

The Canon of Medicine

(Avicenna, 980-1037 A.D)

Translated by Arabic, originally Title is:

Al-Qānūn fī al-Ṭibb, also known as

“A Treatise on the Canon of Medicine of Avicenna”

Volume. II

AMS Press, New York, United States, 1973

(Reprinted from the Edition of 1930, London, United Kingdom)



THESIS I. DISORDERS OF HEALTH

I. DEFINITION OF THE TERMS : CAUSE, DISEASE, SYMPTOM



191. CAUSE.—The word “Cause,” in medical works, refers to that which initiates a given state of the human body, or maintains a fixity of such a state.

§ 166. It is to be noted, says Costæus, that the term cause does not refer to “efficient” cause, for disease, not being a definite entity, does not require an efficient cause. In other words, disease is not in-formed matter.—This applies equally in modern thought. If the changes of disease are modified biochemical reactions, they cannot be considered in terms of matter and form. But formal causes, and substantial causes, as well as the differences between qualities and dispositions, tendencies, passive and active states, and fixed morbid conditions, are all better understood under the precise thought of modern scholastic philosophy.—A cause may be understood as anything which effects, or assists, or maintains, or imparts a (morbid) function, whether actively or passively—morbid, because this part of the Canon is concerned with disease.

Human body. Not an animal body. The teaching to be presented does not necessarily apply to veterinary medicine.

Fixity of state.—Note that some states are labile, and others are stable or fixed. Labile states are more or less easily curable, but fixed states are very difficult to resolve or cure.

State.—We must distinguish carefully between cause, disposition, state, habit, symptoms.

192. DISEASE.—This is an abnormal unnatural state of the human body, in virtue of which injurious effects result. This injurious effect is the beginning of the disease. Such an abnormal state is either (*a*) an intemperament, or (*b*) an abnormal composition (see 205, 231.).

§ 167. It may be noted that on this view the state is primary, and the disease secondary. To the modern view, the disease comes first, and the state is its result. The state is “the reaction to the causal noxious agent.” Such a state is (*i*) detrimental to the body, (*a*) by an “aggressive” action upon the tissues by the agent, (*b*)

as an unfortunate by-effect, producing degenerations of various kinds and degrees—sometimes mechanically (pressure on parts, interference with vascular supply)—sometimes incidentally, in the form of late toxic actions of the microbic poisons, (ii) beneficial to the body—though indirectly, since it is certainly damaged in the process—as tending to destroy the invading organisms or at least neutralizing the poisonous products.

In Avicenna's view, however, both agent and state are equally important. One cannot speak of a "reaction," any more than one would say (for instance) that sodium carbonate is a reaction to hydrochloric acid. Unless both substances are there, there is no reaction. So, without an abnormal state, there is no malady.

Note also that "poisoning" ("intoxication") is not a disease.

§ 168. The following classification of words often used indifferently for "disease," as if they were really synonymous, will help to a more precise usage.

A.—Terms bearing primarily a general sense.

Ill-health: not used specifically; there may or may not be a diagnosable "disease."

Illness: the state of being ill; sickness. Vaguely used for anything from slight disability to a fatal condition. More definite in meaning than "ill-health."

Malady: (lit. ill condition; *male habitus*). A synonym for "an illness," appearing in polite literature for conditions not necessarily organic, or for conditions which have not been diagnosed, and yet may prove fatal.

Ailment. This may be some definite morbid condition, or simply imply discomfort (possibly short of actual pain). Literally, is synonymous with "a sickness," "an illness."

Disorders, in general. (cf. 198.) This term is used still more specifically, as a rule. See under *B*.

Disease (*Morbus. Marād*) in general. This word is technical, whereas the other words have a more popular application.

B.—Terms bearing a special sense, whether used in that manner or not.

