muscle of the heart contracts feebly ; the muscular fibres in the walls of the blood-vessels lose their tonicity and the blood-vessels dilate ; the blood collects in the large venous trunks, more especi­ally of the abdomen ; the vessels of the skin are emptied of blood, giving rise to the marked pallor. Two of the great causes that keep up the normal circulation of the blood through the body are in partial abeyance : the heart has not sufficient energy to contract, and there is not a sufficient quantity of blood passing into it from the blood-vessels. The heart beats feebly (1) because its nervous energy is lowered, and (2) because it has not a sufficient quantity of blood to act upon. An understanding of these facts gives the general indications for treatment,—(1) external stimulation over the heart by mustard poultices or turpentine stupes ; (2) elevation of the limbs, to cause the blood to gravitate towards the heart ; (3) manual pressure on the abdominal cavity from below upwards, to encourage the flow of blood from the dilated abdominal veins into the heart. These different measures may be supplemented by the administration of stimulants by the mouth, or, if the patient cannot swallow, by subcutaneous injection of a diffusible stimulant,

. such as ether or ammonia. In syncope or faintness from mental emotion the weakened heart cannot drive a sufficient quantity of blood to the brain ; the patient feels dizzy and faint and falls down insensible. The condition is a transitory one, and the recumbent posture, assisted if need be by elevation of the limbs, causes the blood to gravitate to the heart, which is thereby stimulated to contraction ; a sufficient quantity of blood is then driven onwards to the brain, and the insensibility passes off. If the patient is in the sitting posture when he feels faint, the head should be depressed between the knees, which will cause the blood to rush to the brain, and the faintness will pass off.

With few exceptions the soft parts are freely supplied with blood­vessels, and as a preliminary to a consideration of the different forms of injuries it will be well to say a few words about hæmorrhage or bleeding. If a blood-vessel is torn or cut across, the blood within it escapes, either externally on to the clothes or floor, or, in the case of a subcutaneous injury, into the tissues, giving rise to *ecchymosis.* Cessation of the bleeding may take place in conse­quence of an arrest of the hæmorrhage either by nature’s effort or by the adoption of artificial means by the surgeon. The loss of blood may be so great that the heart’s propelling power is weakened, and in this way the natural arrest is assisted. But there is always a danger that with the arrest of the hæmorrhage the heart’s action may recover its power and the bleeding recommence. In arresting hæmorrhage temporarily the chief thing is to press directly on the bleeding part. The pressure to be effectual need not be severe, but must be accurately applied. If the bleeding point cannot be reached, the pressure should be applied to the main artery between the bleeding point and the heart. In small blood-vessels pressure will be sufficient to arrest hæmorrhage permanently. In large vessels it is usual to pass a ligature round the vessel and tie it with a reef knot. Apply the ligature also, if possible, at the bleeding point, tying both ends of the cut vessel. If this cannot be done, the main artery of the limb must be exposed by dissection at the most accessible point between the wound and the heart, and there liga­tured. Hæmorrhage has been classified in three varieties—(1) primary, occurring at the time of the injury ; (2) reactionary, or within twelve hours of the accident, during the stage of reaction ; (3) secondary, occurring at a later period, and caused by unhealthy processes attacking the wound and giving rise to ulceration of the coats of the blood-vessels. In treating these different varieties the principles already laid down hold good. In cases of severe hæmor­rhage the patient suffers from syncope owing to loss of blood. Syncope from loss of blood is to be treated on the same principles as those already laid down for shock. But in addition it may be necessary in cases of severe hæmorrhage, in which much blood has been lost, to introduce into the circulation fluid which will give the heart something to act upon. Blood drawn directly from the arm of a healthy person, and introduced through an opening in the vein of the arm, has frequently been made use of. The tendency of the blood to coagulate when brought in contact with foreign matter has led to the adoption of ingenious instruments to avoid this danger. Some surgeons have used defibrinated blood, and others milk. The opinion is at present gaining ground that a nutrient fluid is unnecessary, and that all that is required is to introduce an aseptic neutral fluid at the temperature of the body which has no tendency to cause coagulation of the blood with which it mixes. A saline solution, composed of 75 per cent, of common salt in dis­tilled water, fulfils all these requirements ; 4 to 6 oz. are generally sufficient. Recent experiments have been made by which blood drawn from the arm of the giver is mixed with a solution of phos­phate of soda. This admixture prevents the blood from coagulat­ing, and it can be introduced into the blood-stream with safety.

