevating and depressing the eyelids when performing the operation for strabismus may also be had recourse to.

The surgeon, if he is ambidextrous, can easily operate upon either eye without changing his position ; but should this not be the case, it will be necessary for him to stand behind the patient when performing the operation upon the right eye.

It is now necessary to fix the eye. For this purpose a small double hook may be used, which should be inserted into the sclerotica; but usually the surgeon obtains the necessary immobility by means of the index and middle fingers of the hand which is unemployed; the index depresses the lower lid, while the middle finger, carried a little upward and inward, upon the caruncula lacrymalis, makes moderate pressure upon the ball from within outwards. Desmarres has a ring upon his finger to which is attached a small flexible projection terminated by two claws, which he inserts into the sclerotica (see pl. 42, fig. 5).

§ 1. DEPRESSION.—This is performed with cataract needles (see Instruments, pl. IX., fig. 8, 9, 10 and 11). Scarpa's needle is a little more curved than that of Dupuytren, and has a projecting ridge upon its concave aspect. This ridge strengthens the point of the instrument, but increases the danger of dividing the lens, when pressing upon it in depression, by rendering it more liable to penetrate the substance of the cataract. The needle of Dupuytren, a little flatter and smaller at the point, has a conical stem, which gradually and exactly fills up the little wound made in its introduction, and thus the vitreous humour is less liable to escape. The handle of these needles is marked with a small black spot, on the same side as the convexity of the point, by which the surgeon always knows the position of the instrument when its point is buried in the eye. The operation by depression may be performed by introducing the needle into the eye through the sclerotica, *scleroticonyxis*, or through the cornea, *keratonyxis*. These are the principal methods, of which all others are only varieties.

A. Scleroticonyxis.—*1st stage. Puncture* (left eye).—The surgeon depresses the lower lid and fixes the eye, with the index and middle fingers of the left hand, then, taking the needle like a pen between the thumb, the index, and middle fingers of the right hand, he rests the two remaining fingers upon the cheek for a support. The needle is held a little obliquely from below upwards towards the sclerotica, its point being directed at a right angle to the surface which it is to penetrate; its convexity should look upwards, and the edges transversely, so that the little wound which is made will be parallel to the direction of the ciliary arteries. The patient being directed to turn the eye inwards, the needle is plunged into the sclerotica a line and a half or two lines from the cornea, and about half a line or a line below the transverse diameter of the globe. By making the puncture nearer the cornea, we would run the risk of wounding the iris and the ciliary body; by mak-

ing it more distant, we might perforate the lens, and render the manipulation by which the needle is brought behind the iris more difficult. Finally, by introducing the instrument below the transverse diameter, we avoid wounding the ciliary artery, which runs along between the sclerotica and the choroid, in the plane of this diameter. The puncture should be made firmly and at once, for at the moment when the first prick of the instrument is felt, the patients often make a sudden movement backward, which may either change the point of puncture, or disengage the needle already thrust into the eye.

2d stage. Passage of the needle between the iris and the lens.—The needle having passed through the sclerotica, should be carefully withdrawn until its curved portion only remains in the eye. Then, by rotating the handle of the instrument with the thumb, the concavity of the point is turned backward and the convexity forward; the black spot upon the handle indicates the extent of the movement. At the same time that this movement of rotation is being executed, the handle of the instrument is slightly elevated and carried towards the temple, so that the point turning around the inferior border of the lens, can, without injuring it, be carried between it and the iris. Contact or adhesions which may exist between the iris and the capsule render this manœuvre very delicate. The needle, brought to a horizontal position, is then turned from without inwards, so that its point may appear in the opening of the pupil.

3d stage. Incision of the capsule.—In the majority of cases the crystalline apparatus cannot be depressed in mass. The laceration of the capsule is especially necessary when the cataract is soft and of considerable volume. This manœuvre has besides the advantage of revealing the real nature of cataracts of doubtful character, and consequently furnishes timely indications for modifying the mode of operating (breaking up). This division of the capsule should be made with the edge of the needle, and is executed by making slight forward and backward movements beneath the inferior, and then upon the superior circumference of the envelope.

4th stage. Displacement of the opacity.—The capsule being divided, the concave face of the needle is brought to act upon the superior circumference of the lens, and by a slow and carefully managed lever-like movement, during which the handle is elevated and brought forward, the lens is carried downwards and outwards into the vitreous humour. The needle should retain it in this position for eight or ten seconds.

This displacement is executed with a moderate degree of pressure, in order to prevent the lens from rotating under the needle, which might cause its falling into the anterior chamber. Should this accident happen, the opaque body must be perforated with the needle and carried from before backward through the pupil. If the attempt to do this proves ineffectual, we must then have recourse to extraction by incision of the cornea.

To obviate the difficulties of this manipulation, Gerdy has invented a needle whose point being introduced into the eye, bifurcates at the will of the surgeon by the dilatation of the two branches which compose it; the lens is thus embraced and directed with greater certainty to the bottom of the eye by these two branches, which form a double support to it, and thus present any rotation on its axis.

B. Reclination is only a modification of the process just described. The needle carries the lens from before backward into the vitreous humour, and then depresses it so that its anterior becomes its superior aspect (see pl. 41, fig. 6). This variety of depression is applicable to soft cataracts when the capsule and the lens are displaced at the same time. After the depression it frequently happens that a few fragments of the capsule or the lens, separated by the pressure of the needle, are found floating in the middle of the eye. Each of them should be detached and carried into the vitreous or aqueous humour, in order to facilitate their absorption. By doing this we prevent the formation of secondary cataracts, which frequently result from the consecutive union of these particles.

C. *Breaking up.*—This method is especially applicable to soft and liquid cataracts. In this operation the capsule is lacerated, and its contents, if they are liquid, escape into the humours of the eye, where they are absorbed. If the cataract, although soft, can be divided into fragments, each fragment should then be divided into small particles, in order to submit it more thoroughly to the dissolving action of the humours of the eye.

When cataracts adhere to the iris, we must limit ourselves to the laceration of the capsule opposite the pupil. This operation is effected by means of a small hook which is slid flatwise between the capsule and the iris. When it has been introduced to the level of the pupil, the hook should be turned towards the capsule and made to act upon it in radiating lines.

D. *Suction.*—This method is applicable to soft cataracts only.

Laugier plunges into the cataract a hollow needle with an opening near its point. This needle is attached to a small syringe, whose piston being put in action, sucks the opaque humour from the cataract.

Blanchet operates by means of suction upon liquid cataracts ; but he introduces his needle through the cornea, and instead of a syringe to draw out the cataract, uses a small india rubber vessel similar to that in the plate (see Instruments, pl. X., fig. 17), which being compressed and then left to its own elasticity, sucks out the opaque liquids with more or less rapidity.

We will now pass rapidly over the different secondary methods by which the operation by depression has been modified.

Petit of Namur, *Ferrein*, and, still later, *Bowen*, divide the capsule upon the posterior aspect of the lens ; the lens alone is then depressed, and the anterior fold of the capsule remains in its place.

Bretonneau and *Velpeau*, after introducing the needle into the sclerotica, divide the hyaloid cells extensively before bringing it around the inferior border of the lens, thus preparing a way along which this body can be carried into the vitreous humour.

Bergeron and *Goirand* detach the lens from the vitreous humour around its entire circumference ; then, after isolating it from the ciliary processes, carry it and the capsule into the vitreous humour together.

Pauli, and, still later, *Hervez de Chégoïn*, propose to elevate the lens, instead of depressing it, upon the principle that its specific lightness is the only cause of its re-ascension after depression.

Malgaigne having noticed that the lens never re-ascends but when it has been depressed together with its capsule ; and besides, that the capsule resists absorption for a long time, and that there is no great inconvenience produced by leaving it in its place, recommends the following method : Plunge the needle, with the concavity of its point looking upwards, into the sclerotica, at the place of election, and in such a manner that it will penetrate the posterior and inferior part of the lens ; divide the capsule by carrying the needle backward, and then, with a half circle in the vitreous humour, bring the needle above the lens, in such way that its concavity looks downwards ; by a slight pressure, the lens is forced downwards, and the two laminæ of the capsule close together behind it. The method is only applicable to lenticular cataracts.

E. *Keratonyxis*.—Depression through the cornea is only performed in rare cases where the eyes are deeply buried in their sockets, and of

such excessive mobility, that they can be fixed with difficulty. In this operation, all the movements of the needle are made through the pupil, where they chafe the borders of the iris; loss of the aqueous humour, the passage of the lens into the anterior chamber, cicatrices of the cornea, etc., are formidable accidents, and which, added to the difficulties of the operation, have long since caused the abandonment of the operation through the cornea in the majority of cases.

1st stage. Puncture.—An opaque cicatrix being the result of the wound, the puncture should be made near the periphery of the cornea, and the inferior half is to be preferred. Should there be an opaque spot on the cornea, this is chosen of course as the point for introducing the needle. The instrument should be carried through the cornea, one edge looking upward and the other downward, so as to make a small linear vertical wound.

2d stage. Depression and breaking up.—The point of the needle being introduced into the anterior chamber, by a movement of rotation its concavity is turned towards the lens. The capsule is then divided in the ordinary way, and the flat side of the needle being applied to the superior curve of the lens, is depressed into the vitreous humour by a lever-like motion, the handle of the instrument being directed upward and inward.

Breaking up.—The lens should now be transfixed by the needle, and an attempt made to break it up by rapid movements of rotation. Breaking up of the central portion of the lens is alone practicable when the cataract adheres to the iris.

§ 2. EXTRACTION.—Extraction of the cataract may be effected by an incision through the cornea, *Keratotomy*, or through the sclerota, *sclerotomy*.

A cataract knife, to incise the cornea; a needle or capsular knife, to divide the capsule; a small scoop, eye forceps, and a delicate pair of scissors, compose the necessary instruments (see Instruments, pl. IX., fig. 1, 2, 3, 4, 5, 6 and 7). Wenzel's knife is lancet-shaped; it has the convenience of incising the cornea and the lens at the same time, but the inconvenience of not completely filling up the wound which it makes when cutting the flap, which gives room for an escape of the aqueous humour. Richter's knife, in more common use, has a short and triangular-shaped blade, which closes exactly the wound in the cornea. The shortness of its blade renders it less liable to wound the internal angle of the eye.

The general arrangements and preparations already mentioned for the operation by depression are equally applicable to extraction.

The incision of the cornea makes a semi-lunar flap, which may be inferior, oblique, or superior; so that there are three methods; the operation by the inferior, the oblique, or the superior flap.

1. *By the inferior flap*—(pl. 42, fig. 1, 2, 3 and 4).—*1st stage.*—*Incision of the cornea* (fig. 1).—The point of the instrument is applied to the cornea on a level with its transverse diameter, and a half a line or a line in front of the sclerotica; with a sudden puncture, and a steady hand, it is made to penetrate the anterior chamber; a pause is then made to see that the knife has not wounded the iris; if this is not the case, the handle is carried a little backward, and the point directed horizontally from without inwards, along the transverse diameter, so that it will come out of the cornea on the other side at a point diametrically opposite to that where it entered; the blade of the instrument should be held parallel to the plane of the iris; the point having passed completely through the cornea, the knife should be pushed on slowly and with precision, not abruptly, so as to cut a flap whose borders will be everywhere equally distant from the sclerotica. Too much haste in this first stage of the operation may endanger the iris, or the loss of the aqueous humour. It is necessary that the muscles, which contract spasmodically from the influence of the puncture, should relax; and also that the knife should close the wound accurately as it advances, in order to prevent the escape of the aqueous humour (fig. 2). The flap once cut, the upper lid should be allowed to fall, and the patient given a moment of rest.

2d stage.—*Division of the capsule* (fig. 3).—The capsular knife, held like a writing pen, should then be introduced by its back from below upwards, through the wound in the cornea; its point being brought in contact with the capsule divides it lightly and without pressure, in order not to force back the lens. This incision of the capsule may be made with an ordinary cataract needle.

3d stage.—*Expulsion of the cataract* (fig. 4).—It frequently happens after the incision of the capsule, that the lens escapes of its own accord, owing to the contraction of the muscles which compress the globe of the eye. When this does not take place, pressing lightly upon the upper lid with the finger or the handle of the instrument usually suffices to force the lens into the opening of the pupil; it soon passes into the anterior chamber, and slips through the wound in

the cornea. Its expulsion may also be facilitated by means of two pressures combined, one upon the upper lid, and the other from below upward on the lower lid. Some particles of the lens or its capsule frequently remain in the field of the pupil; they should be extracted with the scoop, or the eye forceps, to prevent the formation of secondary cataracts.

2. *By oblique flap.*—*Wenzel's method* (fig. 6).—The point of the knife should penetrate the middle of the external and superior fourth of the cornea, and make its exit at the middle of the internal and inferior fourth. This method is more difficult of execution than the preceding; but the cicatrisation of the wound is more rapid; the lower lid is less liable to be caught under the flap, and there is less danger of wounding the nose, or the caruncula lacrymalis, in passing through the cornea.

3. *By the superior flap.*—*Methods of Richter, Wenzel, Jaeger, etc.* (fig. 7.)—This operation is performed in the same manner as that by the inferior, or oblique flap. The base of the flap corresponds to the transverse diameter of the cornea, and its free edge looks upward. This method, more difficult in its performance than the two first, has this advantage over them, that it is less frequently followed by the escape of the aqueous humour, and cicatrisation takes place rapidly, as the flap is retained in its proper position by the upper lid.

Furnari's method.—Furnari uses a double edged knife (see Instruments, pl. 9, fig. 5), terminated by a delicate point slightly curved on its flat surface. This little point is used to incise the capsule. The instrument penetrates the anterior chamber from without inwards (see pl. 42, fig. 8); the capsule is then incised, and through the opening made in the cornea, a delicate pair of eye forceps are introduced (fig. 9), with which the lens is broken up and extracted.

Sclerotomy.—This operation was proposed by Bell and has been since abandoned. An incision was made in the sclerotica; through this incision a pair of forceps were introduced, with which the lens was seized and removed. But this method exposes the ciliary arteries to lesion, to the instantaneous escape of the vitreous humour, to inflammation of the choroid, of the retina, etc., accidents which should give the preference to the operation through the cornea.

§ 3. *MIXED METHOD (Quadri).*—The ordinary needle is introduced through the sclerotica, with which the lens is depressed or broken up; a small pair of forceps carried through the cornea, are used to divide the capsule and extract the fragments through the corneal opening. This method is generally rejected.

OPERATION FOR ARTIFICIAL PUPIL.

The operation for artificial pupil, performed for the first time by Cheselden in 1728, has, since that period, undergone an infinite number of modifications. The multiplicity of the causes which render this operation necessary, account for the number and variety of the methods in use. These have nothing exclusive in their character, and it is from the nature of the affections themselves which require this operation, that the surgeon must determine upon the method which he will adopt.

Four principal methods include all the modes of operating: 1st, the *incision of the iris* (iridotomy); 2d, *excision of the iris* (iridectomy); 3d, *detachment of the iris* (iridodialysis, or coredialysis); 4th, *displacement of the natural pupil* (corectomy).

Whatever method is adopted, the previous general preparations, the arrangement of the patient, the surgeons, and the assistants, are the same as those described above for cataract.

1st method. *Incision of the iris* (iridotomia or coretomia).—*Cheselden's method*.—Cheselden introduced a small sickle-shaped needle through the sclerotica, as in the operation for cataract by depression; the needle being fairly entered into the posterior chamber, he turned the point of the instrument towards the iris, and with a slight sawing motion made a horizontal incision of this membrane from behind forwards from a line and a half to two lines and a half in length. *Sharp* introduced the needle through the cornea. *Reichenbach, Odhelius* and *Richser*, incised the cornea and divided the iris from before backward.

Jurine introduces a needle through the sclerotica, and perforates the iris from behind forward, and again from before backward. These two punctures are then united by a single incision made by disengaging the needle downwards and backwards. This method, of very delicate execution, exposes the lens to injury, and may be followed by a greater or less detachment of the iris.

Janin having noticed that the horizontal incision of the fibres of the iris was almost constantly followed by reunion of the lips of the wound, determined to divide them across; to effect this, he introduced a small

knife, or a pair of delicate scissors, through the cornea, and made his incision vertical, and on the inner side of the natural pupil. Experience has shown that the pupils made by Janin's method close up as frequently, and are in no way exempt from the inconveniences attributed to the operation of Cheselden.

Compound section of the iris.—Whatever method is adopted, simple incisions of the iris are almost always followed by cicatrisation of the lips of the wound, which occasions an obliteration of the artificial pupil. To remedy this inconvenience the compound section of the iris is at present generally employed.

Guerin's method.—To unite the advantages of the methods of Cheselden and Janin, Guerin first opens the cornea, and then makes a crucial incision of the iris which divides its radiating fibres vertically as well as transversely.

Flajani's operation is analagous to that of Guerin; he uses the same needle to incise the cornea and the iris.

Maunoir also incises the cornea, and then, with delicate bent scissors, cuts a triangular flap from the iris, whose apex is at the centre and base at the circumference of that membrane.

Carron du Villars operates in the same way as Maunoir, but uses scissors without rings and which are kept open by a spring. The instrument of Carron du Villars is more easily managed than that of Maunoir.

Velpeau (see pl. 42, fig. 12,) uses an elongated double-edged knife, resembling very much the *serpent-tongued* lancet. The instrument transfixes the cornea; the point passes first through the iris from before backward and penetrates the posterior chamber; it is then brought from behind forward through the iris into the anterior chamber, about a line and a half or two lines from the first incision. The point is now carried anew through the cornea, and thus with a single thrust a flap is cut from the iris and the cornea. The small flap in the iris contracts upon itself, and soon disappears, leaving a triangular shaped artificial pupil.

Valuation.—The simple section of the iris is in general easily and quickly made; inflammation is less to be feared than in other methods, but it cannot be trusted, and the tendency which wounds of the iris have to cicatrise sometimes destroys the results of the operation, an inconvenience from which even compound section of the iris is not exempt.

2d method. *Excision of the iris* (iridectomy).—*Wenzel's method* (pl. 42, fig. 12).—This operation is the same as that of Velpeau described above, with the exception that Wenzel removes the little flap of the iris with the scissors, while Velpeau leaves it to itself.

Sabatier opens the cornea as in the operation for cataract, turns up the corneal flap, draws the iris outwards with forceps and excises it with scissors curved upon their flat surface.

Mulder, after making a crucial incision of the iris (pl. 42, fig. 10), removes one by one the small triangular flaps resulting from this incision.

Physick uses a pair of cutting forceps; one of the jaws is introduced behind, the other in front of the iris. These jaws being brought together remove a circular portion of the iris. *Furnari* uses an instrument similar to that of Physick.

Leroy d'Etioles operates upon the iris in situ, with an instrument similar in shape to the tonsil cutter. A small turning hook catches the iris and draws it between two rings, which, sliding one upon the other, excise the portion caught by the hook.

Beer makes a small incision in the cornea, through which he introduces a small hook which catches the iris and draws it through the wound in the cornea; with a delicate pair of scissors he excises this portion of the iris.

Gibson, *Walther* and *Lallemand* (of Montpellier), have variously modified Beer's method.

Desmarres incises the cornea with eye forceps, seizes a fold of the iris, draws it out through the wound and excises it.

Valuation.—Excision has this advantage over simple incision of the iris, that it is not followed by occlusion of the artificial pupil; but its execution is more difficult, as it necessarily requires more patience on the part of the patient, and greater firmness in the surgeon.