- (i.) Any condition in which an *organic lesion*—some macroscopic change in the body—is present, is - - - - - "disease." This word implies a more or less serious disturbance, and even suggests the risk of death. The lesions present often determine the distinctive name of each separate disease. Where the etiology is still unknown, the disease may be provisionally named - - - - - "sickness."
- (ii.) Conditions in which there is *not* necessarily any *organic* lesion, or where such a lesion has not been detected. These conditions do not receive distinctive names; are not necessarily serious; are probably not fatal. The name of each condition originally bore a distinct meaning:
 - (a) arising out of the temperament - - - - - "distemper,"*
 - (b) arising out of the disposition or state. Now means simply "not fit"; or, vaguely, "ill-health," - - - - - "indisposition."
 - (c) implies involvement of bodily functions. May be sub-classified according to the "system" involved. Or, vaguely, means simply "something is out of order," - - - - - "disorder,"
 - (d) implies involvement of the nerves, or nervous system. (I.e., almost equivalent to "functional" as opposed to "organic" (Lat. *passio*). Implies a certain amount of pain - - - - - "affection."

* Now only applied to a specific disease in veterinary surgery.

(e) A condition in which pain is the chief feature, whether general, or in some special region ; but the pain is presumably not very severe. Sub-classification according to the region or organ "complaint."

193. SYMPTOM. This is a phenomenon consequent upon this non-natural state of the body. Some symptoms are entirely abnormal phenomena, like the pain of colic. Others are (exaggerations) of a natural phenomenon, like the intense flush on the cheeks seen in peri-pneumonia.

§ 169. A lengthy discussion about what is to be regarded as a symptom is here given by Costæus. He shows that the word "symptom" is derived from the Greek to indicate something which occurs simultaneously with the disease producing it. He also discusses the exact meanings of the terms : weakness, impaired function, loss of function, abolition of function, "affections," preternatural excretions and retentions (cf. "retained" placenta). The question is also raised as to whether a given symptom is directly due to the disease, or is indirect, or is collateral, or is in no real relation to the disease.

Avicenna's brief statement really covers all these points. As regards our modern ways of thinking, one gathers together all the phenomena which are ever found to occur in a case of a given disease, and we simply arrange them as far as possible into the immediate effects, the remote effects, and those phenomena whose nature is not absolutely certain—they may be caused by the disease ; they may be sequels ; or they may be concurrent because some other morbid condition is, or happens to be, simultaneously present.

194. A short table of examples.

Example of a cause.	Example of its corresponding malady.	Example of the corresponding symptom
Decay ; putrescence.	Fever.	Thirst, headache.
Fulness of lacrymal sacs from developmental error.	Obstruction of uvea.	Loss of vision.
Acrid "flux."	"Ulcer" in lung.	Flushed cheeks ; curved nails.

195. (a) The difference between "symptoms" and "signs."
We speak of a symptom in regard to its own intrinsic character, or in relation to that to which it belongs. A "sign" is that which guides the physician to a knowledge of the real essential nature of the disease.

It is asked : Are symptoms to disease as shadow is to object ? The answer is, that the two are associated but are not inseparable. In other words, the symptom is a (scholastic symbolism, of §56, sqq.) and not *m.f.* The term "symptom" refers to many phenomena, some of which are really the direct consequence of the disease, while others are only indirectly its result. This question would never arise were it not for the custom of supposing "diseases" are entities of some kind.

(b) One disorder may originate a second. Thus colic produces syncope, or paralysis, or spasms and convulsions.

Costæus says : To the patient, "colic" is "pain." The distension is the cause of the pain. The pain interferes with or even arrests the vitality of the part,

and in that sense produces the syncope. Pain is: the contact of disordered disorganised function upon the consciousness. It is a form of "touch." The consciousness "touches" the impaired function. "Paralysis" is "loss of the faculties of movement and sensation." "Convulsions" = "depravity" of the faculties of movement and sensation.

There is, therefore, a certain literal truth in the general statement.

(c) *A symptom may be the cause of a disorder.* Thus, violent pain causes the suffering of colic, and syncope is the effect of the pain. The violent pain of an inflammatory mass is due to the descent of the matters to that spot.