In a recent contusion careful pressure should be applied, with cotton wadding fixed in position with a bandage. The aim is to prevent ecchymosis and to hasten the absorption of the effused blood after it has escaped into the tissues. Accurate pressure fulfils these ends more perfectly than the commoner application of cold.

The procedure for the treatment of an open wound is—(1) arrest of hæmorrhage ; (2) removal of any foreign bodies in the wound ; (3) careful apposition of its edges and surfaces,—the edges being best brought in contact by the use of horse-hair stitches, the surfaces by carefully applied pressure ; (4) free drainage of the wound to prevent accumulation either of blood or of serous effusion, which may be done—*(a)* by leaving the dependent corner open, or (*b*) by introducing a drainage-tube, a skein of catgut, or a skein of horse­hair ; (5) avoidance of putrefaction by the use of antiseptic pre­cautions ; (6) perfect rest of the part by appropriate means during the cure. These methods of treatment require to be modified for wounds in special situations and for those in which there is much contusion and laceration. In punctured wounds free drainage is of primary importance. When a special poison has entered the wound at the time of its infliction or at some subsequent date the following dangers have to be combated—(1) an intense inflamma­tion in the wound itself and surrounding parts ; (2) inflammation of the lymphatic vessels leading from it ; (3) inflammation of the lymphatic glands ; (4) blood-poisoning of the general circulation. One of the commonest poisons is that connected with wound putre­faction ; of others some are the result of diseased action in the lower animals, *e.g.,* hydrophobia, whilst some are special diseases in man. These diseased conditions are at the present time being carefully studied, and the observations all tend to one conclusion, that they are due to specific organisms which have found entrance into the diseased animal or man, and, finding there a suitable nidus for their growth and development, have set up a specific disease. If the surgeon is accidentally wounded in operating on the living subject, or the pathologist in making a post-mortem examination, the poison may pass into the wound and give rise to one or more of the symptoms already indicated. There can be no doubt that these special poisons,@@1 which are spoken of as pathogenic or infect­ive, are in some way associated with low forms of plant life, and that in this they resemble the poison of putrefaction. If the operator is in good health the poison will generally have little effect ; if he is in bad health the effect may be very severe. We do not yet know in what cases bad results are to be expected. The great point in every doubtful case is to purify the wound thoroughly with some powerful antiseptic, so as to destroy the poison at the point of inoculation. If the poison escapes the germicidal action of the antiseptic used and enters the system, the patient should be stimu­lated, as the poison exercises a depressing action. For hydrophobia no cure is at present known. Experiments are, however, now (1887) being made by Pasteur which will throw some light on this dreadful disease.

Burns are dangerous accidents in young children and in old people when the areas affected are large, and when they are situated over the cavities of the body. The patient may die of shock soon after the accident, of deep-seated inflammations coming on during the stage of reaction, or of hectic, which in all probability is a form of chronic pyæmia associated with profuse discharge from the wounded surface. To prevent death from any of these causes stimulating treatment is necessary. It has long been known that it is important to keep the air from the wounded surface, and antiseptic dressings must be used to prevent the access of organisms to it. When the skin is destroyed to any great extent contraction is apt to take place, followed by deformity. Care must be taken during the process of cure to prevent this, by keeping the limb in an extended position during the treatment of burns on the flexor surface. To hasten cicatrization after a burn in which the skin has been destroyed grafts of epidermic tissue may be planted on the granulating surface according to the method of Reverdin. These grafts, each the size of a pin’s head, become fixed and from them cicatrization spreads over the surface. After cicatrization the tendency to contraction is not nearly so great. Epidermis grafting must not be confounded with skin grafting, in which the grafts are of the whole thickness of the skin.

A bone may be broken at the part where it is struck, or it may break in consequence of a strain applied to it. In the former case the fracture is generally transverse and in the latter more or less oblique in direction. The fully developed bone is broken fairly across ; the soft bones of young people may simply be bent—“ *green stick."* or "*willow*" *fracture.* Fractures are either simple or com­pound. A simple fracture is analogous to the contusion or sub­cutaneous laceration in the soft parts ; a compound fracture is analogous to the open wound in the soft parts. The wound of the soft parts in the compound fracture may be caused either by the same force which has caused the fracture, as in the case of a cart wheel going over a limb, first wounding the soft parts and then fracturing the bone, or by the sharp point of the fractured bone coming through the skin. In either case there is a communication between the external air and the injured bone. As some years elapse before the epiphyseal extremities of the bone become united by osseous deposit to the shaft, external violence may cause a

@@@1 For their classification, as yet very imperfect, consult Ziegler’s *Pathological Anatomy* (trans. by Macalister, London, 1883-84).