3d method. *Detachment of the iris* (coredialysis).—The facility with which the iris detaches itself from the ciliary ligament was taken advantage of for the first time by Assalini and Buzzi, in the operation for artificial pupil. Scarpa systematised this method, and introduced it into practice.

Scarpa's method (pl. 42, fig. 13).—A needle, *a*, is plunged into the eye through the sclerotica, as in the operation for cataract by depression; the point of the needle is carried to the superior and internal border of the iris, passed through this membrane from behind for-

wards, and with a see-saw motion, one-third of its circumference is detached by depressing it from within outwards.

Léveillé's method.—This method differs from the preceding only in the previous depression of the lens to avoid injuring it during the operation.

The methods of *Himly*, *Flajani* and *Beer*, consist in introducing the needle through the cornea, which facilitates the operation and allows the pupil to be made at any point of the iris. *Assalini* makes a large opening in the cornea, and detaches the cornea with eye forceps. *Bonzel*, whose method has been variously modified, detaches the iris with a small hook.

Langenbeck's method.—Impaction is united with detachment. An opening of one or two lines in length is made in the cornea, with an ordinary corneal knife; through this opening a small hook enclosed in a cylindrical sheath is introduced; the hook, slipped from its sheath, catches the iris and draws the detached flap into the wound in the cornea, where it contracts adhesions which prevent it from closing up the newly formed pupil.

Jungken, *Græfe* and *Reisenger* have modified Langenbeck's instrument, without changing his mode of operating.

Luzardi's method.—Luzardi invented a hooked needle consisting of two branches sliding one upon the other, but held together by a spiral spring (see Instruments, pl. 9, fig. 12). The needle is easily introduced into the eye, either through the cornea or the sclerotica, without any previous incision; when it is fairly entered, one of the branches is slid backward, which exposes a small hook with which a flap of the iris is seized; the spring, left to itself, forces the moveable branch against the hook, which thus grasping the detached flap, easily serves to draw it out through the wound.

Donegana's method.—Donegana unites incision with detachment. A small sickle-shaped needle, having a cutting edge on its concave aspect, is introduced through the cornea or sclerotica; the iris is detached with the convex border of the instrument, while with the concave cutting edge it is divided from its circumference towards its centre.

Huguier, remarking that when the iris is detached from the ciliary ligament, it folds before the instrument and is incised with difficulty begins by dividing it from the centre to the circumference, and afterwards detaching each lip of the wound.

Valuation.—All the operations through the sclerotica endanger the

crystalline lens ; and so much the more, as the needle masqued by the iris is managed with difficulty, and may deviate from its course. By operating through the cornea, these dangers no longer exist, and every point of the entire circumference of the iris is equally accessible.

Detachment alone is not always followed by a success of long duration ; the detached iris may unfold itself and obliterate the new pupil. It is therefore more certain to join impaction with detachment. The methods of Langenbeck and Luzardi being practicable with a simple hook, are applicable in the great majority of cases. Detachment is necessary when the iris adheres to the capsule, when there is anterior synechia, or when the greater portion of the cornea is opaque.

4th method. *Displacement of the natural pupil* (*corectopia*).—This displacement is applicable in cases where the natural pupil is masked by a spot upon the centre of the cornea. The object of the operation is to place the pupil behind a portion of the cornea which is not opaque.

Adams' method.—Adams made a small incision in the cornea, into which he drew the iris, to change the position of the natural pupil. When cicatrising, the wound of the cornea created adhesions which retained the iris and the pupil in their new position.

Himly, like Adams, makes an incision through the cornea, and draws the iris outwards with a small hook caught in the circumference of the natural pupil.

Guepin, of Nantes, and *Desmarres*, have invented a punch-like knife with which a small portion of the cornea is removed, and into which opening the iris falls ; when the iris does not fall into this opening of its accord, it is easily forced into it by making a slight pressure upon the eyeball. The cicatrisation of the cornea creates an impaction of the iris.

Valuation.—Displacement of the natural pupil is easily effected ; it is not liable to produce the inflammations which are to be feared in the other methods. But it is only practicable in those cases where the iris and pupil are both perfectly healthy.

SPOTS UPON THE CORNEA.

Spots upon the cornea are always the result of former ulcerative inflammation. These are perpetuated in the great majority of cases, by an inflammatory state of the cornea, during which, we may notice a vascular network converging toward the spot. It has been supposed

that these vessels perpetuate the opacity, and that their division or removal would be followed by the disappearance of the specks.

The surgeon, however, should not adopt the use of cutting instruments upon the cornea, until after thoroughly trying the ordinary methods of treatment. The operations which we are about to describe, require both prudence and great dexterity. Their employment is dangerous, and may occasion the loss of the eye.

1st. *Scarifications*.—These were first employed by *Demours*, who made four or five isolated, yet deep punctures with the point of a lancet, or a delicate bistoury, introduced obliquely into the spot. *Holscher* adopted this method to render a portion of the cornea transparent for an artificial pupil. *Richet* circumscribed the whole of the opaque spot with a circular furrow by carrying a cataract knife, whose point was introduced obliquely through half the thickness of the cornea, entirely around it. He then removed the small circular flap which resulted from the first stage of the operation.

2d. *Seton*.—*Pellier* and *Delarue* have published cases in which a flat thread passed between the laminæ of an opaque cornea, restored its transparency. The thread was introduced with a flat delicate needle. This operation is difficult in its performance, and exposes the patient to the gravest accidents. It is now completely abandoned. This is also true of *trepanning*, proposed by *Erasmus Darwin*, and of the *exsection* of the opaque flap, performed by *Dieffenbach*. We recall these dangerous operations from memory only.

3d. *Abrasion of the cornea*.—This operation, by which an ulcer is made to take the place of an opacity, is condemned by the majority of practitioners; yet it was adopted successfully in the case of a young girl, by *Malgaigne*. It should only be attempted upon persons who are entirely blind, and only upon them after the employment of every other means (*Desmarres*).

The eyelids being separated and the eye held firmly in its place, either with forceps or by means of hooks introduced into the sclerotica, the surgeon grasps the cornea with a pair of mouse-toothed forceps, and dissects from it a superficial flap with a cataract knife; by this method, which is always tedious and very painful, we run the risk of opening the anterior chamber. It should only be resorted to for the removal of *metallic spots*, produced by the injudicious use of badly prepared metallic colyria.

PTERYGIUM AND PANNUS.

Pterygium is a species of fleshy excrescence which attacks the cornea, and is usually triangular in form ; its position is commonly towards the inner angle of the eye.

Pannus, less regular in its form, may attack any portion of the cornea. The same modes of operating are applicable to both.

The small excrescence is seized with a double hook, or a pair of mouse toothed forceps, and excised with a small scalpel or a pair of scissors curved upon their flat surface ; it should then be cauterised with the nitrate of silver. These diseases frequently return, and are apt to leave an opacity of the cornea after them.

HYPOPION ; PHLEGMON ; HYDROPHTHALMIA.

§ 1. Purulent accumulations in the anterior chamber (*hypopion*) are easily absorbed in the great majority of cases ; so puncture is rarely necessary. But should the nature of the case require it, it may be performed by introducing an ordinary cataract needle into the most dependant part of the transparent cornea.

§ 2. In cases of *acute phlegmon* of the eye, when the pain caused by the purulent accumulation has become intolerable, an exit must be given to the fluid. *Scarpa* made an incision in the centre of the cornea and cut out a circular flap, a proceeding which is both long and painful. It is preferable to open the cornea at its most inferior portion by a simple incision with a cataract knife. By this method, there is a chance of preserving some portion of the cornea transparent.

§ 3. *Hydrophthalmia*, when it greatly distends the globe, or when it is accompanied by intense inflammatory action, also requires a puncture of the eye. According to the case, the liquid may be entirely or only partially evacuated by a puncture made either in the cornea or the sclerotica.

Desmarres, for puncturing the sclerotica, uses a lancet shaped needle having two shoulders a short distance from its point, to prevent it penetrating too far. A channel is also cut in the blade by which the liquid can escape.

EXTIRPATION OF THE EYE.

Extirpation of the eye, the eyelids being preserved.—Ordinary method.—Carry an incision outward, two-thirds of an inch, or an inch,

from the external angle of the eyelids ; draw these aside by dissecting up their internal surfaces ; seize the diseased eye with a hook or a pair of Museux's forceps, plunge a bistoury in at the inner angle of the eye, and carry it from within outwards as close to the inferior aspect of the orbit as possible, repeat this process with the superior aspect of the mass, in order to thoroughly circumscribe and detach the tumour ; exchange the bistoury for the curved scissors, and with them divide the pedicle which still attaches the tumour to the bottom of the orbit ; this is the most simple and rapid operation for extirpation of the eye.

Dupuytren commences by detaching the tumour from the superior aspect of the orbit ; then excising its pedicle, he draws it from behind forward, and completes its removal.

Should it be deemed advisable to remove the eyelids with the globe of the eye, they may be circumscribed with two semilunar incisions, and the operation completed as described above.

INSERTION OF AN ARTIFICIAL EYE.

The wound remaining after the extirpation of the eye having entirely cicatrised, a proper enamelled eye being chosen, the upper lid should be raised up and the most convex portion of the artificial eye inserted under it. The under lid should then be depressed, and both eyelids being finally left to themselves will support the artificial eye in its place. This eye, at first, should be retained but for a short time, so as gradually to accustom the soft parts to its contact. It may, finally, if too loose, be replaced by another still larger.

The *extraction* of the artificial eye is effected by means of a blunt gold or silver needle curved like a hook ; the lower lid is depressed, and this instrument slid between it and the eye. A slight lever-like motion is then given to the needle, which displaces the artificial eye and causes it to slip from the socket.

PLATE XLIII.

OPERATIONS UPON THE EAR.

FIG. 1. *A section showing the winding direction of the Eustachian tube, and of the external auditory canal.—a, inferior turbinate bone of the nasal fossæ; b, middle turbinate bone; c, opening of the Eustachian tube, on a level with the attachment of the inferior turbinate bone; d, first bend formed by the Eustachian tube, which takes its course from this point more directly outwards; e, membrana tympani; f, external auditory canal, in its course from within outwards it completes the arch which would be formed by the continuation of the Eustachian tube, if projected externally in its original course; g, internal carotid artery.*

FIG. 2. *Perforation of the lobe of the ear.—a, perforator; b, a cork placed behind the lobe of the ear as a support.*

FIG. 2 bis. Instrument for the perforation of the lobe of the ear; also used for the introduction of ear-rings.

FIG. 3. Extirpation of a polypus of the external auditory canal.

FIG. 4. Perforation of the membrana tympani; a b, Deleau's perforator; c, membrana tympani.

Pl. 43.

Fig. 1.



Fig. 2.

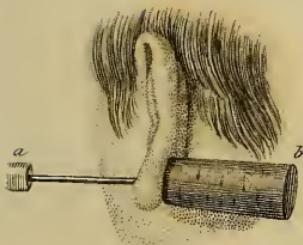


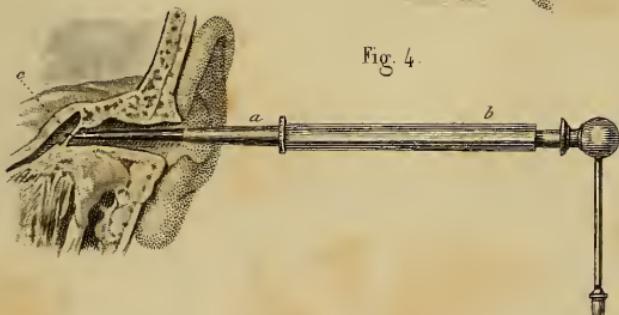
Fig. 3.

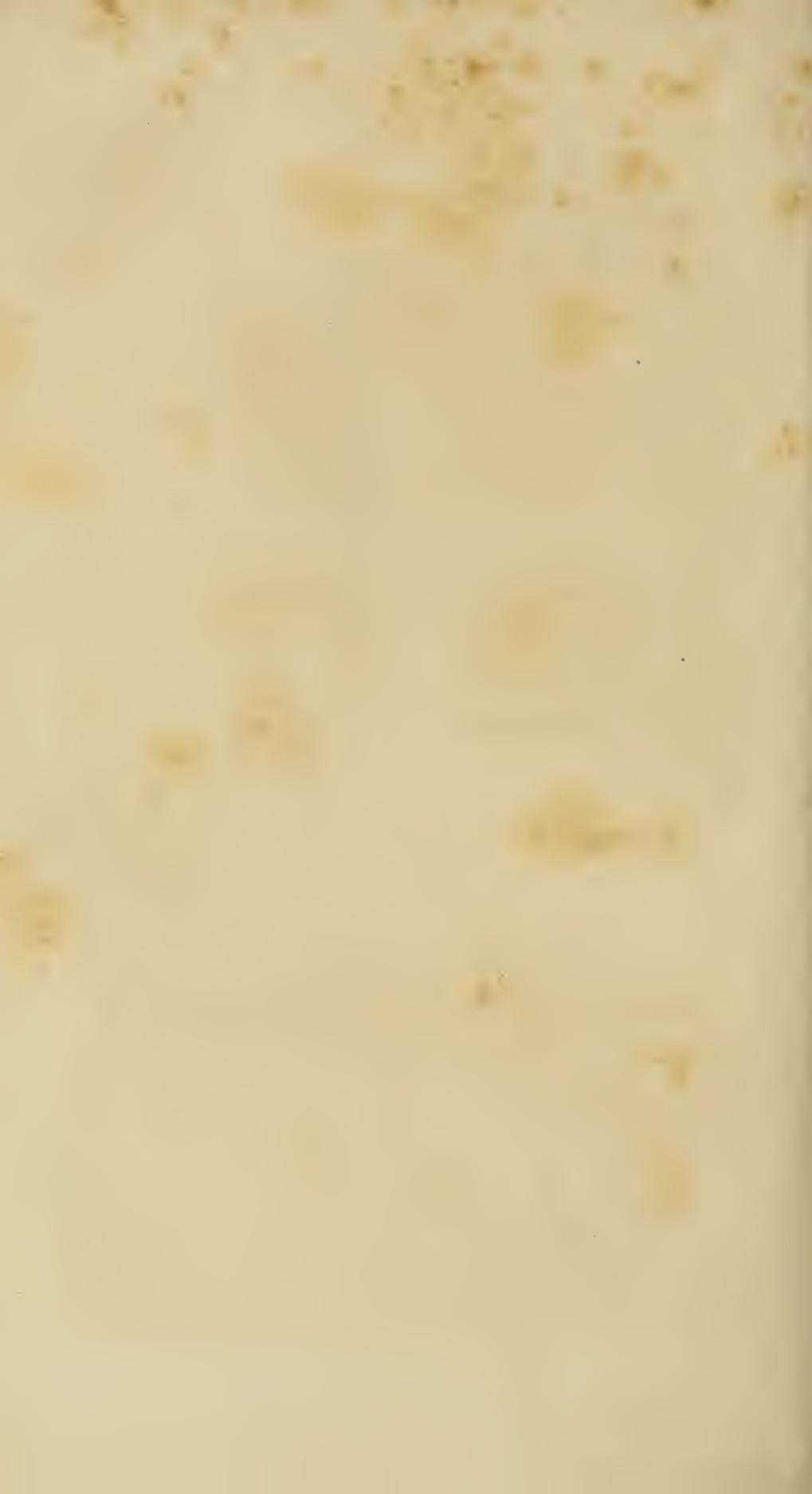


Fig. 2^{bis}



Fig. 4.





OPERATIONS UPON THE EXTERNAL EAR.

(*Pl. 43, fig. 2 and 2 bis.*)

PERFORATION OF THE LOBE OF THE EAR.

This operation, the object of which is the insertion of ear-rings, may be performed with a punch, or any sharp-pointed instrument. The operation is usually performed with a small trochar, *fig. 2 bis*, whose canula has a moveable point, and a cork, which is placed behind the ear as a support for the lobe.

The surgeon commences by compressing the lobe forcibly between his fingers to benumb it; then, taking the cork and holding it in its place with his left hand, he perforates the lobe at once from before backward with the trochar, which is buried in the cork. He then withdraws the cork and the stem of the trochar; the canula is left in the lobe, to aid in the introduction of a leaden wire or a silken cord, which is tied in the form of a ring, and allowed to remain until the wound is cicatrised and become converted into a permanent opening suitable for the reception of ear-rings.

WOUNDS OF THE EXTERNAL EAR, AND OTOPLASTY.

Simple wounds brought together by points of suture carried through the entire thickness of the *pinna*, usually unite by the first intention.

Otoplasty is only applicable to lesions of the lobe with loss of substance. The method by sliding (see *Blepharoplasty*) should be preferred, and in all cases, the flap which is destined to restore the loss of substance should be so attached that its cutaneous surface shall be directed outwards.

FOREIGN BODIES IN THE EXTERNAL MEATUS.

It would be difficult to enumerate the foreign bodies which might accidentally obstruct the auditory canal; they may be divided into two classes: 1st, bodies forming in the ear itself, wax more or less hardened, pus, coagulated blood, etc.; 2d, bodies introduced from without.

The extraction of these foreign bodies may be effected either with scoops, or forceps whose curves and dimensions are appropriate to the direction of the external auditory canal (see Instruments, pl. X., fig. 3, 4 and 5). The forms of these bodies, their solidity or softness, etc., will furnish indications to the surgeon, which will direct him in the choice of the proper method of operating for their removal. By drawing with the left hand the pinna of the ear upwards and outwards, we straighten a little the curves of the canal, and thus facilitate the introduction of instruments. By lubricating the canal with oil, the expulsion of the foreign body is more easily effected; if it should be solid, and tightly embraced by the soft walls of the canal, we may make use of specula (Instruments, pl. X., fig. 1 and 2) to dilate the passage, or introduce instruments from without for the purpose of crushing or cutting it in pieces. It must be remembered, as an anatomical fact, that in adults the vertical diameter of the canal is greater than its transverse diameter. Instruments therefore should be carried along the inferior wall of the canal, in order that they may be insinuated more easily between it and the foreign body. In infants, on the contrary, the transverse is greater than the vertical diameter. In the second place, the membrana tympani being inclined from above downwards and from without inwards, this arrangement should be recollected that the membrane may not be wounded, nor the foreign body forced into the angle which is formed at the internal extremity of the canal.

Hardened wax and analogous substances may be softened and removed by the use of injections of warm water. *Mayor* has also successfully used forcible injections for the expulsion of solid bodies, which the reflux of the liquid forced outwards.

If all these means fail, we may have recourse to the method of *Paul, of Egina*, who advises the surgeon to make a small incision behind the pinna, on a level with the canal, through which a probe can be introduced behind the foreign body, and used to force it from within outwards.

POLYPI OF THE AUDITORY CANAL.

Polypi of the auditory canal may be removed, or destroyed in situ, by ligature, excision, avulsion, and cauterisation. The nature of the polypus, its form and volume, should furnish to the surgeon the necessary indications for a choice of the proper method to adopt.

The ligature may be applied directly, or with the aid of Desault's knot-tyer (Instruments, pl. XII., fig 8) to a polypus with a pedicle.

Avulsion of the polypus is applicable to nearly all cases. It is effected with steel forceps (Instruments, pl. X., fig. 4, and pl. XII., fig. 1). The blood which frequently flows in abundance after the operation can be stopped by cauterisation. The nitrate of silver, or Vienna paste, is usually employed for this purpose. The action of the caustic should be carefully watched, and it would be prudent to introduce a small wad of cotton into the auditory canal to preserve the membrana tympani.