Costæus adds: Pain interferes with the "breath," and may even arrest it. In consequence, a "refrigeration of the heart" takes place. That is, the temperament of the heart becomes below normal in regard to "cold." But this is a disease. This change of temperament accounts for the syncope.

Descent of matter (inflamm. exudate) as a cause of pain.—The acridity and similar qualities of the exudate do actually irritate the nerve-endings, and therefore produce pain in addition to that due to tension.

(d) *A symptom may be at the same time a malady.* Thus headache is an effect of fever, but may also last so long as to amount to a "disease."

§ 170. Costæus adds: Pain such as headache may simply be a symptom, that is, evidence of an "intemperamental state," or "solution of continuity." But, *to the patient*, it is *the* thing; it *is* the malady.—Little does it concern the patient that there is an underlying cause to be treated if the practitioner proves unable to relieve his pain.

Further, persistent pain impairs vitality; in this sense a pain is a disease.

§ 171. Symptoms are still confused with diseases in our textbooks. Thus, "jaundice" appears amongst the diseases, instead of being placed separately along with a number of other characteristic symptoms, such as ascites, which is not taken as a specific disease even by the lay. Originally, symptoms were explained in terms of changes of quality and the like. This theoretical explanation was abandoned owing to a degradation of (metaphysical) knowledge. The symptoms then became "diseases." The diseases were then investigated, and found to be more numerous than the symptoms (which was already understood). Subdivisions were then made, and particular diseases specified and defined, and the multiplicity of causation emphasized. The exact succession of processes revealed by the microscope and biochemistry was elucidated. These successive procedures are the evidence of "advance" and "progress." All the while the fact is overlooked that the same processes occur in every "disease," and that when the whole subject, treated from pathology, is reduced to its least common multiple that range reveals itself as much the same as that of ancient lore. Cf. also § 173.

(e) *One and the same thing may be at once "disease," "symptom" and "cause."* Considered in relation to the present,

it is "disease"; considered in relation to the past, it is "cause"; considered in relation to the future, it is 'symptom.' —Examples: the fever of consumption is the sign of ulceration of the lung. Considered in itself, it is the disease. Considered in its effect, it is the "cause" of gastric weakness. Again, the headache which fever gives rise to (in those cases where fever causes headache) (esp. meningeal disease) may remain behind (after the subsidence of the fever) and be itself the "disease." To particularize, the malady itself sets up inflammation of the meninges, and this sets up headache.

2. THE STATES OF THE HUMAN BODY. THE TYPES OF DISEASE*

196. There are three states of the human body, according to Galen :—

(i) *Health*—a state in virtue of which the human body presents that particular temperament and configuration whereby all its functions shall proceed unembarrassed.

(ii) *Disease*—a state which is exactly contrary to (i).

(iii) *A third state* which is neither health nor disease. There are three variants of this :—(a) the health is not perfect and yet there is no actual illness. Ex. : the state in old persons, and in juveniles, and in those convalescent from illness. (b) Both states occur simultaneously in the same member : either in two quite different respects (as when the temperament of a person is normal, but there is compositional abnormality ; or in two respects which are related to one another (as when a person is healthy in form, but there is error in size or position of a member ; he may be healthy in regard to two passive qualities, but not in regard to two active ones). (c) Both states occur in one person, but at different times of the year (as when a person is well in winter but ill in spring).

197. Some disorders are simple, and others compound.

The simple disorders are where there is (1) one single kind of intemperament, (2) an isolated abnormality of configuration.

The compound (composite, compositional) disorders are where there are two or more kinds together, which together appear as one single malady.

198. The *simple disorders* comprise three groups :—

1. *Disorders of Temperament*.—In this case the members affected are formed of similar parts, but the temperament is

* Costæus believes that Chapter I of the original should come in here, the present chapter being the real opening of this Thesis.

depraved. The term is not used unless the disorder is primarily in these essential parts, and then applies even if composite members are affected secondarily [*i.e.*, temperamental disorders are distinguished from compositional (205)].