ABSENCE AND OBSTRUCTION OF THE AUDITORY CANAL.

The congenital absence of the meatus auditorius caused by the consolidation of its bony parietes, is beyond the resources of art. But when a membrane more or less thick, situated deeply, or otherwise, obliterates the canal, *puncture*, *incision* and *cauterisation* have been successfully employed.

It is always prudent to begin with an exploring puncture, to determine the existence of a cavity behind the membrane; if, by this puncture, the hearing is improved, a crucial incision of the membrane may be made, and the flaps excised. Some dilating substance should then be introduced into the artificial opening to keep it patent, and prevent its obliteration during the healing of the wound.

Itard and *Bonafond* have made use of cauterisation by the nitrate of silver, for destroying deeply seated membranes (see the caustic holder of *Bonafond*, Instrument, pl. X., fig. 14).

The obliteration of the canal caused by the thickening of its soft parietes, may be cured by the use of dilating bodies, such as catgut, prepared sponge, etc., which may afterwards be replaced by a canula of gold, or ivory, to keep up the dilatation.

Whatever method is adopted, the surgeon should proceed carefully and be wary of creating lesions in the internal ear.

OPERATIONS UPON THE INTERNAL EAR.

(*Pl. 38, fig. 1, and Pl. 43, fig. 1 and 4.*)

PERFORATION OF THE MEMBRANA TYMPANI.

The object of this operation is to render the internal ear permeable to the air, in order to remedy the deafness which is caused by the complete and incurable obliteration of the Eustachian tube. Perforation of the *membrana tympani* may be effected: 1st, by *puncture*; 2d, by *excision*; 3d, by *cauterisation*.

1st. *Puncture*.—*Astley Cooper's method*.—A small curved trochar is carried along the anterior inferior wall of the external auditory canal, until it reaches the membrana tympani. The surgeon then suddenly thrusts the point of the instrument through this membrane to the extent of a line or a line and a half, and the patient immediately recovers his hearing.

Buchanan's method.—The operation is the same as the preceding, but the trochar used is square; the membrane being punctured, the size of the artificial opening is increased by rotating the instrument.

2d. *Excision*.—*Himly's method*.—The perforation effected by the methods employed by Astley Cooper and Buchanan is liable to close again. To remedy this inconvenience, Himly joined excision to puncture, by means of a punch, which has since been perfected by Fabrizi and Deleau (see Instruments, pl. X., fig. 12, 14 and 16).

Deleau's perforator consists of a canula whose extremity presents a circular cutting edge; this canula encloses a point whose base is also sharp. By turning a spring this point is forced through the membrane, and by the action of another spring as suddenly returns into the canula, cutting a circular flap from the membrane, which is caught between the canula and the base of the point (see pl. 43, fig. 4, application of Deleau's perforator).

3d. *Cauterisation* proposed by Richerand is now generally abandoned.

PERFORATION OF THE MASTOID CELLS.

The communication which exists between the mastoid cells and the

cavity of the tympanum has suggested the propriety of making an artificial passage for the external air by perforating the mastoid process.

This operation may be performed with a small trephine, a trochar, or a perforator. The most favorable point for the operation is a little in front of the mastoid process, and from seven to nine lines above its apex (Malgaigne).

Perforation of the mastoid cells is not only indicated in certain varieties of deafness, but may also be performed to give exit to pus or liquids contained in these cells or in the internal ear, the sequelæ of abscesses, or organic lesions of the bony tissue.

This operation does not always effect the results which it promises; it is not exempt from danger, and in some cases has been followed by death. These considerations, joined to the fact that the cells are frequently atrophied, which renders the operation useless, should render surgeons exceedingly cautious in determining to operate.

CATHETERISM OF THE EUSTACHIAN TUBE.

(See *Pl. 38, fig 1, and Pl. 34, fig. 1.*)

We must recollect that the Eustachian tube is a canal from an inch and a third to an inch and two-thirds in length, having an orifice, *c* (*Plate 43, fig. 1*), which looks downward, inward and forward, and is situated behind the inferior turbinated bone, *a*; the orifice of this tube may be reached, therefore, through the mouth, or by the nasal fossæ. *Fig. 1st, pl. 38*, represents Deleau's sound, *d*, lying upon the floor of the nasal fossæ, and introduced at *e*, into the pharyngeal orifice of the Eustachian tube.

The object of catheterising this tube is the removal of any obstructions which may exist in its cavity.

Guyot's method.—In 1724, Guyot, a postmaster at Versailles, operated successfully for the first time in catheterising the Eustachian tube. He introduced a sound into the tube by the mouth. This method had at first numerous partisans, but in 1741, *Cleland* introduced the operation through the nose, and Guyot's method was from that time generally abandoned.

Cleland's method.—Ordinary operation.—This is performed with a very delicate silver instrument, curved like a female catheter (see Instruments, *pl. X., fig. 8*). The patient being seated, with his head thrown slightly back, and firmly held by an assistant standing behind him, the

surgeon takes the catheter, previously oiled, in his right hand, and introducing it into the nostril on the same side as the tube which he intends to sound, carries it along the floor of the nasal fossæ as far as the velum palati. In this first stage of the operation, the beak of the catheter is directed downward and a little outward. After a passage of about two inches and a quarter, the beak of the catheter strikes the velum of the palate, which causes a disagreeable sensation to the patient, and provokes a sudden movement of deglutition. The beak of the catheter is then turned slightly upwards and outwards, by rotating its stem, which should always be kept close to the external wall of the nostril. By carefully making slight forward and backward movements, the beak is caught in the orifice of the tube. This result is indicated by the retention of the instrument, and the peculiar sensation experienced in the ear by the patient. To inject the tube, the catheter should be held firmly in its position by squeezing it between the nostril and the fingers, and introducing into its orifice the extremity of a small syringe.

Deleau's method (see pl. 38, fig. 1).—Instead of a silver, Deleau uses a gum elastic flexible catheter, which can be introduced more deeply into the tube without being stopped by the winding parietes of the canal (see Instruments, pl. X., fig. 11). A stylet introduced into the catheter serves to support it, and to give it the proper curve. The extremity of the stylet extending a short distance beyond the catheter, is first caught in the tube; the catheter, guided by the stylet, is then pushed on as far as possible, and the stylet is withdrawn. The external extremity of the catheter is terminated by a small silver lip, to which is fitted a piece of wire bent like a spring, which fixes the apparatus in its position by clasping the ala of the nose of the patient. When the catheter is fast, injections appropriate to the disease can be introduced through it. Deleau recommends injections of air above all others; to introduce them, he uses an india rubber bag (see Instruments, pl. X., fig. 17), which only requires to be compressed to force a current of air into the tube.

These *douches* of air may, in certain cases, be of valuable assistance to our diagnosis. In fact, the surgeon by applying his ear to the ear of the patient, can easily recognise when the air penetrates the cavity of the tympanum and returns between the catheter and the parietes of the tube; in such cases, the obstruction is not complete. If the current of air passes through the internal ear and comes out through the ex-

ternal auditory canal, there is a perforation of the membrana tympani. Finally, the rattles and gurglings which are perceived by this auscultation reveal the presence of purulent or other liquids in the internal ear, etc.

Another method of Deleau's.—When the nostril corresponding to the diseased tube is itself obstructed, catheterism may be effected through the other nostril, by increasing the curvature of the catheter, and adjusting the dimensions of the curved part to the distance to be traversed, in order to reach the orifice of the tube. To facilitate the introduction of the beak of the catheter, its convexity should be slightly straightened.

Gairal's method.—Gairal carries the catheter to the posterior extremity of the nasal fossæ; as soon as the beak of the instrument has passed beyond the floor of the nostril, he makes it describe a fourth of a circle upwards and outwards; the catheter being then carried a little farther on, its extremity is caught in the orifice of the tube, and continuing the slight movement of rotation outwards, the instrument is introduced still more deeply into the canal.

The lip of Gairal's catheter has divisions marked upon it which indicate the limits of the rotation which it is proper to make.

OPERATIONS UPON THE LIPS.

EXCISION OF A FOLD OF THE MUCOUS MEMBRANE OF THE LIP.

In some persons, whilst in the act of laughing, or even of speaking, a portion of the mucous membrane just within the free border of the lip protrudes habitually, forming an unsightly prominence and everting the lips to a greater or less degree.

To remedy this deformity, the transverse fold should be seized with the forceps, and excised with a pair of scissors curved upon their flat surface. Compresses, dipped in cold water or a solution of alum, and held between the lip and the teeth, usually suffice to arrest the slight haemorrhage which sometimes arises from the operation.

SWELLING OF THE UPPER LIP.

If swelling of the upper lip exists as a symptom of scrofulous disease, we should limit ourselves to a general treatment for the diathesis, and abstain from any operation. But when an enlargement is found existing in an individual otherwise healthy, we may have recourse to *Paillard's* operation, by which the size of the lip is diminished by the removal of a flap of its internal mucous membrane. To do this, an assistant seizes one of the labial commissures and everts the lip by drawing it a little forwards; the surgeon with the hand which is disengaged does the same with the other commissure, and then with a bistoury removes a mucous flap of half its thickness throughout the whole length of the lip. The same dressing is applied, as for the operation last described.



Pl. 44.

Fig. 1.

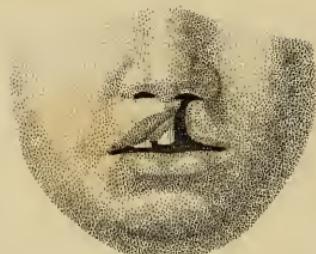


Fig. 2.

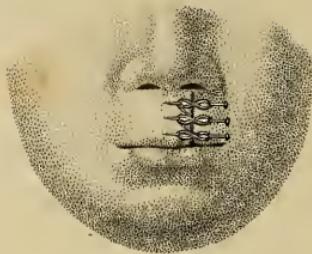


Fig. 3.

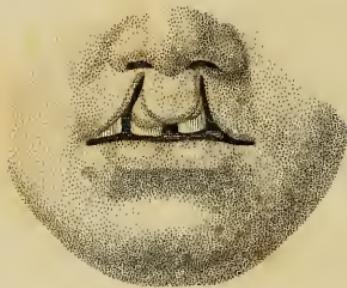


Fig. 4.

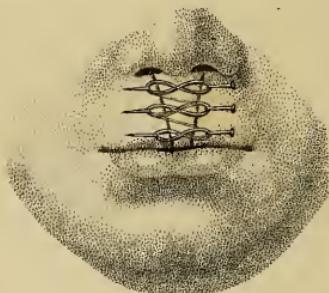


Fig. 5.

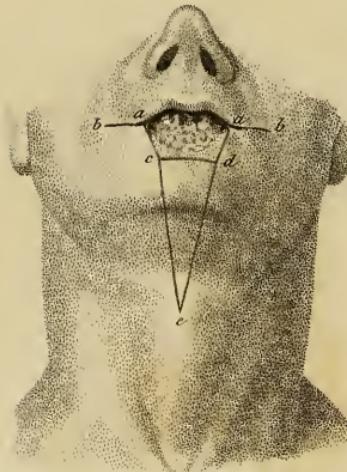


Fig. 6.

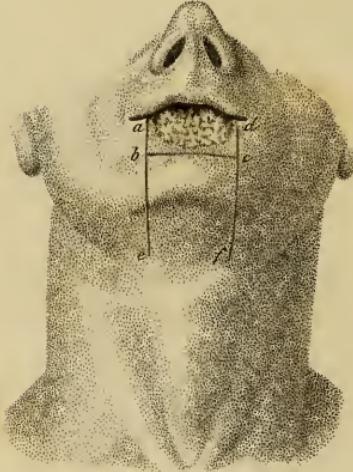


PLATE XLIV.

HARE-LIP; CHEILOPLASTY; CONTRACTION OF THE ORIFICE
OF THE MOUTH.

FIG. 1. *Simple hare-lip.*

FIG. 2. *The same after the operation.*—Three points of twisted suture unite the edges of the wound.

FIG. 3. *Double hare-lip.*

FIG. 4. *The same after the operation.*

FIG. 5. *Cheiloplasty.*—The cancerous portion, *a c d a*, is comprised between the two incisions, *a c e*, *a d e*. The commissures are prolonged by the two incisions, *a b*, *a b*; the two edges, *a d e*, and *a c e*, are brought together and united at the median line by points of suture.

FIG. 6. *Chopart's method.*—Two incisions, *a e*, and *d f*, form a quadrilateral flap, *a e f d*, from which the diseased portion is removed by the incision, *b c*; the flap, *b e c f*, by sliding, is then brought upward to a level with the commissures, *a* and *d*.

PLATE XLV.

HARE-LIP CONTINUED, ETC.

FIG. 1 and 2. *Operation for hare-lip.—Malgaigne's method.*

FIG. 1. Two incisions, *a* and *b*, detach two small flaps with an inferior base, whose bleeding surfaces are brought together to fill up the small notch, or gap, which remains, after the operation, when performed in the ordinary way.

FIG. 2. The two flaps, *a* and *b*, brought down before their union.

FIG. 3 and 4. *Method of Mirault, of Angers.*—A single flap, *a*, is preserved upon one of the borders of the division. This small flap is intended to fill up the notch (see fig. 4).

FIG. 5 and 6. *Contraction of the orifice of the mouth.—Dieffenbach's method.*—Two incisions, *a b* and *c d*, through half the thickness of the soft parts, form a triangular flap whose base corresponds to the retracted orifice and apex to the commissure of the lips.

FIG. 6. The flap is removed; the mucous lining, *a*, alone is preserved and lies at the bottom of the wound.

FIG. 7. The mucous lining is divided transversely; the two membranous flaps, *a* and *b*, are made use of to cover the raw edges of the wound, and form the mucous surface of the new lips.

FIG. 8. This represents a section of the parietes of the cavity of the mouth, in order to show the position of the threads, *a b* and *c d*, which are introduced before the division of the mucous lining, and intended for the points of suture.

RESTORATION OF THE ORIFICE OF THE MOUTH.

This operation is performed when there is an abnormal adhesion of the lips, or a contraction of the orifice of the mouth. If the abnormal adhesion is congenital and complete in a newly born infant, the mouth should be immediately opened by dividing the membrane which closes it. For this purpose, a puncture should be made with a straight bistoury at one of the points which corresponds to the commissure of the lips,

Fig. 1.

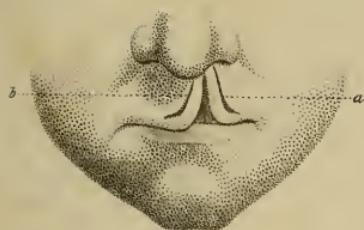


Fig. 2

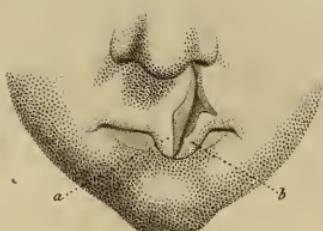


Fig. 3

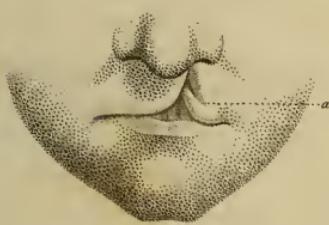


Fig. 4

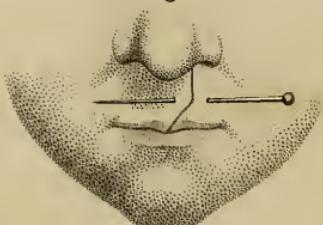


Fig. 5

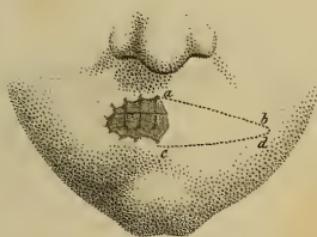


Fig. 6.

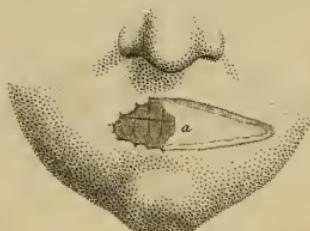


Fig. 7

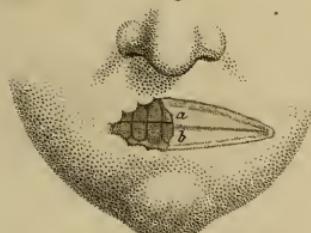
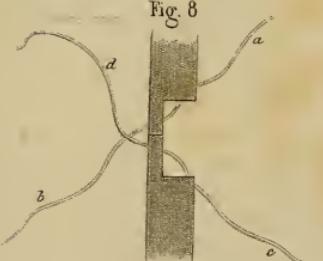
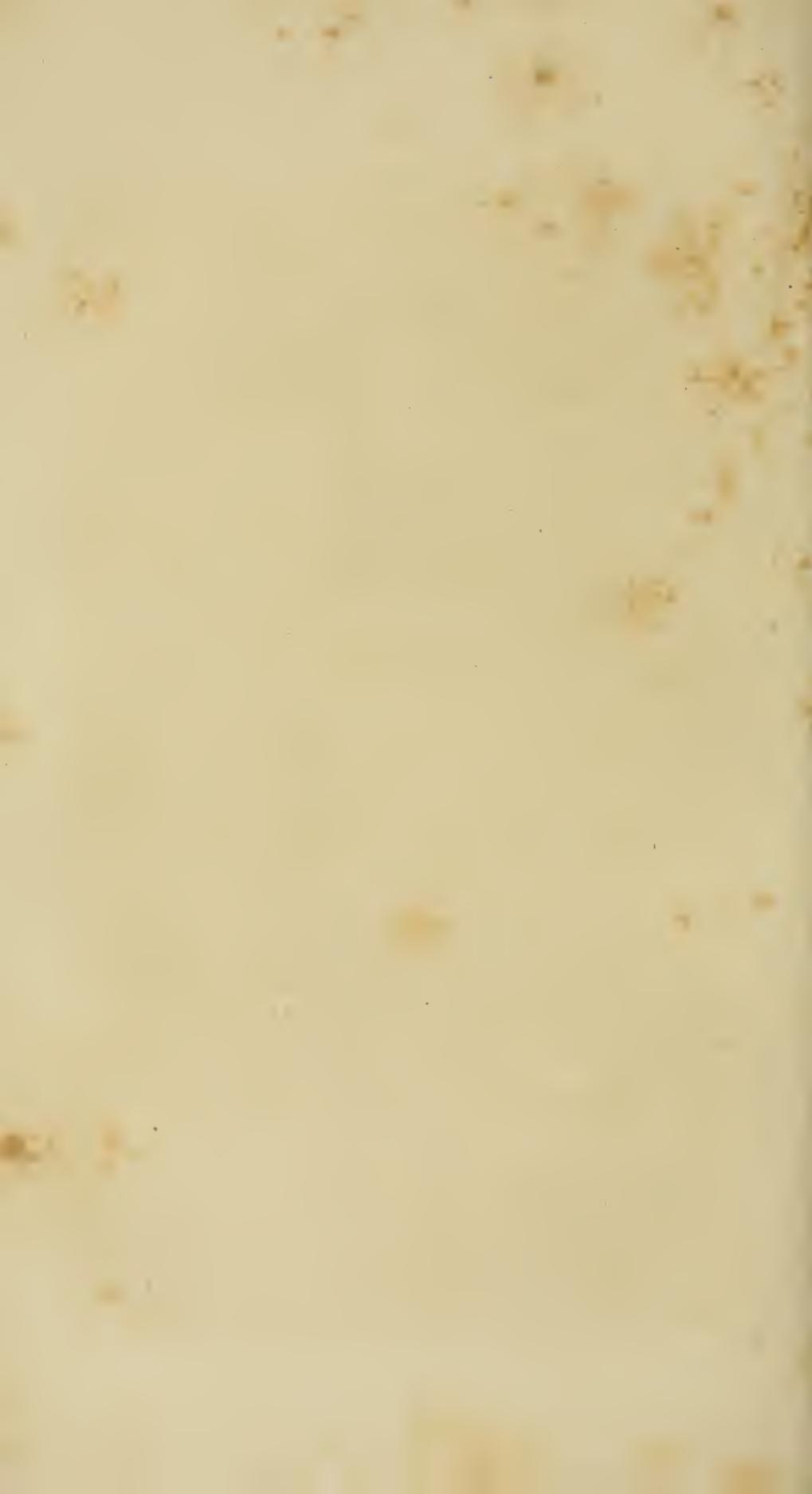


Fig. 8





and a director introduced through this opening as a guide for the cutting instrument (whether bistoury or scissors), with which the operation is to be performed. The two bleeding lips are now to be covered with a small fold of linen spread with cerate, to prevent all contact between the wounds during the process of healing.

When *contraction* of the mouth is produced by bad cicatrices, the result of burns, or ulcers, the success of an operation is more doubtful than in cases of abnormal adhesion. The process of cicatrisation creates new adhesions which have a tendency to re-produce contraction. To prevent these cicatrices from again establishing this deformity, the operations which we are about to describe have been devised.

Boyer's method.—The orifice of the mouth being re-established by means of incisions carried as far on either side as the course of the labial arteries will permit, the two commissures are drawn outwards by means of two blunt silver hooks, pulling one against the other. An appropriate bandage is made use of to support the hooks firmly in this position, and they keep up the dimensions of the mouth while cicatrisation of the lips is taking place. This method has had a fair share of success.

It has been proposed to make a puncture with a trochar on a line with each commissure; then to pass through these artificial openings a leaden wire whose extremities are to be brought together, and twisted and tightened every day, in order to cut through the intervening soft parts, but the divided tissues cicatrize and re-unite after the passage of the wire.

Krügen-Hausen's method.—The leaden wire is not inserted to divide the soft parts; it is left in its place without tightening, and when the two little apertures through which it passes are healed and have become permanent openings, the orifice of the mouth is established with the bistoury; the two cicatrised openings form the commissures. By this operation the results of cicatrisation are less to be feared than by the preceding method. In the place of the leaden wire, a small silver cañula may be introduced, or one of Scarpa's leaden styles (see Instruments, pl. VIII., fig. 13), the largest extremity of which is in the mouth, and the point being bent over protrudes externally.

Dieffenbach's method (see pl. 45, fig. 5 and 6).—In order to prevent the edges of the wound from again uniting, Dieffenbach invented a method by which the mucous membrane is preserved, and employed to cover the raw edges of the newly formed lips.

The surgeon introduces the index finger of his left hand into the

mouth of the patient, to put the parietes of the cheeks upon the stretch; the other hand, holding a pair of sharp-pointed scissors, or better still, a sharp-pointed straight bistoury, introduces the extremity of the instrument obliquely a little above the place where the commissure of the lip should be situated; the blade of the instrument should not be forced entirely through the cheek, but carried from without inwards, through half the thickness of the tissues, until it reaches the contracted orifice of the mouth. The point of the instrument being disengaged, its edge should be turned in front, and with a single cut all the superficial half of the tissues are divided from behind forwards. A second incision below the first is then made in the same way, and the two are united at the point intended for the new commissure by a small semi-lunar incision. The triangular flap, *a b c d*, lying between these two incisions must now be excised, care being taken not to injure the mucous membrane which lines the bottom of the wound.

The second step of the operation consists in putting to its destined use the mucous membrane which has been preserved. For this purpose, it is isolated from the other tissues as much as possible, then divided horizontally to within two or three lines of the commissure. These two flaps, one above and the other below, are then turned over the raw edges of the wound, and united to the skin by delicate points of suture.

Velpeau's method.—Before the horizontal division of the mucous membrane, Velpeau inserts the threads which are to be used for sutures. Each thread, attached to a needle, is carried from within outwards through the mucous membrane and the skin. A row of threads for the upper, and also one for the lower lip are thus inserted; between these two rows the incision of the membrane is made, and union is effected by tying the threads (see pl. 45, fig. 8).

Method of Serres, of Montpellier.—Serres divides the skin and mucous membrane at the same level, and then brings the two membranes together and unites them by points of suture. This method is more simple than the preceding, but it does not offer the same prospects of success.

HARE-LIP.

The operation for hare-lip consists of two principal steps: 1st, the paring of the edges of the division; 2d, bringing them together and causing their union by the process of adhesion.

1st. *Paring the edges.*—The patient, if he is an adult, may be seated

upon a chair, with his head thrown slightly back, and held in this position by an assistant; if the patient is a young child, he should be wrapped in a sheet or towel, and held upon the knees of an assistant. The assistant holding the patient's head should push the cheeks forward as far as possible, and compress the facial arteries upon the lower jaw in front of each masseter muscle. The surgeon commences the operation by elevating the upper lip, and dividing with the bistoury, or a pair of scissors, the frenum which unites it to the gums. The angle of the left border of the division is then seized with the fingers or a pair of hooked forceps, and drawn a little forward and downwards, and now, with a pair of strong and very sharp scissors, all the red border of the division is incised with a single cut, which is carried one or two lines beyond its superior limits. The right border is then excised in the same way by an incision which joins that of the other side. These two incisions form an inverted V, whose branches enclose the borders of the unnatural cleft.

2d. *Re-union.*—The cut edges of the wound are now brought together and united by three points of twisted suture applied in the following manner: the inferior angle of the left flap is seized as above and a pin is introduced obliquely from below upward, and from without inwards, upon the line of junction between the vermillion border and the common integument, and comes out by the bleeding surface of the lip. The pin should pass through between the two anterior thirds and the posterior third of the thickness of the lip, entering from two to three lines beyond the edges of the wound, and coming out of the wound about a line above the mucous border of the lip. The angle of the flap is then transfixed by the same pin, but from above downwards and from within outwards, entering by the bleeding surface and coming out by the vermillion border of the lip.

This first pin describes a curve with its concavity downwards, for the purpose of causing a projection below of the two angles of the flap, in order to prevent, if possible, the small notch which almost always remains on the border of the lip after the union of the flaps. Some surgeons, instead of introducing the first pin at the vermillion border of the lip, carry it through the skin half a line or a line above it.

The first pin being introduced, and union maintained at this point by means of a thread carried around it in the form of a figure of 8, the second pin is inserted in a similar manner above the first, and in a horizontal direction, equi-distant from the first pin and the superior

angle of the wound. The third pin is inserted in the same manner above the second (see pl. 44, fig. 2). Between these pins strips of adhesive plaster may be attached, which will bring the cheeks forward and assist in maintaining the union. Finally, the points of the pins should be cut off, and small pieces of adhesive plaster applied between them and the skin to prevent irritation. A small piece of linen spread with cerate, and a little lint, are all the dressing which will be required.

For the first few days the patient should be kept alone as much as possible, in order to withdraw him from all external influences, which, by exciting either crying or laughter, might endanger the union of the wound. Liquid aliments alone should be used, and if the patient be a very young child, he may be entirely deprived of food for the first two days without injury. The wound itself should be an object of special care, for young infants may suck and swallow the blood which is flowing from it unnoticed. On the third or fourth day, the lower pin may be withdrawn, by turning it upon its axis, to avoid a painful drawing upon the wound which might have the effect of separating the newly united parts. On the next day, the middle pin may be withdrawn; and on the day after, the upper. The adhesive straps should be allowed to remain until the ninth day.

Malgaigne's method (see pl. 45, fig. 1 and 2).—“Although in the ordinary method which we have described above, the lower pin is so inserted that it causes a projection downwards of the two angles of the divided lip, yet the notch is almost always present after union in a greater or less degree. To remedy this defect, Malgaigne proposes the following method :

“Everything being arranged as in the ordinary operation, the edges of the lip are removed from above downward, either with the scissors or the bistoury, by carrying the incision at first exactly parallel to the edges of the hare lip; then, having reached the rounded angle which terminates them, the incision is curved so as to take a direction parallel to that of the angle, and is carried for a line or a line and a half along the natural border of the lip, until it reaches the point where this border takes its natural horizontal direction. These two flaps thus formed are supported by a delicate pedicle which easily admits their being turned from above downwards, so that their bleeding surfaces will look toward each other. The first pin, which must be very strong, should be inserted at the bottom of the lip, so as to bring together the two angles formed by turning down the flaps; one or two more pins should

also be inserted above the first. The main part of the lip is thus brought together, and the only thing now required is to give to the free border its proper shape.

"To do this, the surgeon brings together the pedicles of the two flaps. Sometimes the incision has not been carried low enough down, and the flaps which are turned down do not take a direction parallel with the rest of the cut edge of the lip; if such be the case, the incision must be prolonged downward and to one side, until the requisite direction is obtained. Then, preserving so much of the flap as is necessary to prevent the notch, the superfluous portion is cut away with the scissors: it is advisable, on account of the contraction of the cicatrix, to leave the flap half a line longer than appears necessary. The flap should be brought together with a needle, or with points of interrupted suture. If the hare-lip extends only through a part of the depth of the lip, it should be prolonged a little in the direction of the nostril, so as to obtain an easier and more exact co-apportion of the superior angle. If the frenum descends too low, it should be cut without hesitation." (*Manual of Operative Surgery.*)

Method of Mirault, of Angers (see pl. 45, fig. 3 and 4).—The edge of one of the borders of the cleft is entirely removed. A flap with a pedicle below is cut on the other border. The bleeding edges of the hare-lip are brought together, and the flap which was preserved is applied from below upward upon the notch.

DOUBLE HARE-LIP.

(*Plate 44, figures 3 and 4.*)

If the middle projection is not large enough to be readily pared, it is advisable to remove it entirely, and perform the operation already described for simple hare-lip. But if this projection is large enough to be preserved, its edges as well as those of the lateral divisions must be pared off. They are then brought together with pins, which should be carried through the lateral flaps and the tubercle. Their union presents a cicatrix in the shape of a V or a Y. It may happen that the middle projection is too large for a single pin to be carried through it and also bring together the two lateral divisions at the same time. In such cases, isolated points of suture may be inserted on each of the branches of the V shaped incision which forms the wound. The notch which remains after the operation for double hare-lip is usually larger than that after single hare-lip. The methods of Malgaigne and Mirault,

modified according to the nature of the case, are also applicable to this affection.

COMPLICATED HARE-LIP.

The most common complications of hare-lip are : 1st, the presence of teeth projecting forward ; 2d, the abnormal projection of the os incisivum ; 3d, the faulty direction of the median tubercle, and the irregularity of the border of the lip ; 4th, a cleft in the velum palati, or roof of the mouth.

1st. *The projecting teeth* should be forced back and maintained as much as possible in their normal position by means of threads fastened to the adjoining teeth ; if this cannot be effected, they must be extracted.

2d. *The abnormal projection of the os incisivum* is a complication which can be remedied in different ways. If the bone is moveable, it should be forced backward ; if it is firm, it must be exsected.

Desault forced back the osseous tubercle by means of a bandage very tightly applied, which was carried over the projecting portion and fastened on the back side of the head. The patient wore the bandage until the bone was sufficiently reduced to allow the operation to be performed in the ordinary way. *Gensoul* has corrected the abnormal direction of the intermaxillary bone by fracturing it, by which he was enabled to give it a vertical direction. Whatever method may be adopted, the operation should not be performed until after the unnatural projection of the os incisivum has been rectified.

Blandin, with a pair of strong scissors, excised a triangular portion, with its base downwards, from the partition of the nasal fossæ. The intermaxillary bones thus deprived of their support, were then forced backward.

3d. *The faulty or abnormal insertion of the central labial tubercle* at the bottom of the nose, frequently depends upon the projection of the osseous tubercle to which it is attached ; in such cases, the labial tubercle may be used to form the columna of the nose. *Dupuytren* divided the adhesions of the labial to the osseous tubercle with a bistoury ; he then exsected from the latter all that portion which projected beyond the bones of the upper jaw ; and, after paring the edges of the cutaneous tubercle, as well as the lateral borders of the cleft, he proceeded to bring them together as in simple hare-lip. The cutaneous tubercle was carried upward beneath the nose, and fastened in the place of the columna by points of suture.

4th. *Division of the vault of the palate.*—*Phillips' method.*—When there is a separation of the bones, Phillips inserts a silver wire armed with a steel point through the base of the nose, behind the alæ; two small plates of pasteboard or cork previously applied to the alæ of the nose, are also transfixed by the silver wire. The wire is then bent upon the pieces of pasteboard, which serve as a support for it, and the nose is thus embraced between two buttons, which approximate the parts whose union is about to be attempted.

REMOVAL OF CANCERS OF THE LIP AND CHEILOPLASTY.

Cancroid excrescences and superficial tumours developed on the free borders of the lips, may be excised with scissors curved on their flat surfaces. The small tumour should be seized and drawn out with hooked forceps, and excised, the incision being extended a short distance into the healthy tissues. The wound usually cicatrises very well of itself. If deemed advisable, the wound may be cauterised by the application of Cauquoin's, or the arsenical paste.

Larger tumours, which comprise a larger amount of the substance of the lip, should be included between two V shaped incisions, which can be made with the scissors, or the bistoury. After the removal of the tumour, the two borders of the V shaped incision are brought together by points of suture. This method is applicable to tumours of moderate size. There may be some difficulty in bringing together the edges of the flaps; to increase their extensibility, they may be dissected up and isolated from the subjacent tissues.

Large and irregular tumours require special operations, the character of which, the surgeon must determine upon from the nature of the case. The removal of these tumours always occasions a considerable loss of substance, which should be repaired by one of the methods for the operation of cheiloplasty.

CHEILOPLASTY OF THE LOWER LIP.

The Italian and Indian methods are less employed than the French operation by sliding the flap. Whatever method is adopted, it is important to preserve as much of the mucous membrane as possible to cover the new lip.

Chopart's method (see pl. 44, fig. 6).—The tumour is included between two vertical and parallel incisions, commencing at the free border

of the lip, and carried as far downward as the os hyoides. These two incisions form a quadrilateral flap which is dissected up from above downwards. This dissection being concluded, the diseased portion of the flap is removed by a transverse incision. To repair the loss of substance occasioned by the removal of the tumour, the head of the patient should be brought forward, and the flap raised to a level with the commissures, or to the remaining portion of the lower lip. The flap is kept in place by points of suture inserted along the two vertical wounds. If any portion of the mucous membrane has been saved, it is to be used to cover the new lip. Should the free border of the lip be healthy, it may be preserved by carrying the incision for the removal of the diseased parts below it, and then be joined to the quadrilateral flap which is brought up from below. (Vignerie.)

Method of Roux of Saint Maximin.—The tumour being removed by a semilunar incision extending from one commissure to the other, M. Roux dissects up the integuments below; he then separates them from the lower jaw and carries the dissection as far as the os hyoides, proportioning its extent to the loss of substance which it is destined to repair. The skin of the chin forms a sort of moveable pocket in front of the lower jaw, or an apron which can be raised up to the proper level of the lower lip and supported in this position by means of strips of adhesive plaster or by a bandage, until perfect cicatrisation has taken place. If the tumour extends over the cheek, the commissures should be divided, and the semilunar incision should be prolonged until it reaches the external extremity of this division.

Morgan's method.—To facilitate the dissection of the flap which is to be brought up from below, Morgan has modified the preceding method, by making a vertical division of the integuments, commencing at the middle of the semi-lunar incision. Two flaps are thus formed, which can be easily dissected up, raised to the level of the commissures, and united along the median line by points of suture.

Malgaigne's method.—“All the diseased parts should be first removed, either by a V shaped incision, or by two vertical incisions carried as far as the base of the lower jaw, and there united by a transverse section.

“If the V incision is adopted there will be a triangular shaped loss of substance; the angles of the mouth on each side must then be prolonged by a transverse incision, and so dissected up as to form two triangular flaps. Their vertical borders should then be united along the

median line by points of suture ; as to the upper border, all that portion of it which exceeds the extent of the intended lip must be attached to the border of the transverse incision which lies opposite to it on either side of the mouth.

" If the operation by the two vertical incisions is adopted, the loss of substance is quadrilateral in shape ; to the two incisions which prolong the commissures, two others parallel to these and carried along the base of the lower jaw must be added. By dissection we can thus detach two lateral quadrilateral flaps, which are to be brought together at the median line, and the transverse incisions must be united wherever it may be necessary.

" By this operation, the cheeks alone contribute to form the lip, whose free border is constituted by the raw edge of the transverse incision. The new lip thus formed contains the muscular fibres belonging to the orbicular and its antagonistic muscles ; it is covered within by a natural mucous membrane ; and even the free border can be covered by this membrane by adopting Dieffenbach's method " (*Manual of Operative Surgery*).

It is rarely necessary to perform the operation of cheiloplasty for the upper lip. Losses of substance in this situation are usually repaired by flaps taken from the cheeks. The indications furnished by the nature and the form of the loss of substance to be repaired will assist in the choice of a method to be adopted.

GENIOPLASTY.

When injuries, attended by loss of substance, which require this operation are small, the edges of the opening may be excised, dissected up and brought together by points of suture. If the loss of substance is of such nature that it cannot be brought together by the above method, a flap may be taken from the cervical region, and brought up on the cheek by the Indian or by the French method. The form, dimensions, and situation of the loss of substance to be supplied will furnish the surgeon with the indications to be fulfilled. In all these cases, the general principles which we have laid down for blepharoplasty and cheiloplasty should be followed.

PLATE XLVI.

OPERATIONS UPON THE NOSE AND NASAL FOSSÆ.

RHINOPLASTY.

Rhinoplasty originated in India, where the Brahmins sometimes performed it to restore mutilations which were the result of legal penalties. It was imported into Italy about the fifteenth century, and systematised as a regular operation by Branca and Tagliacozzi. It was performed by Carpue, in England, in 1813, a little later by Græfe, in Germany, and afterwards by Delpech, in France.

The object of the operation is to restore the nose in cases where it has been partially or entirely lost. There are three principal methods recognised at the present day by which this is effected. The operations once in vogue of replacing the lost organ by another perfect nose, or by using the integuments of another person, are no longer performed.

1st. *Indian method*.—*Ordinary operation* (fig. 1st).—This consists in taking from the forehead of the patient a portion of integuments sufficient to repair the loss of substance. For this purpose, we begin by making a model of wax, or paper, of the nose which is wanting. This model is then turned up on the forehead, so that its base looks upward; its exact shape is traced with ink on the skin of the forehead, and the surgeon makes a section of this skin about two lines beyond the outline which he has thus traced out. The flap is then dissected up to the root of the nose, taking care to leave a pedicle, *d*, large enough for the passage of vessels to nourish it. It is now twisted upon its pedicle, *d*, so that its bleeding surface is turned towards the nasal fossæ, and its edges are joined to the previously pared edges of the cavity of the nose by points of suture. Tents of lint, or two rolls of india rubber *ee*, are then introduced below, to keep the nostrils open, and support the flap. Union being obtained, the points of suture must be removed, the pedicle *d*, cut upon a director, to straighten that portion of it which is twisted, and which usually unites smoothly, if left to itself.

Pl. 46.

Fig. 1.

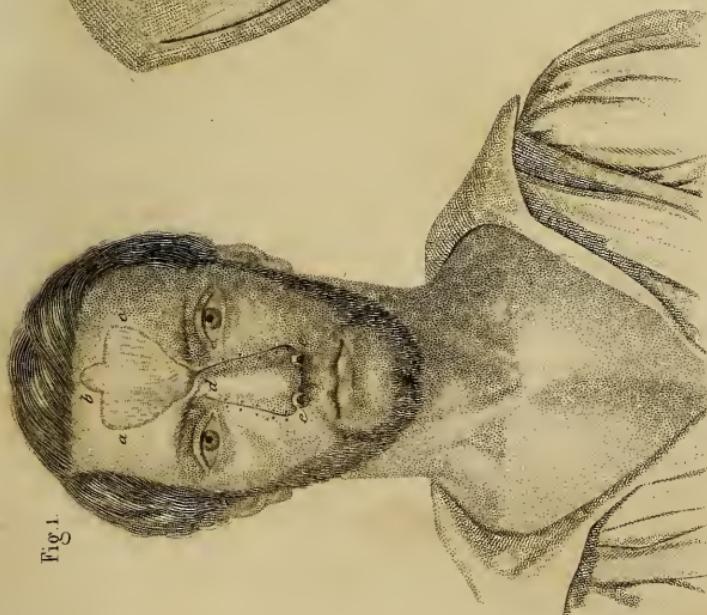
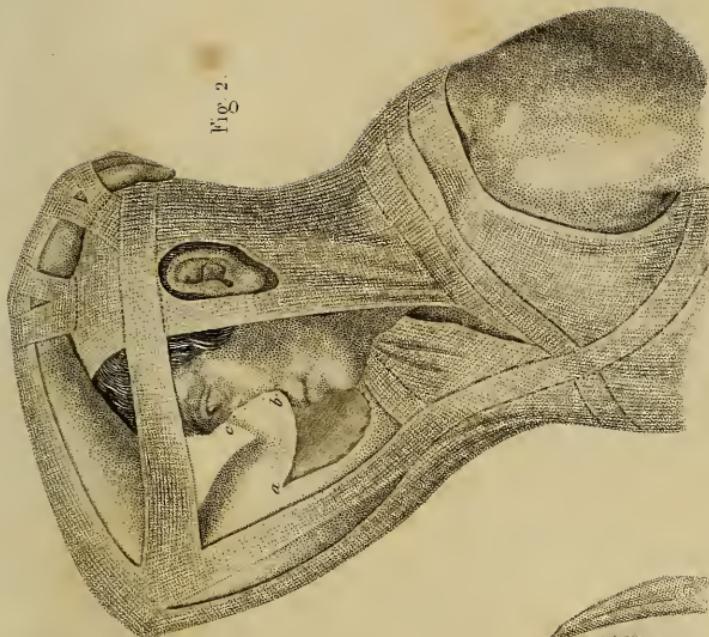
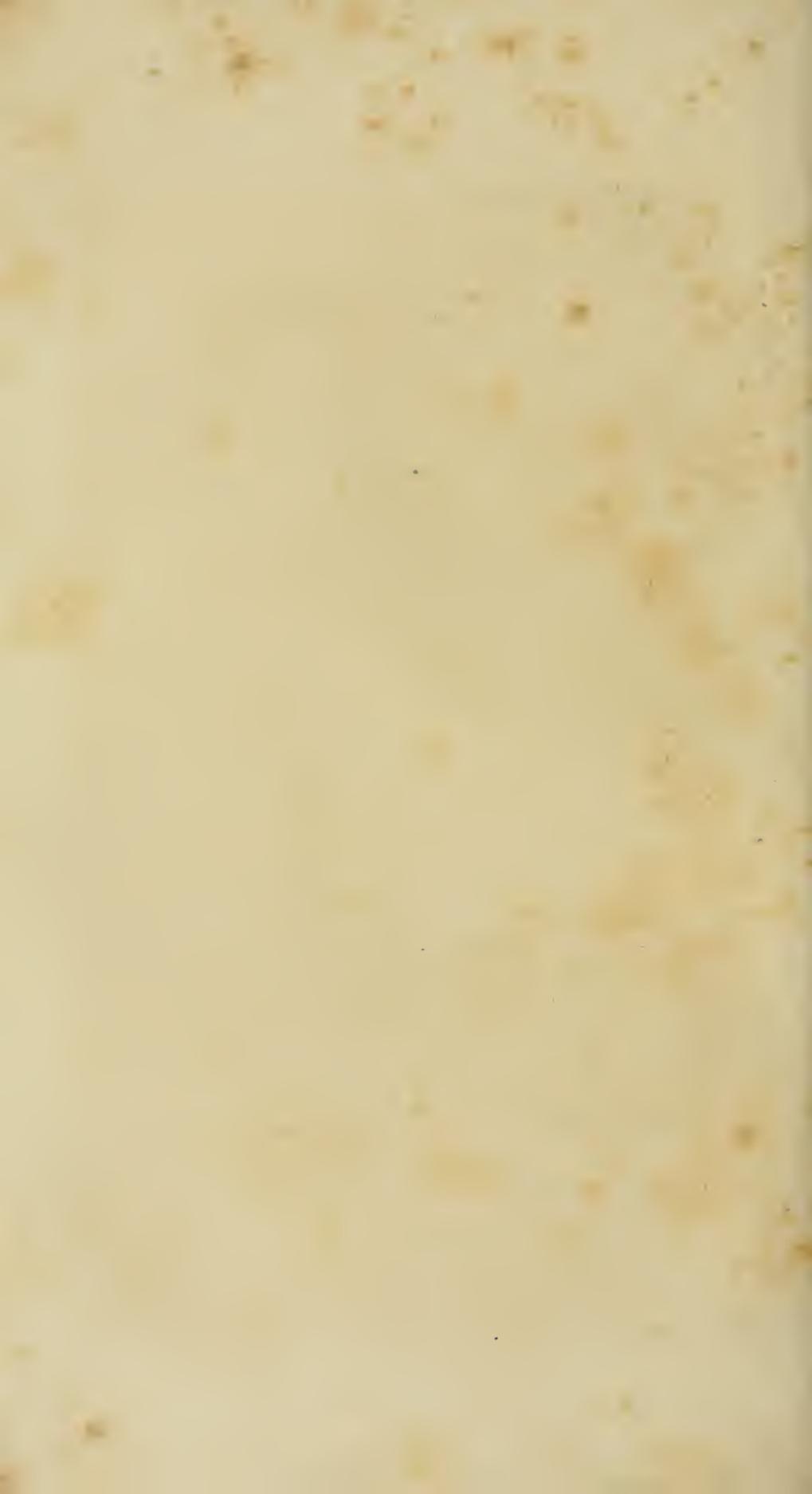


Fig. 2.





The wound of the forehead requires only simple dressings, and cicatrises without difficulty.

Delpech's method.—This consists in cutting the base of the flap as represented in fig. 1, that is to say with three points, *a*, *b* and *c*. The two lateral points are used to form the alæ of the nose, and the middle point *b* the columnæ.

Lisfranc, to avoid an amount of torsion of the pedicle, which might cause gangrene of the flap, by obstructing the circulation, carried one of his incisions lower than the other, and twisted the flap towards the long incision. But the advantages to be gained by this modification do not always compensate for the inconveniences to which it is exposed by carrying the incisions too near the loss of substance which is to be restored.

Italian method.—*Græfe's operation.*—This is only a modification of the operation described and performed in Italy by Tagliacozzi. The flap is taken from the skin of the arm, the patient being subjected for some time before the operation, to the fatiguing position which it is necessary for him to retain while cicatrisation is taking place. Fig. 2 represents the bandage to be applied for supporting the arm in a position near the face.

A flap of about five inches in length, and four and a half in width, is marked out upon the arm; it is then dissected up from its point to its base, in such way that those portions intended for the root of the nose and the sides can be immediately fastened in their proper position by points of suture, while the base remains adherent to the arm. Union of the parts thus brought together being obtained, the flesh is divided at its base and separated from the arm. This base may be cut into three points, as has been described above (Delpech's method). Tagliacozzi dissected up the flap and allowed it to suppurate before uniting it to the loss of substance. He thought that the process of suppuration increased the thickness of the flap, and rendered it more fit for the restoration of the nose.

French method.—This consists in filling up the loss of substance by a flap taken from the neighboring parts. It is the method by sliding the flap, already described (see Blepharoplasty, plate 37). The varieties of this method being more appropriate to partial restorations, can be submitted to no general rule. The alæ of the nose may be restored by a flap taken from the cheek; the columnæ, by a flap taken from the upper lip, care being taken that the mucous membrane is not injured, that only half the thickness of the lip is used, etc., etc.

Summing up.—Rhinoplasty is always an important operation. It rarely effects as much as it promises, and the noses thus made frequently shrink and diminish in size, forming tubercles whose appearance is sometimes more hideous than the original deformity.

At the present time, when the manufacture of noses of wax, or pasteboard, attached to spectacles has reached such great perfection, rhinoplasty is performed only in extreme cases, and the surgeon ought to yield to the solicitations of the patient only after informing him of the dangers and difficulties attendant upon the operation. The Italian method is not well borne by feeble individuals. The Indian method is preferable in the great majority of cases, and Delpech's operation is the best of all.

CONTRACTION AND OCCLUSION OF THE NOSTRILS.

The methods already described for the treatment of occlusions in other parts of the body are also applicable here; to incision or excision, is added dilatation by means of proper canulae to prevent the cicatrisation from again creating the deformity.

FOREIGN BODIES IN THE NOSTRILS.

There are two passages for the extraction or compulsion of foreign bodies, one in front by the nostrils, the other behind by the pharynx. The size and nature of the body, and the situation which it occupies in the nasal fossæ, will furnish the indications for the method to be adopted for its removal. Pincers or forceps such as are used for the removal of foreign bodies from the external auditory canal may be employed; if the substance is lodged far back, a slight push will usually suffice to force it into the pharynx. In cases where simple means prove inefficient, a dossil of lint may be passed from behind forward through the nasal fossæ, which will draw the foreign body along with it (for the details, see plugging of the nasal fossæ).

POLYPI OF THE NASAL FOSSE.

(See pl. 47, Fig. 1.)

The surgical treatment of polypi of the nostrils depends in a great measure upon their nature, seat and form.

According to their nature, polypi are divided into :—1st, Soft, mu-

cous, or vesicular polypi; 2d, fleshy; 3d, hard, fibrous, or cartilaginous; 4th, fungous or carcinomatous, (malignant).

1st. Mucous, or vesicular polypi are most common, and the least serious in their character; they consist of a greyish substance, slightly vascular, and containing in its vesicles a serous fluid. In general, slightly adherent and frequently pedunculated, these polypi can be easily torn away. They take root in the superior and external walls of the nasal fossæ.

2d. Fleshy polypi are well supplied with blood vessels. They frequently grow to a large size, and push out and deform the parietes which resist their growth.

3d. The hard or fibrous polypi, more rare than the preceding, are formed of a dense tissue, almost completely destitute of vessels. They force the bony walls of the nostrils before them, and frequently cause their absorption. Their pedicles are sometimes exceedingly resistant, and difficult of access.

4th. Under the name of fungous (malignant) polypi, authors have described certain flabby, painful tumours, which bleed readily and profusely, but whose nature is not as yet perfectly settled. Before resorting to an operation the surgeon should endeavour to ascertain, so far as it is possible, the real nature of the polypus. A carcinomatous affection should command the greatest circumspection.

The methods of operating, generally in use, are:—1st, *Cauterization*; 2d, *Torsion*; 3d, *Avulsion*; 4th, *Excision*, and 5th, *Ligature*.

1st. *Cauterization*.—All the varieties of solid and liquid caustics have been employed. Liquid caustics, such as sulphuric acid, acid nitrate of mercury, butter of antimony, etc., should be applied to the polypus with a hair pencil. A small *speculum nasi*, to protect the healthy tissues from the caustic, should be introduced, and the cauterization repeated more or less frequently according to the extent and nature of the disease.

Under the name of *Jensck's caustic*, a mixture of sulphuric acid, butter of antimony and nitrate of silver, has obtained a great reputation in Germany. The nitrate of silver, and the actual cautery have also been successfully employed. The actual cautery is especially suited to mucous polypi, which can be reached through the pharynx. It should not be introduced into the nostrils without a great deal of prudence and dexterity, lest it give rise to an inflammation which might extend to the brain.

2d and 3d. *Torsion, and Avulsion, or tearing away,* are frequently combined. The operation is performed with polypus forceps (see Instruments, plate XII., fig. 1 and 2). Gerdy uses a very strong pair of forceps, whose jaws are armed with teeth, which extend from the pivot to the extremity of the instrument. These forceps resemble very much the forceps used for phimosis (see *phimosis*); with them a large portion of the polypus can be firmly grasped. Curved instruments are employed to seize polypi situated in the posterior nasal fossæ.

The patient being seated opposite a window, with his head thrown back and held by an assistant, the surgeon separates the nostril with one hand, and with the other introduces a pair of closed forceps as far as the polypus. Having reached the tumour, the forceps are opened and carried on until the pedicle is fairly within their jaws. Now the *torsion* commences. The polypus being firmly grasped, the instrument is rotated a number of times. This maneuver frequently suffices to break up the adhesions of the polypus. A peculiar sensation indicates to the surgeon that this result has been effected. Pressing their jaws together, the forceps should then be withdrawn for the purpose of extracting the whole or a portion of the polypus. Occasionally a single operation of this sort completely clears the nasal fossæ; but in the great majority of cases it is necessary to re-introduce the instrument into the nostrils, and again to perform the maneuver, in order to destroy the remains of the tumour which still adhere, and thus, by successive attempts, to completely remove the obstruction. During the operation, a good deal of blood is necessarily lost; a few moment's rest between each attempt should be allowed to the patient.

Some polypi are so soft and slightly adherent that they can be torn away with the fingers; some are pediculated in such a way that a cord carried around the pedicle suffices to bring them away.

Indurated polypi of large size frequently require the use of disarticulating forceps, one branch of which is introduced after the other; in some cases it is necessary to enlarge the opening to facilitate the extraction of the polypus; this is done by dividing the ala of the nose, the upper lip, or even the vault of the palate.

When we operate upon polypi through the posterior nares, curved forceps should be used, and the tumour pushed backward by introducing the little finger into one of the nostrils. Hæmorrhage may follow the operation. Astringent injections, cauterization, etc., usually

stop the flow of blood. But should these means fail, we must have recourse to plugging the nares.

4th. *Excision* is especially applicable to pediculated polypi, situated near the nostrils. Fibrous polypi, with a large pedicle, which cannot be reached with the ligature, may also be excised.

Excision is performed either with the scissors, or the probe pointed bistoury. The polypus being seized with the forceps, should be drawn as near as possible to the opening of the nostrils, and then firmly held until its excision is effected.

Wately removed a large and deep seated polypus by carrying a ligature around its pedicle; one of the ends of this ligature was used as a guide for a sheathed bistoury, which was furnished with an eye near its point, through which the cord was passed. The instrument being carried down to the pedicle, it was then divided. In all cases, the surgeon should select scissors or a bistoury whose shape will permit him to effect the result which he proposes with certainty and facility.

5th. *Ligature*.—The operation by ligature comprises three principal steps, whose object is:—1st, to introduce a loop of silk cord or metallic wire, through the nostrils into the pharynx, or by the pharynx into the nostrils; 2d, to carry this loop around the pedicle which it is intended to strangle; 3d, to constrict the pedicle by means of a knot-tyer.

1st Stage.—A pair of forceps properly curved and of the requisite length may be introduced into the nostril and carried backward into the pharynx; at this point, the two ends of a ligature, introduced by the mouth, should be placed in the jaws of the forceps, which then draw them out through the nostril (*Ledran*).

An eyed probe armed with a ligature, may be carried through the nostril into the pharynx, where the cord can be caught either with the forceps, or the fingers.

Belloc's sound (see Instruments, plate X., fig. 15), for certainty and convenience is more to be depended upon than the preceding. The operation is performed with this instrument in the same way as for plugging the nares (described above).

2d Stage.—The loop of thread should be carried around the pedicle of the polypus in such a manner that it will not slip. It may be arranged either with the fingers, or by means of instruments made for the purpose, called ligature carriers, which are so constructed that the surgeon can give the loop the proper size while carrying it around

the pedicle (see Instruments, plate XII., figs. 3 and 4, for the ligature carriers, invented by Felix Hutin and that of Charriere).

3d Stage.—The loop being placed in its proper position, and the pedicle fairly embraced, the surgeon takes hold of the ends of the ligature and draws out the ligature carriers, in order to use the knot-tyer. A glance at figures 5, 6, 7 and 8, of plate XII., will give an idea of these instruments and their modes of action. Mayor's knot-tyer, which resembles a string of beads, is flexible, and adapts itself to the windings of the cavities into which it is introduced. The ligature should be tightened daily, until the polypus drops off; this usually happens within the week.

PLUGGING OF THE NASAL FOSSÆ.

This operation ought only to be performed to arrest a hæmorrhage, which resists the ordinary method of treatment. Cold or astringent injections, cold affusions to the head and back, foot and hand baths, elevation of the arms, should all be previously tried. If the hæmorrhage still persists, we should have recourse to plugging. By this operation, a direct compression is not exercised upon the point from whence the blood flows, but its escape both before and behind is prevented, and a clot is formed in the nasal fossæ, by the pressure of which the hæmorrhage is arrested.

Franck's method.—A piece of a pig's intestine which has been dried in the air is employed here. After softening it, one of the extremities is tied and introduced into the nasal fossæ by means of a sound; water is then injected into the bag thus formed, and the end, outside of the nostril, firmly secured.

Martin St. Ange uses an instrument similar to that of Franck, to which he gives the name of Rhinobyon. It consists of a small bladder fastened to a silver canula, which is furnished with a stop-cock; this bladder is introduced into the posterior nasal opening, it is then filled with air, and the stop-cock closed. The dilated bladder acts as a plug in the pharynx; a roll of lint placed in the nostril in front completes the occlusion, and a small pair of forceps sliding upon the canula, fastens the apparatus to the alæ of the nose.

Martin Solon has simplified this last method. Instead of a silver canula he uses a gum-elastic catheter. A double thread attached to the end of the catheter, where the bladder is fastened, hangs out of the nostrils and can be used to fasten the roll of lint

after the bladder has been distended with air. A simple stopper in the catheter prevents the escape of the air.

Ordinary method.—A roll of lint to stop the posterior opening of the nasal fossa is made, and to this a very strong silk thread is tied, whose extremities are long enough to reach from behind forward, through the nostril. Belloc's sound (see plate X., fig. 15), or a very flexible gum-elastic catheter, is introduced by the nostril; when the extremity of the instrument is in the pharynx, the button of Belloc's sound is sprung, or if the gum-elastic catheter is used, its end is drawn out through the mouth; to this end the threads of the plug *c* are attached, and by withdrawing the catheter they are brought from behind forward through the nostril; by pulling upon the thread the plug is introduced into the posterior nasal opening, which it stops as completely as possible. A second plug slid between the two threads should be tied into the nostril in front. The nasal fossæ being thus tamponned, both in front and behind, the apparatus should be allowed to remain for two or three days. To withdraw the plugs, the thread in front of the nostrils must be cut; the posterior plug can be seized through the mouth by a pair of forceps, or pushed backward into the pharynx, by means of a catheter carried through the nostrils.*

* It is more surgical to attach a ligature to the posterior plug, before its introduction, which is brought out at the mouth and attached temporarily in front; by drawing on this the posterior plug can be more readily removed. Without this precaution the withdrawal of the posterior plug is sometimes a troublesome and very painful process. Sponge is a good substitute for lint, as a material for the plugs.—ED.

OPERATIONS UPON THE FRONTAL AND MAXILLARY SINUSES.

PERFORATION OF THE FRONTAL SINUS.

The diseases which require trepanning of the frontal sinus are : fractures, caries, necrosis, abscess, the presence of foreign bodies, polypi, etc. A semi-lunar incision, with its concavity looking upwards and inwards, is made on a line with the commencement of the eyebrow ; the flap being turned up, the crown of a small trepan is applied. This is always an important operation, and to cure the fistula which frequently follows it, recourse must be had to compression (which often fails), or to autoplasty.

CATHETERISM AND PERFORATION OF THE MAXILLARY SINUS.

Catheterism.—The entrance to the maxillary sinus is situated above the inferior turbinated bone *a* (see plate 43, fig. 1), and below the middle turbinated bone *b*; to reach it, a small curved sound must be introduced beneath the middle turbinated bone. About the middle of this bone the point of the sound will encounter an opening, into which it can be inserted.

Jourdain has employed emollient injections successfully, in a case of retained mucus. If the orifice of the sinus cannot be found, or if it is obstructed, an artificial opening can be made with a small curved trochar, by perforating from within outward the bony walls of the sinus beneath the turbinated bone.

Perforation of the parietes of the sinus is the plan of treatment generally adopted at the present day, and there is more than one method of performing the operation. *Lamorie* perforated the sinus from the outside, between the zygomatic process and the third molar tooth. *Desault* made his opening through the canine fossæ after first incising the skin of the cheek. *Desault's* method has been modified; an incision of the gums is made, and the perforation effected half an inch or more above its border. The wound leaves no visible cicatrix.

Cheselden opened the sinus through the mouth. All these methods have their advantages and their disadvantages; peculiar cases may require their application, but the following operation is the one generally preferred.

Ordinary method.—This method, which is attributed to Meibomius, leaves no visible cicatrix, and consists in perforating the alveoli and thus reaching the maxillary sinus through its floor; the opening is thus dependent, and is easily accessible to instruments.

All of the molar teeth correspond to the sinus, and through one of their sockets the opening should be made. If one of the teeth is wanting, the operation should be performed through its socket; if a molar tooth is carious, it should be extracted in preference, whichever it may be (*Malgaigne*). If all the molar teeth are sound, the second should be extracted, and the perforation made through its socket.

The operation may be performed with a punch, a trochar, or a small perforating trephine. The nature of the affection requiring the operation should indicate the dimensions of the opening. Belloc introduced a wooden stopper into the artificial orifice to prevent the food from finding its way into the sinus. Other surgeons have recommended the introduction of a permanent canula.

It is very difficult to appreciate theoretically the relative value of these methods; but perforation of the alveoli is in general easy, and besides appears to be indicated by nature herself, since in certain cases liquids contained in the sinus frequently escape through the socket of a tooth which has been lost.*

* The operator should be provided with several drills gradually increasing in size, which should be successively introduced by a boring motion. The opening should be large and free, otherwise it will become clogged up.—ED.

PLATE XLVII.

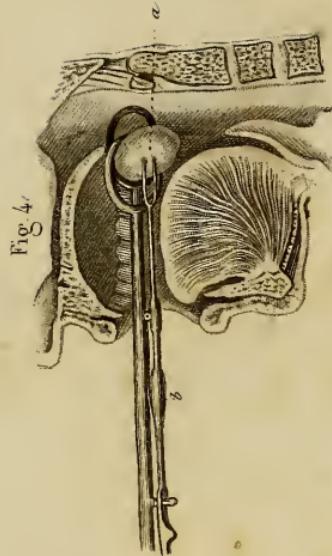
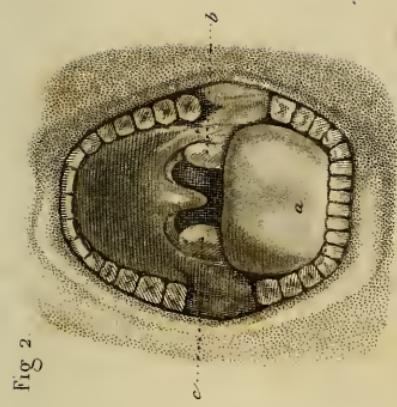
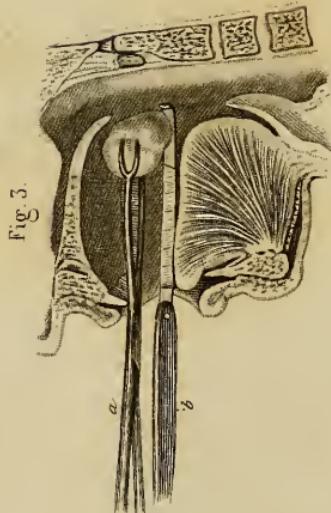
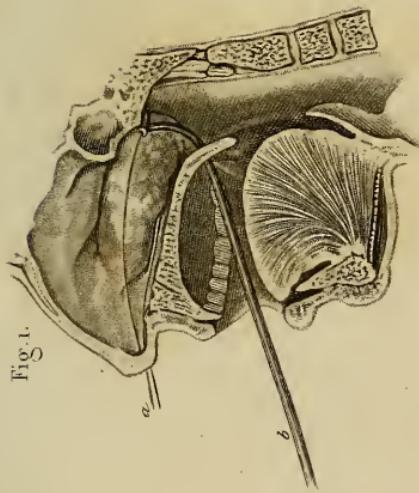
LIGATION OF A POLYPUS OF THE NASAL FOSSÆ; REMOVAL
OF THE TONSILS.

FIG. 1. Antero-posterior vertical section of the face; *a*, loop of thread carried around a polypus of the nasal fossæ by Charriere's ligature holder, *b* (Instruments, plate XII., fig. 4).

FIG. 2. Anatomical arrangement of the tonsils between the pillars of the velum palati; *a*, the tongue; *c b*, the tonsils.

FIG. 3. A tonsil seized with the hooked forceps *a*, is being excised with a probe pointed bistoury *b*, around a portion of whose blade a piece of linen is wound.

FIG. 4. *a*, a tonsil being excised by means of the tonsil instrument *b* (Instruments, plate XIII., fig. 1 and 2, 3 and 4).







Pl. 48.

Fig. 1.

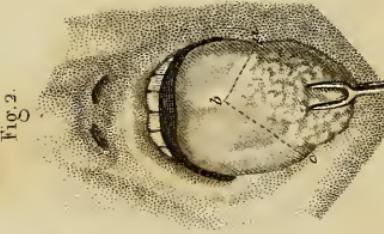


Fig. 3.

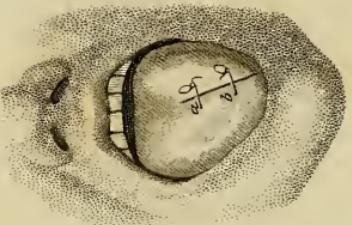


Fig. 4.

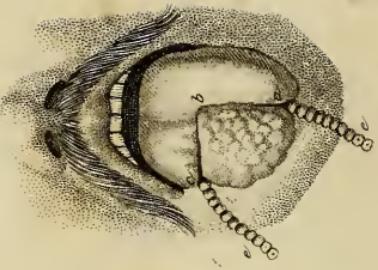


Fig. 5.

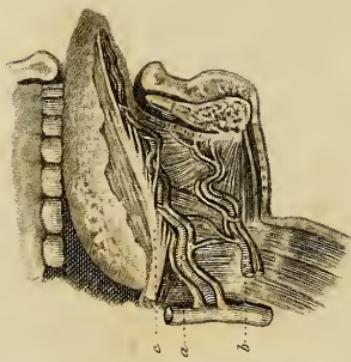


Fig. 6.

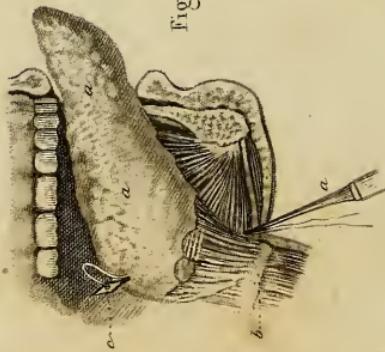


Fig. 8.

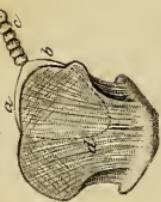


Fig. 7.

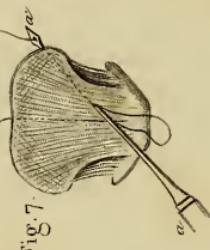


Fig. 9.

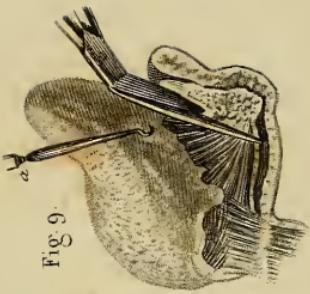


PLATE XLVIII.

CANCER OF THE TONGUE, AND THE OPERATION FOR STAMMERING.

FIG. 1. *Surgical anatomy*.—This represents the course of the lingual arteries *a* and *b*; *c*, the hypoglossal nerve. Farther on we shall show the muscles of the tongue.

FIG. 2. The cancerous portion is seized with the hooked forceps *d*; two incisions *ab* and *cb*, united at the median line forming a V, make a triangular wound, whose edges are afterwards brought together by points of suture; fig. 3, *a* and *b*.

FIG. 3. *Union after the operation*.

FIG. 4. The cancerous portion is comprised between two ligatures *bc* and *ba*, which are tightened by means of two knot-tyers in the form of a string of beads, *e e*.

FIG. 5. *Method of Vidal*.—A straight needle *a*, attached to a handle, is introduced just above the os hyoides *b*, and passed through the tongue from below upward; *c*, a loop of thread introduced into the eye of the needle.

FIG. 6, 7 and 8. *The same method*.—Transverse section of the tongue, showing the course which the needle should take.

FIG. 6. *a*, the needle, *b*, an end of thread disengaged; the other end *c* is hanging down on the outside.

FIG. 7. The needle *aa*, has been withdrawn and thrust laterally through the tongue, so that its point appears along the border of the diseased organ; the ends *bc* of the thread are disengaged.

FIG. 8. *a* and *b* show the ends of the thread, whose loop *d* embraces the lateral half of the tongue, brought together by a knot-tyer *c*.

FIG. 9. *Section of the genio-glossi muscles after the method of Baudens*.—A hook *a* is buried in the mucous membrane; the section of the genio-glossi muscles is being effected by means of scissors very much bent on their flat surface.

CANCER OF THE TONGUE.

MODES OF OPERATING.

Before undertaking any of the operations involving the loss of a portion of the substance of the tongue, the surgeon should not forget that some tumours are entirely superficial, and that in such cases it is only necessary to remove a thin layer of the tongue to isolate them from the sound parts; that others are encysted, being seated within the substance of the organ, and can be easily extracted by enucleation. But some diseases require *excision*, or the *ligature*.

Excision.—Excision always involves a certain amount of the sound tissues of the organ, proportionate to the extent of the disease, generally a line or more beyond the limits of the tumour. Corks, inserted between the teeth, are used to keep the mouth open; the tongue should be caught with hooked forceps and drawn as far as possible out of the mouth; the section should be made either with a bistoury, or with scissors—straight, oblique, or curved, according to the form and situation of the cancer. If the removal of the diseased portion cannot be effected with a single cut, the operation should be commenced upon the inferior aspect of the organ so as to prevent the flow of blood from obscuring the second incision.

Boyer included the tumour in a V shaped incision (fig. 2, *cb* and *ba*). The wound was afterward brought together by two or three points of suture (fig. 3).

Ligature.—*Mayor's method*.—The disease is isolated from the sound parts, by means of ligatures carried through the entire thickness of the organ. For a cancer which occupied only half of the tongue, Mayor transfixed the organ near its base with a bistoury, and incised it from behind forward through its entire thickness. The diseased portion was then embraced by a ligature which was tightened by means of Mayor's knot-tyer (Instruments, plate XII., fig. 7). The disease may also be embraced between two ligatures (fig. 4), without having recourse to incision.

Method of J. Cloquet.—In the case of a cancer which had attacked

the entire lateral half of the tongue and advanced towards its base so far as to prevent the application of the ligature by the mouth, Cloquet performed the following operation :—

A curved needle, fixed in a handle, with an eye near its point, was introduced along the median line of the neck, above the os hyoides, and carried upwards entirely through the tongue. The eye of the needle being brought out near the front teeth by carrying its handle backwards, two ligatures were passed through it. The surgeon then withdrawing the needle, brought the ligatures out through the wound in the neck, thus leaving one end of the double ligature in the mouth, and the other hanging in front of the neck below. The needle was then introduced anew into the wound in the neck, and brought out upon one of the sides of the tongue, its eye now threaded with the ends of the ligature already in the mouth, and again withdrawn, brought out these through the original wound in the neck. These two ligatures answered the following purpose : One of them embraced transversely the half of the tongue, and the other, being caught in a small incision made in the tip of the organ, included in an antero-posterior direction all that portion which was cancerous.

Method of Mirault, of Angers.—This is only a modification of the preceding. The needle is passed through the tongue from below upward, and being brought out of the mouth, is again thrust through from above downwards along one of the sides of the organ.

Method of Vidal.—(Figs. 5, 6, 7 and 8). We borrow from the author the following description of his operation :—"I use a large straight needle inserted into a handle (fig. 5, *a*). Its point is lance-shaped, and near the extremity is an eye. If but one half of the tongue is to be ligated, a very strong single ligature is inserted into the eye. After seizing the tongue by its apex and drawing it as far forward as possible, the needle should be thrust in just above the os hyoides *b*. The more the disease has extended towards the base of the tongue, the farther back should the point of the needle be carried. After passing through the tongue from below upward, the point of the instrument appears in the mouth with the loop of the ligature in its eye ; the two ends of the cord hang in front of the neck, and are held by an assistant. The surgeon holding the handle of the needle with one hand, with a pair of dissecting forceps in the other, catches one end of the ligature in the mouth, and drawing it out through this cavity gives it to another assistant (fig. 6, *b*) ; one thread

c still remains in front of the neck. The surgeon then carries the needle *a* downwards, as if about to withdraw it; but having brought the point below the tongue, he thrusts it again upwards and outwards until it appears upon one side between the anterior pillar of the velum palati and the border of the tongue (fig. 7). The end of the ligature which hangs in front of the neck is then drawn out of the eye of the needle with the forceps. The instrument being free, is withdrawn. The ends of the thread *a b* (fig. 8) are now tied in the mouth, or are carried through a knot-tyer *c*. If the whole of the tongue is cancerous, a double ligature may be introduced which will embrace both portions of the tongue. For this purpose two ligatures should be introduced into the eye of the needle; one of which should be black, and the other white. This difference in color facilitates the ligature of the same side of the organ with the same thread.

OPERATIONS FOR STAMMERING.

Works upon operative surgery describe a great number of methods by which surgeons have attempted to remedy stammering. Now that experience has sufficiently demonstrated the inutility and danger of the greater part of the operations which have been undertaken for this purpose, we shall limit ourselves to the description of those methods which offer some chance of success, and which, from their simplicity, are by no means dangerous.

Baudens' method.—*Section of the genio-hyo-glossi muscles* (fig. 9).—The patient is seated upon a chair, with his head held by an assistant who at the same time draws back the commissures of the lips; the surgeon, with a hook in the left hand, raises the mucous membrane above the border of the genio-hyo-glossi muscles, and thrusting a pair of half open pointed scissors, bent upon their flat surface, to the depth of about an inch, and as closely as possible to the lower jaw, divides with a single cut the attachments of these two muscles. A small piece of sponge or lint is then placed in the wound and allowed to remain until the haemorrhage ceases. The wound rapidly heals.

Method of Bonnet.—*Subcutaneous section of the genio-hyo-glossi.*—The patient being seated with his head thrown back, the surgeon introduces the index finger of the left hand into the mouth, as far down as the tubercles on the inner surface of the jaw; then, with the right hand he thrusts a sharp pointed tenotomy knife, beneath the chin and

along the median line, through the skin, the platysma and the space between the digastric and the mylo-hyoïd muscles; this instrument is then replaced by the blunt-pointed tenotomy knife, which is carried into the wound, with its edge forward, until the point of the instrument is felt by the finger in the mouth—when the surgeon gives a lateral direction to the cutting edge of the knife, and with it divides one after the other the genio-hyo-glossi muscles. Before this part of the operation is performed, the surgeon should assure himself that the knife is fairly between the tubercles, and that it is not caught in the mucous membrane. After the operation, an extravasation of blood, more or less in quantity, may take place, which slightly embarrasses deglutition during two or three days.

The various operations for stammering have so frequently proved to be ineffectual, that we are forced to have recourse to persevering discipline of the organ, which has been reduced to a system by Colombat (de l'Isere), Serres (d'Alais), and other physicians, who have obtained by its use undoubted success.

DIVISION OF THE FRÆNUM.

The frænum, when it is prolonged too far towards the tip of the tongue, interferes with suction in the newly-born child, and still later in life prevents distinct articulation.. It should not be forgotten that the ranine veins are situated on the under surface of the tongue, on either side of the frænum. The child must be placed upon the knees of an assistant, who should hold the head back and pinch the nose to force the child to open its mouth; the surgeon should raise the tongue with the thumb and index finger of the left hand, to put the frænum on the stretch, and having in his right a pair of scissors curved upon their flat surface, with them he divides it with a single cut, as far as possible from the tongue, by directing the point of the scissors downwards, to avoid wounding the ranine veins.

The slit handle of a director may be used to raise up the tongue, by introducing the frænum into the opening. The wound requires no special treatment.

Two accidents may follow this operation; 1st, retroversion of the tongue into the pharynx, an accident which might cause suffocation, as J. L. Petit remarks; 2d, haemorrhage, when the ranine veins are wounded. In the first, the index finger easily brings the tongue

forward into its proper position, and in the second, astringents may be used, or cauterization performed with a steel probe heated to a white heat. Malgaigne recommends the closing of the wound in the vein with a point of interrupted suture.

We sometimes observe in newly-born children sublingual tumours which appear in the shape of very firm fleshy excrescences. These tumours should be seized with the forceps, and excised with curved scissors.

ABNORMAL ADHESIONS OF THE TONGUE.

These adhesions may be congenital, or recent. In the first case, they are mere cellular bridles, which are easily divided with the scissors; in the second, they are frequently the result of inflammation, have more extensive connections, and are sometimes exceedingly resistant.

The patient should be seated in a chair, with the head thrown very far back and the mouth kept open by means of a cork placed between the molar teeth; the surgeon, standing behind the patient, should separate the cheek and the free portions of the tongue, and then with a bistoury held obliquely with its cutting edge looking outwards, divide the adhesions. The operation should be suspended from time to time to allow the patient to use astringent gargles.

The wound heals of itself. To prevent new adhesions, the patient should be advised to move his tongue frequently and to slip a finger between the divided surfaces.

EXCISION OF THE UVULA.

The patient being seated in a chair and held in the same position as for excision of the tonsils, the surgeon seizes the uvula with polypus or torsion forceps, and excises it with a simple cut of the scissors or a bistoury. The haemorrhage is usually slight, and may be arrested by squeezing the remaining portion of the uvula between the jaws of the forceps, or touching the bleeding surface with the nitrate of silver.

OPERATIONS UPON THE TONSILS.

ABSCESS OF THE TONSILS.

When tonsilitis terminates by suppuration, a purulent collection results, which must be evacuated. To effect this, the index finger of one hand should be carried down as far as the tonsil, and along this finger should be slid a sharp-pointed bistoury, whose blade is wound with adhesive plaster to within a third of an inch of its point. The pus is evacuated by making an incision at the point where fluctuation is felt.

EXCISION OF THE TONSILS.

(*Plate 47.*)

Chronic inflammations of the tonsils frequently cause hypertrophy of these glands which embarrasses deglutition and respiration. Scariification, cauterization and the ligature have all been employed at different epochs for this affection. At the present day excision is generally adopted. It may be performed with the hooked forceps of Museux and a probe-pointed bistoury, or with some one of the various tonsil instruments invented for the operation.

Operation.—The patient should be seated opposite the light, with his head resting upon the chest of an assistant who keeps the jaws separate by means of wedge-shaped cork placed between the teeth; the same assistant may, if necessary, stand in front of the patient, and depress his tongue with a spatula, or the handle of a spoon. The surgeon standing in front, seizes the tonsil with Museux's forceps and brings it out between the pillars of the arch of the palate, by pulling it slightly forward, which places the gland in a more prominent position and a greater distance from the carotid artery; then, with its back downwards, the surgeon introduces a probe-pointed bistoury whose blade is wound with linen to within an inch and a half of its extremity, and carrying it beneath the tonsil, excises the gland with a sawing motion from below upward, and parallel with the margins

of the pillars of the fauces; the portion excised is withdrawn with the forceps. As a general rule, as much as possible of the tumour should be removed. This operation is rarely followed by much haemorrhage, and astringent gargles, or powdered alum applied to the bleeding surface by means of a brush, usually suffice to arrest the flow of blood. Occasionally the haemorrhage is considerable; in such cases the surgeon should resort to the actual cautery for its arrest. Full respirations have also been advised to stop the flow of blood. Should the carotid artery unfortunately be wounded, immediate compression must be made with the fingers upon the primitive carotid; compression should also be made at the same time upon the point from whence the blood issues, by means of a piece of lint fastened to one of the jaws of a straight pair of Museux's forceps; this one branch of the forceps should alone be introduced into the mouth and the plug of lint applied between the pillars of the arch of the palate, the check being used as a point of support for the other branch; a piece of cord passed through the handles and tied, fastens the forceps in this position, and thus a temporary compression will be obtained, sufficient in some cases to arrest a slight haemorrhage, and always useful if the operation of tying the carotid is performed.

We cannot undertake the description of the various instruments invented for the excision of the tonsils. (Instruments, plate XIII.) Fig. 2 represents Fahnestock's instrument, modified by Velpeau. The tonsil is caught between its two rings; a sliding spear, either single or double (fig. 3), or a revolving hook (fig. 4), fastens the tonsil and causes it to project between the rings by a lever-like motion, which lifts out the tonsil to a certain distance from the plane of the rings; the tonsil being thus fixed, its section is effected by sliding one of the rings upon the other *a* (plate 47, fig. 4).

These instruments, many of which are very ingenious, may be advantageously employed to operate upon children, but they are not applicable to all cases, and frequently effect only an incomplete section of the diseased gland. Thus the preference is generally given to the bistoury, for performing this operation (plate 47, fig. 3, *a, b*).



PL. 49.

Fig. 1.

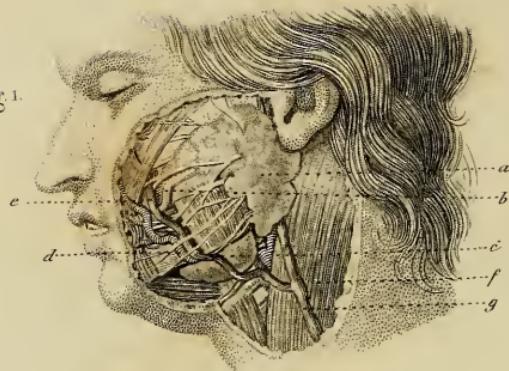


Fig. 2.

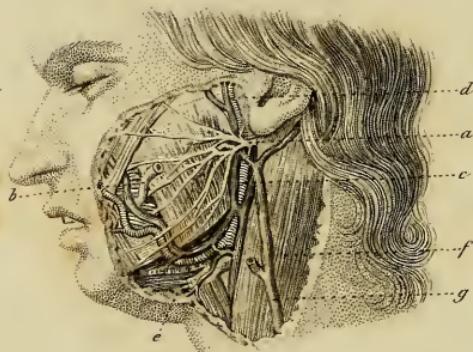


Fig. 3.



Fig. 4.

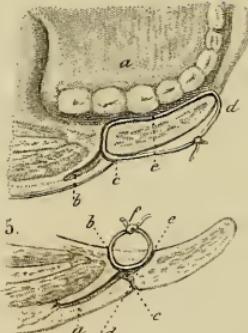


Fig. 5.

PLATE XLIX.

OPERATIONS UPON THE SALIVARY APPARATUS.

FISTULA OF THE PAROTID AND STENO'S DUCT.

SURGICAL ANATOMY.

FIG. 1. *The parotid gland*, *a*, which is almost pyramidal in shape, is bounded above by the zygomatic process and the temporo-maxillary articulation; behind, it rests upon the *sterno mastoid-muscle*; it corresponds with the mastoid process and the digastric muscle, and winds from without inwards around the ramus of the lower jaw bone, sending prolongations beneath its angle. The external carotid artery and the facial nerve pass through its deep or reflected portion. The relations of these organs with the gland, we shall notice farther on.

In front, the parotid gland is thin; it spreads itself upon the external surface of the *masseter* muscle by irregular prolongations, whose inner aspect is in relation with the transverse facial artery, and some branches of the facial nerve. Its superficial surface is also in relation with some lymphatic glands, which are occasionally lodged in its substance, but which are more frequently situated in the meshes of the fascia, which forms a sheath to the gland. These ganglia may be the seat of morbid affections or of abscesses, and the gland itself remain perfectly healthy.

FIG. 2. The deep relations of the parotid are of great surgical importance. In this plate the gland has been dissected up and removed so as to show the nerves and blood-vessels which wind along in its substance.

The *facial nerve*, *a*, is embedded in the substance of the gland and here divides into branches, the principal of which take a direction nearly horizontal, which should not be forgotten when opening abscesses in this region. Incisions made at right angles with the course of the nerve, frequently cause paralysis of the face, by cutting some of its larger branches.

The *external carotid artery*, *c*, passes almost always from below

upwards through the deep portion of the gland. The *temporal artery*, *d*, the transverse facial artery and important venous branches, pass through the gland in diverse directions.

Are not these relations sufficient to indicate the difficulties and dangers attending the extirpation of this gland?

Steno's duct, *b* (fig. 1 and 2), takes a horizontal direction from behind forward, upon the masseter muscle, in the course of a line drawn from the lower part of the ear to the commissure of the lips; on a level with the anterior border of the masseter, the duct changes its direction and takes a perpendicular course in the substance of the cheek, perforates the buccinator, and, after passing obliquely for a short distance between this muscle and the mucous membrane of the mouth, opens into its cavity on a level with the space which separates the first and second molar teeth. This duct is accompanied in its course by some branches of the transverse facial artery, and also by a branch of the facial nerve.

The *sub-maxillary gland*, *c* (fig. 1), is situated beneath the body of the lower jaw, and corresponds with the maxillary fossa, in which it is lodged; below, this gland is covered by the cervical aponeurosis and the platysma myoides; within, it has relations with the digastric, mylo-hyoid and hyo-glossus muscles and the lingual nerve. Its most important relation is with the *facial artery*, *d* (fig. 1), which passes through it in a direction upwards and inwards. *Wharton's duct* takes its origin in this gland and opens into the mouth upon one side of the frænum linguae.

FIG. 3. *Morand's method.* (See modes of operating.)

FIG. 4. This represents a horizontal section of fig. 3. *a*, superior dental arch; *b*, Steno's duct; *c*, fistulous opening; *e*, a seton tied externally upon the cheek; *d*, commissure of the lips.

FIG. 5. *Method of Deguise.* (See modes of operating.)

MODES OF OPERATING.

There are two classes of salivary fistulæ; one of them affects the parotid gland directly, and is seated either in the gland itself, or in one of the roots of the salivary duct; the other is produced by lesions of Steno's duct.

§ 1. *Parotid fistulæ* may be cured by different means.

1st. *Irritating injections*, recommended by Louis, consisting of astringent, or more or less escharotic liquids.

2d. *Cauterization*, by means of caustics, or the actual cautery.

3d. *Blisters*, applied upon the fistula itself have been employed successfully by Velppeau.

4th. *Compression*, proposed by Desault for the purpose of producing atrophy of the gland; the more methodical *compression* proposed by Malgaigne, who applies a piece of gold leaf covered with Burgundy pitch upon the fistulous opening, in order to favour cicatrization by preventing mechanically the passage of the saliva.

5th. *Excision*, which consists in circumscribing the ulcer by two elliptical incisions, and then uniting their edges by suture.

6th. *Extirpation* of the parotid gland is now rejected as an extreme and dangerous resource, and only to be adopted in cases of absolute necessity.

§ 2. *Fistulae of Steno's duct* may be treated by a great variety of operations, classed under four heads, whose object is: 1st, cicatrization of the fistulous orifice; 2d, dilatation of the natural duct; 3d, establishment of a new orifice in the mouth; 4th, atrophy of the gland.

1st. *Mode of cure*.—*Compression* either upon the fistulous orifice, or upon a portion of Steno's duct, between the fistula and the gland, may favour cicatrization of the wound by preventing the flow of saliva through the fistula. This mode of treatment is indicated in cases where the orifice of the duct in the mouth is entirely free, and when the fistula is susceptible of rapid cicatrization.

(2d). *Cauterization* may also be employed in these cases as well as for fistulae of the parotid gland.

(3d). The *twisted suture* may also be successfully used; if the fistula is of long standing its edges should first be pared off.

2d. *Mode of cure*.—*Re-establishment of the natural duct*.—*Morand's method* (fig. 3 and 4).—A seton is introduced by means of a small probe into the orifice in the mouth and brought out by the fistulous opening, or rather, is introduced into the fistulous opening and brought out through the orifice in the mouth. The obstructions to the passage of the saliva through the duct being removed, the seton should be withdrawn, with the exception of one of its extremities, which may be left in the duct. The edges of the fistula should then be pared off and cicatrization promoted by the ordinary means.

3d. *Mode of cure*.—This consists in making an artificial canal.

For this purpose, Deroy carried a red hot iron through the substance of the cheek in front of the masseter muscle, a method which has been modified by most operators since Deroy. At the present time, the method of Deguise is generally adopted.

Method of Deguise (fig. 5).—The figure represents a horizontal section of the cheek which shows the arrangement of the parts; *a*, Steno's duct and *c* the fistulous orifice. A small trochar is passed to the bottom of the fistula and as much as possible into Steno's duct, and carried through the cheek from without inwards and from before backwards in the direction *c b*. Two fingers introduced into the mouth support the cheek and the point of exit for the instrument. The trochar being withdrawn, and the canula left in the wound, a leaden wire *c b* is carried through the tube, when the canula is withdrawn. The trochar is now thrust in a second time in the direction *d e*, opposite the first. A silk thread *d e*, being passed through the canula, it is withdrawn. The silk thread is tied to the extremity *c*, of the lead wire, which is drawn by it into the mouth along the line *d e*, where the two ends of the wire are united to form a ring *f*, which embraces the soft parts at the bottom of the fistula. The edges of the fistula are then pared off and brought together by a point of suture. Cicatrization being effected, the wire is cut and the saliva takes its course through the artificial opening.

The method of Deguise has undergone some modification. Roux uses a silk thread instead of the lead wire, etc. Malgaigne employs a very strong silk thread with a needle at each of its ends. The first needle is thrust into the cheek along the line *c b*; the second in the direction of the line *d e*. The two extremities of this thread being tied in the mouth, the soft parts are embraced in the same way as by the leaden ring. This operation is as quick as it is easy of execution.

4th. *Mode of cure*.—Desault recommended compression to produce atrophy of the parotid gland. Viborg, proposes the ligature of Steno's duct for the same purpose. But experience has not as yet sanctioned these recommendations, and the operations described under the third mode of cure seem to us decidedly preferable.

EXTIRPATION OF THE SUB-MAXILLARY GLAND.

For anatomical details, see the explanation of plate 49.

Operation.—A crucial or semilunar incision of the skin should be made over the gland, and the vessels tied and cut between two ligatures. The gland, being seized with a hook, must be drawn out and isolated from the hypoglossal nerve and the lingual artery by careful dissection; a ligature should then be applied above the place where the gland is to be finally severed from its connections. After the operation, immediate union may be attempted, if the wound will permit it, or it may be filled with lint, and united by the second intention.

RANULA.

Ranula is a name given to tumours developed laterally beneath the tongue, and situated between this organ and the lower jaw, above the supra-hyoid muscles. These tumours, upon whose nature surgeons do not always agree, originate in the sub-lingual gland, or are produced by a dilatation of Wharton's duct. Jobert has described salivary encysted tumours in Wharton's duct. Whatever their character may be, these tumours, sometimes, from their size, render deglutition difficult, project externally, and require a surgical operation for their cure.

Puncture and *incision* employed in ancient times, are now rejected as ineffectual.

Cauterization by the red hot iron was employed by Ambrose Paré; but, at the present time, cauterization by means of liquid escharotics is preferred. Injections of iodine have been used with success.

The *seton* has been used to create an adhesive inflammation of the parietes of the cyst. The *canula*, first applied by Lecat, was again taken up and modified by Dupuytren, who through an incision made in the tumour introduced a double-headed canula which was to be permanently retained; through this tube, the saliva, or the liquids secreted by the cyst could always find exit. This method is frequently successful.

Excision is now generally adopted. To effect it, the upper wall of the tumour is raised up with a hook or the forceps, and excised with a pair of scissors or the bistoury; the tumour empties itself, and cicatrization rapidly takes place.

Of all the operations for ranula, excision is the quickest and the most simple. Cauterization with the nitrate of silver, joined to excision (Malgaigne), is still more certain of success.

Jobert, under the name of *batra-chosioplasty*, has described an operation which is only a modification of the preceding. The flaps resulting from a longitudinal incision of the tumour are turned back and fastened to the mucous membrane of the mouth by points of suture. This operation is both difficult and tedious.



PL. 50.

Fig. 1.

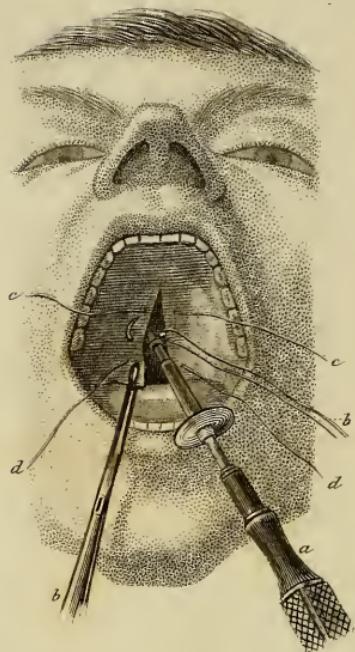


Fig. 2.

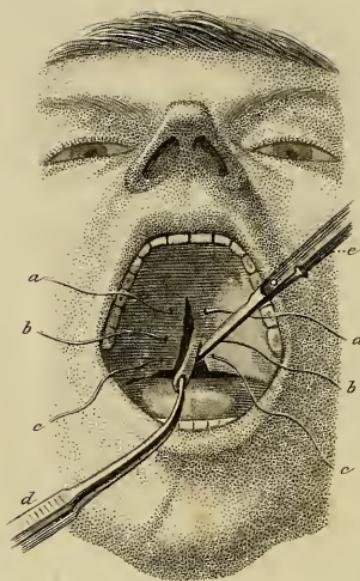


Fig. 3.

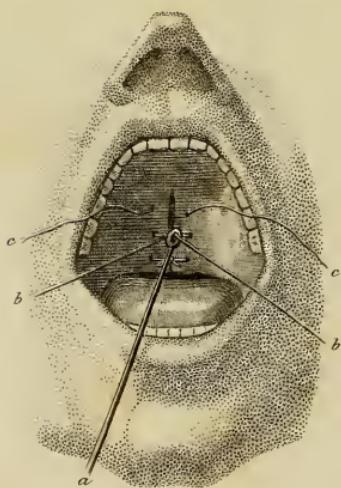


Fig. 4.

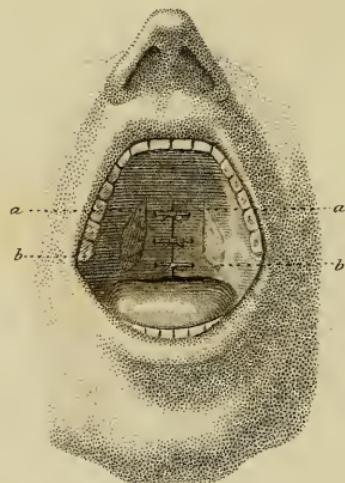


PLATE L.

STAPHYLOPHARY.

FIG. 1. *Roux's method*.—The first and second ligatures, *dd* and *cc*, being in their proper position, the surgeon is placing the third in the middle between them. One of the flaps is held with the forceps *b*, and the needle, attached to its holder *a*, is being carried through its margin from behind forward.

FIG. 2. The three ligatures *aa*, *bb*, and *cc*, being placed in their proper position, the surgeon is paring off the edges of the flaps with a probe-pointed bistoury.

FIG. 3. Tightening of the knots *cc*, *bb*, with the knot-tyer *a*.

FIG. 4. *Staphyloplasty*.—*Dieffenbach's method*.—*ab* and *ab*, longitudinal incisions made parallel to the borders of the gap.

PLATE LI.

STAPHYLORAPHY.

FIG. 1, 2, 3, 4 and 5. *Auguste Berard's mode of operating*.—Fig. 1. The surgeon having seized one of the borders of the cleft with the forceps *a*, is passing a loop of thread *c*, through, from before backwards, by means of the needle-holder *b*.

FIG. 2. The ligatures *a*, *a*, *a*, having been placed in their proper position, the surgeon is paring the edges of the cleft, from above downwards, with the bistoury *c*.

FIG. 3, 4 and 5. These represent theoretically the method of Berard. Fig. 3. Introduction of the first simple thread *bb*, into one of the borders of the wound *aa*. Fig. 4. Introduction of the loop of thread *c*. Fig. 5. The loop of thread *c*, drawing the extremity *b* of the ligature through, from behind forwards.

FIG. 6, 7, 8 and 9. *Method of de Pierris*.—Fig. 6. Application of the instrument behind one of the borders of the cleft; *c*, a moveable thimble retaining a loop of thread *a*. *b*, a barbed needle sheathed in a canula.

FIG. 7. The canula carried to the anterior aspect of the flap. *b*, the moveable needle just before it is thrust through the lip of the flap.

FIG. 8. The needle *b*, forced on by the surgeon, after passing through the substance of the soft palate, raises the moveable thimble *c*, and receives into its notch the loop of thread *a*.

FIG. 9. The needle being withdrawn, brings with it the loop of thread *a*.

PL. 51.

Fig. 1.

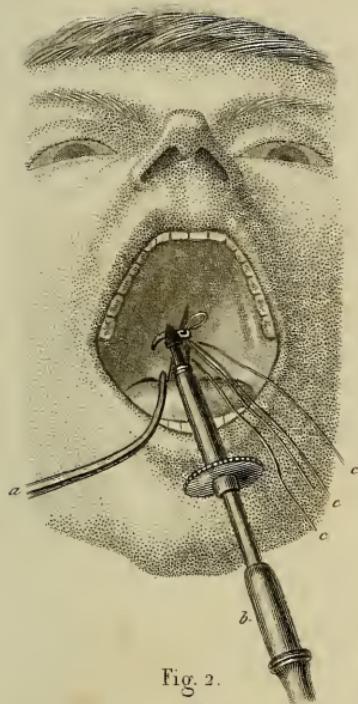


Fig. 2.

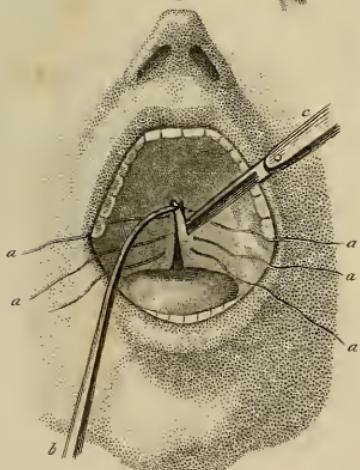


Fig. 3.

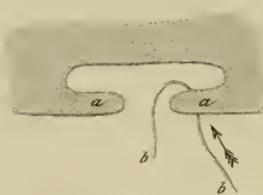


Fig. 4

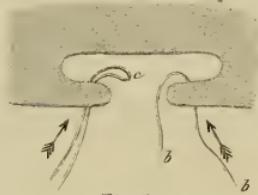


Fig. 5.



Fig. 6.

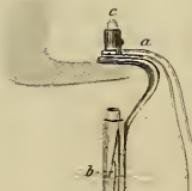


Fig. 7.

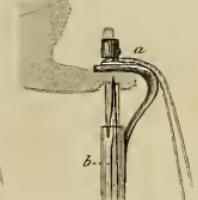


Fig. 8.

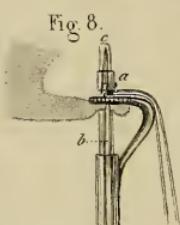
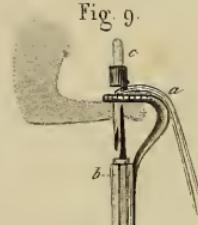


Fig. 9.





CLEFT PALATE.

(*Plates 50 and 51.*)

M O D E S O F O P E R A T I N G .

Divisions of the arch of the palate are almost always the result of congenital deformity, and present themselves under three different forms.

1st. *Simple division* of the arch of the palate only, consists of a fissure of the soft parts in the median line, without loss of substance. 2d. *Incomplete division of the palatine arch*, with separation of the bones. 3d. *Complete division of the palatine arch*, in which the bones and soft parts are completely divided throughout the entire length of the arch of the palate to the dental arch. This division may extend to the lips, and be complicated with hare lip (see hare lip, plates 44 and 45.)

The surgical operations employed to remedy these deformities are, 1st, *Staphyloraphy*, for simple division; 2d, *Staphyloplasty*, a modification of staphyloraphy, for incomplete divisions; 3d, *Palatoplasty* or *uranoplasty*, by which the loss of substance in the arch of the palate is repaired.

1st. *Staphyloraphy*.—This operation was performed during the last century by a French dentist, named Le Monnier; in 1817 Graefe attempted it, but without success. Roux (1819) gave a proper shape to the operation, and performed it with success. Staphyloraphy is in all cases a long and delicate operation, and requires the entire co-operation of the patient; on this account it is only advised for persons who have attained the age of discretion. It consists of three principal stages; 1st, Paring off the edges of the solution of continuity; 2d, The insertion of the threads for bringing together the bleeding edges; 3d, The ligature of these threads.

Roux's method.—Apparatus (Instruments, plate XIII). This consists of, 1st, Three flat ligatures, each formed of two or three well waxed threads; 2d, Six small curved flat needles; a needle is attached to each end of the ligatures; 3d, A needle holder (fig. 13); 4th, A

pair of dressing forceps; 5th, A probe-pointed bistoury; 6th, Roux's bent scissors (fig. 7).

1st Stage.—Insertion of the ligatures (plate 50, fig. 1).—The patient being seated opposite the light, with his head thrown back upon the breast of an assistant, his mouth should be kept widely extended by means of a cork placed between the molar teeth; the surgeon, standing in front, seizes with the forceps *b* in his left hand, the right margin of the cleft, and with his right, armed with the needle holder *a*, carries the point of the needle backward through the cleft, behind the velum palati, and brings it out from behind forwards, piercing the substance of the velum with its point, about three or four lines from the free borders of the division. The needle being carried through to its eye, is loosened from the holders, and its point being caught by the forceps is brought into the mouth, drawing with it the end of the ligature with which it is threaded. After giving the patient a little rest, the same manœuvre is effected upon the left lip of the division, with the needle attached to the other extremity of the ligature. The ends of the ligature are then brought out of the mouth. The lowest ligature should be inserted first, the uppermost second, and the middle ligature, last of all. Figure 1 represents the act of inserting the third ligature.

The ends of the ligatures *cc*, *dd* being brought out externally, and the loop which they form in the mouth depressed towards the pharynx, the surgeon proceeds to the second stage of the operation.

2d Stage.—Paring off the edges of the cleft (fig. 2).—To pare off the edges of the cleft which are to be brought together, the surgeon seizes them with the forceps *d* in one hand, and with the other, armed with bent scissors, or a probe-pointed bistoury *e*, cuts off the borders, from behind forward, on the inner side of the ligatures *aa*, *bb*, *cc*; then, with the probe-pointed bistoury, he completes the flap by prolonging the incision a short distance beyond the angle where the borders of the division are united. The other lip of the cleft is operated upon in the same way, and the two incisions are brought together at the termination of the first.

3d Stage.—Tightening of the knot (fig. 3).—Roux begins by tightening the posterior ligature with the fingers, and after making a simple knot, gives the threads to an assistant, who keeps the ligature *bb* in position by means of the ring forceps *a*, during the process of tightening the second and then the third ligature *cc*. These lig-

tures are drawn tighter than is necessary to bring together the edges of the wound, in order to prevent any separation in the interval between them. The operation being concluded (fig. 4), the ends of the ligatures are cut off close to the knots. The patient retains the utmost possible quiet and silence, and abstains from solid or liquid food during two or three days. Everything which tends to move the arch of the palate endangers the success of the operation. The ligatures are not removed until the third or fourth day. The inferior ligature should be allowed to remain for twenty-four or forty-eight hours longer.

It has been asserted that there are some imperfections in this method of Roux. A great deal of dexterity is necessary to avoid the accidents which might happen to less practised hands than those of the author. In fact, it is essential that the ligatures should be placed at equal distances from each other; that the corresponding points of the same ligature be on the same level; and that they be at an appropriate and equal distance from the borders of the division. If these conditions are not fulfilled, an uniform junction, without wrinkling or laceration of the lips of the wound, cannot be hoped for. The difficulties of an operation in which the ligatures are inserted from behind forward, and where the exact point at which the needle enters the arch of the palate cannot be seen, will be readily appreciated. Besides, the paring of the edges of the division is always difficult, when it is effected with the bistoury, and, with the scissors, there is danger of cutting the ligatures. To avert these accidents and inconveniences, the methods which we are about to describe have been invented.

Method of Berard (plate 51).—Two principal modifications characterize this operation. 1st, The ligatures are inserted from before backward into the lips of the division, which allows the surgeon to see and choose the point of puncture with the needle; 2d, The paring of the edges of the division is made from before backward and from above downward. The lips being put more upon the stretch allow the surgeon to make a cleaner incision.

In performing this operation, Berard used a pair of mouse-toothed forceps to hold the arch of the palate; a pair of dressing forceps answered the purpose of a needle-holder, and the needles employed were very much curved, from six to eight lines in length by one in diameter, with a heel about a fourth of a line in length.

The patient being placed as in the operation of Roux (fig. 1), an

edge of the cleft is seized with the forceps *a* in one hand, while the other with the needle-holder *b* inserts the first ligature from before backward into its substance. The needle is then brought out into the mouth, and the ends of the thread *cc* hang down externally upon the lower lip.

Figure 3 represents this first step of the operation. The thread *bb*, carried through a lip *a*, of the cleft. A second needle is then passed through the other lip in the same way, on a level with the first, but with this difference, that the second needle has a loop instead of a single thread in its eye. Figure 4 represents the loop of thread *c*, inserted into the other lip opposite the thread *bb*. This loop of thread receives the end *b* of the first ligature and draws it through the second lip, in the direction of the arrow *c* (fig. 5).

The first ligature being placed in its proper position, the surgeon proceeds to insert the two others in the same manner.

The paring is effected from below upwards (fig. 2). The surgeon seizes each border of the cleft with the forceps *b*, and pares off the edges with the bistoury *e*.

Velpeau commences the operation by paring off the edges of the bifurcation before inserting the ligatures.

The other modes of operating differ from the preceding only in the instruments employed. Attempts have been made to avoid the difficulties of the various stages of the operation by the use of ingenious instruments which would allow the surgeon to act with greater rapidity and certainty, either in the insertion of the ligatures, or in paring off the edges of the cleft. A description of all the instruments invented for this purpose would be too long for this work. Besides, surgeons who have these instruments before them will comprehend their mechanism at first sight. We will mention a few of the instruments sanctioned by experience.

Dr. N. R. Smith, of Baltimore, has invented a needle, which consists of a steel shank, mounted upon a handle, and curved towards its point in a semi-circle with a radius of about half an inch. There is no eye in the point of the needle, but it is somewhat enlarged and has a notch in its side in which a ligature is inserted. With the ligature thus supported, the needle is thrust from behind forward through one border of the cleft, and as soon as the notch makes its appearance, the ligature is drawn out of it; the instrument is then withdrawn and the

other extremity of the ligature is carried in the same way through the opposite lip of the cleft.

Bourgougnon uses a needle with a moveable point (Instruments, plate XIII., fig. 8, 9, 10 and 11), with which the perforation can be made from behind forward. Other needles of the same sort, both curved and straight, have been used in making the perforation from before backward.

Leroy d' Etiolles has invented an instrument which makes the three perforations and pares off the edges of the cleft, at the same time.

Foraytier and de Pierris use needle-holders, which support the border of the cleft, while the needle, with its ligature attached, is pushed through from before backward (Instruments, plate XIII., fig. 14 and 15, needle-holder of de Pierris). For the description of the mechanism of this instrument (see the explanation of plate 51, fig. 6, 7, 8 and 9).

2d. *Staphyloplasty*.—The loss of substance which constitutes fissure of the arch of the palate is frequently so great as to render junction of the lips of the division impossible, by the operation of staphyloplasty; staphyloplasty should then be attempted, for which there are three methods.

Roux's method.—Roux makes two transverse incisions on either side of the cleft, and carries them outward, parallel with and beyond the division, along the posterior border of the palatine bones, in order to facilitate the extensibility of the parts which are to be brought together, subsequently, in the usual mode.

Dieffenbach's method (plate 50, fig. 4).—Dieffenbach, imitating Celsus, made a longitudinal incision *aa, bb*, parallel to and on each side of the division, about four or five lines from its borders.

Bonfils cut a flap on each side of the cleft, which he dissected up from before backward, twisted upon its pedicle, and applied upon the solution of continuity. This operation, derived from the Indian method, is not so easily performed as those of Roux and Dieffenbach.

3d. *Palatoplasty*.—When the palatine fissure is very considerable, the operation of Roux may be attempted, which consists in dissecting up the soft parts to the outer side of the ligatures, and isolating them from the bones, when they can be easily brought together. For this dissection Roux uses small double-edged knives, with narrow blades, and curved on one face.

Krimer detached two lateral flaps, which he reversed upon themselves, and brought them together over the fissure by points of suture.

It is difficult to determine the comparative value of the different operations for palatoplasty; the surgeon must be influenced in his choice by the shape and extent of the fissure.*

* Our authors have omitted all notice of the very important improvements effected of late years in the operations for cleft palate by our countryman Dr. John Mason Warren, of Boston, and by Prof. Fergusson, of Kings' College, London.

In his paper on "*Operations for fissure of the soft and hard palate,*" published in the New England Quarterly Journal of Medicine and Surgery, April, 1843, p. 538, Dr. Mason Warren details instances of successful closure of fissures in the hard palate, by dissecting up flaps from the concave surface of the roof of the mouth, commencing at the margins of the fissure upon either side, and extending outwards as far as the alveolar projections; these flaps being rendered continuous with the corresponding borders of the fissure in the soft palate, and all being united in the median line, were found to produce a result in regard to the permanent closure of the fissure of the hard palate, which had not been hitherto attained, and the credit of which belongs to Dr. W. In addition to this improvement, Dr. Warren also announces in this paper, for the first time, the great advantages to be attained in securing union of the flaps formed by the soft palate, by *dividing the anterior pillar of the palate on either side, and "cutting away its attachments to the tonsil and to the posterior pillar."*

On the 10th of December, 1844, Prof. Fergusson read before the Royal Medico-Chirurgical Society of London, an admirable paper "on cleft palate and on staphyloraphy," in which he proposes, "on strictly scientific grounds, and in accordance with the modern principles of myotomy," by the systematic division of the *levator palati*, the *palato-pharyngeus*, and the *palato-glossus muscles*, as a preliminary step to the operation of staphyloraphy, "to destroy all motory power in the soft palate for the time being, and thus to permit that repose of the stretched velum which is so essential to a happy result." Med. Chir. Transactions, 1845, p. 288. Prof. F. also details cases successfully treated in accordance with this view.—ED.

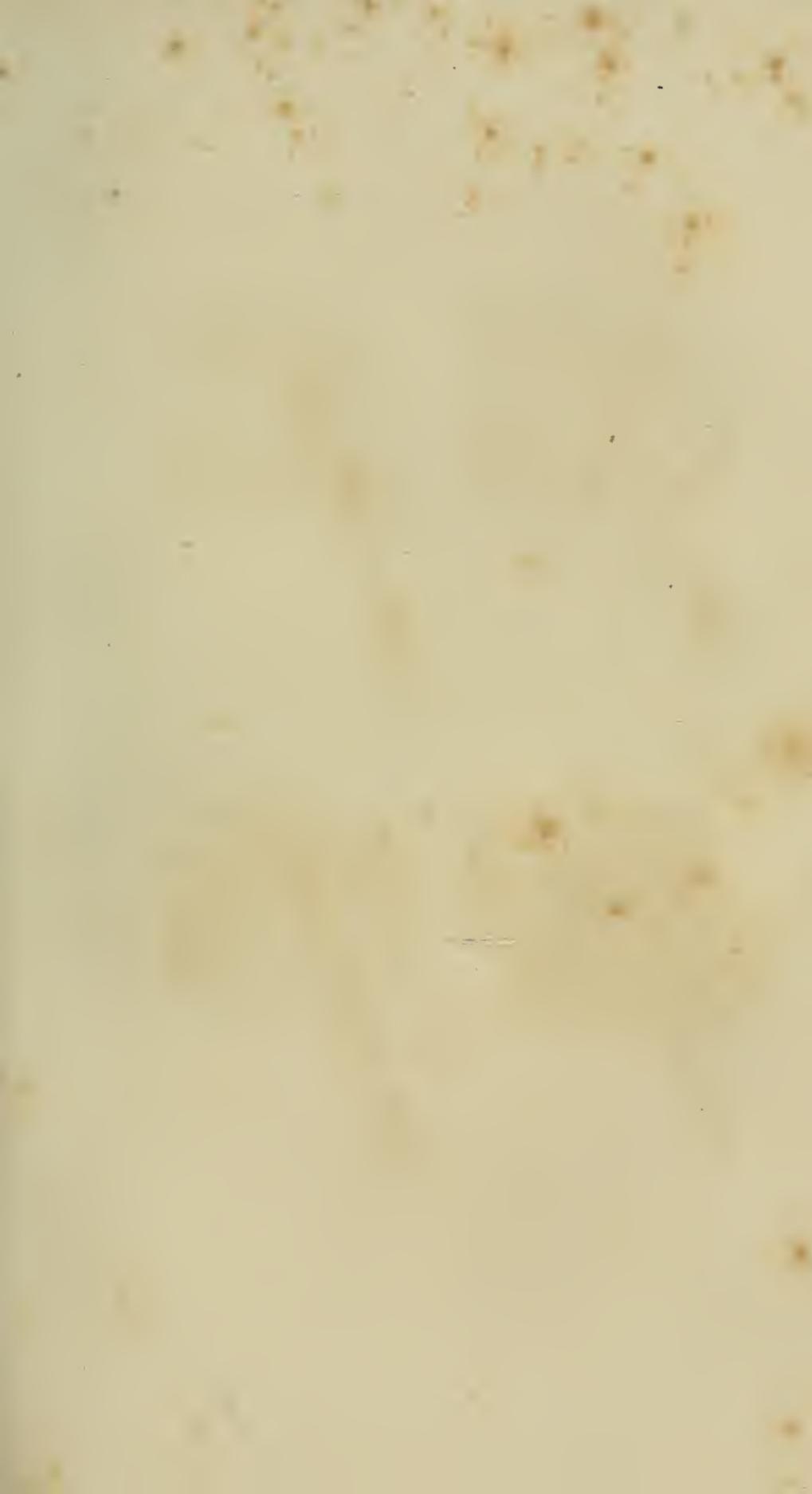


Fig. 2.

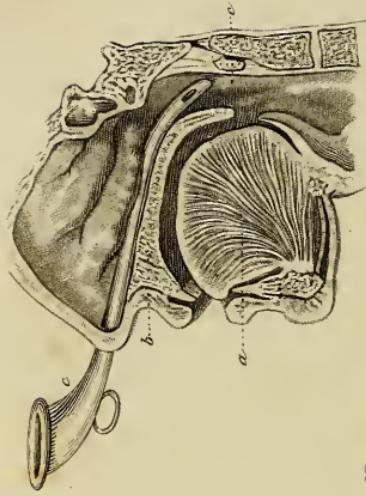


Fig. 1.

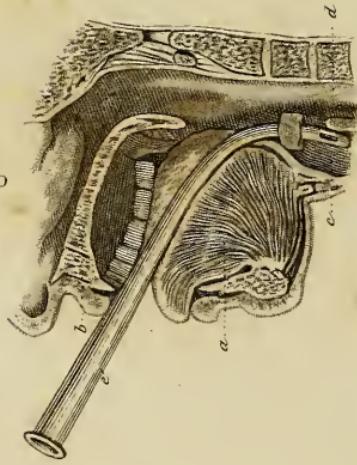


Fig. 3

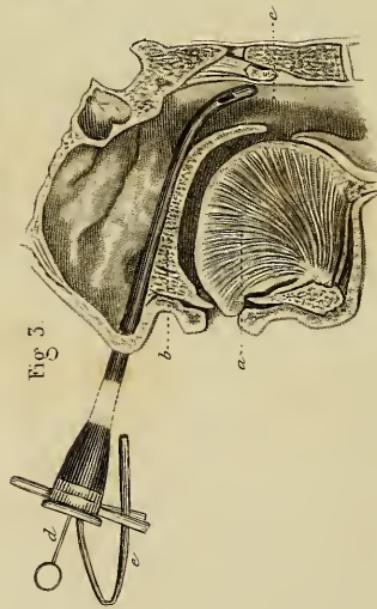


Fig. 4