Disorders of temperament may actually occur in any compound members one may think of, provided these are formed of homologous tissues.

There are sixteen kinds of disorders of temperament, as has been already stated. (41).

2. *Disorders of Configuration.* The members affected are the locomotive organs (the instruments whereby actions and functions are performed). These organs are formed of similar parts.

3. *Solution of Continuity and Dislocation.* The members affected have similar parts. It occurs in organs which are instruments. The disorder is one in which the function of being an instrument is interfered with. Such a solution of continuity occurs at a joint ; here we see that the separate members which go to make up the joints are not affected. The same thing applies in the case of nerves, bones, veins.

Any malady which depends on any of these three groups is named accordingly.

3. DISORDERS OF CONFIGURATION.

199. These are comprised in four main groups :—(i) Errors of development (malformations). (ii) Errors in bulk. (iii) Errors in number. (iv) Displacements.

(i) Errors of Development.

Group.	Subvarieties.	Examples.
1. Errors in form. Here the form is changed from its natural grace, to an extent which impairs its utility.	Deviation from a natural straightness. Straightness of a naturally curved line. Squareness where there should be roundness. Rotundity where there should be squareness.	Head broad and round, with ossified sutures to an extent hindering mental power. Curved shinbones ; genu valgum ; clubfoot. Pupils congenitally elongate or slit-like or small. Great rotundity of abdomen.
2. Errors in passages.	Too wide. Too narrow. Occlusion.	Wide pupils ; varices ; aneurysms ; the dilated blood-vessels in pannus. Small pupils ; narrowed eyes ; stricture of trachea or bronchi ; stricture of oesophagus. Of venous orifices, e.g., in liver. Atresia (Tr.).

Group.	Subvarieties.	Examples.
3. Errors in cavities or sacs.	Too large (distended). Too small (contracted). Obstructed and overfull. Emptied.	Scrotum. Contracted stomach ; contracted cerebral ventricles in epilepsy. Obstruction in cerebral ventricles in apoplexy. Cardiac cavities emptied of blood by reason of excessive joy or extreme pain.
4. Errors of surfaces.	The normal roughness replaced by smoothness. The normal smoothness becomes rough.	At the orifice of the stomach ; also in lienteric diarrhoea. Trachea ; fauces (hoarseness).

(ii) *Errors in bulk.* (a) *Increase* : as in elephantiasis, unduly large penis (priapism) ; macroglossia. The disease which befel Nicomachus, whose body became so huge that he could not be moved. (b) *Decrease* : shortness of tongue so that it cannot reach the other parts of the mouth (tongue-tie). Atrophied and wasted members ; general "decline."*

(iii) *Errors in number.* (a) *Increase* : (α) in normal organs—additional teeth ; supernumerary fingers ; (β) entirely abnormal—warts, calculus, enlarged glands. (b) *Decrease* : (α) in normal organs—congenital absence of a finger ; (β) accidental—loss of a finger through amputation (accidental or surgical).

(iv) *Displacements.* (a) Displacement from the proper anatomical position. (α) Replaceable : e.g., hernia of the intestine ; tremor (which occurs through a quite unnatural to and fro involuntary movement). (β) Not replaceable : e.g., fixation of a joint in a new position, as in gout where joints are hardened (ankylosed). (b) Displacement from the normal position in regard to neighbouring anatomical structures. This results in their being too near together or too far from one another. In such a case one part cannot move towards another as it should ; for instance, adjoining fingers cannot touch one

* *Decline.*—Dhebul.—The term refers to a condition in which the body seems to wither or fade away without obvious reason, or in spite of taking food. The term refers primarily to the causeless losing of flesh by horses, whereby they come to be in an ill-conditioned state. The same word would apply to the wilting of cut flowers or the withering of plants from lack of water, or from reduction of their vitality to such a point that they will not imbibe water any more ; that is, they cannot be "re-vived." Such a condition in man is noted by the laity, but is only referred to in medicine when its pathological basis is visualised ; as, for instance, in wasting from *tabes mesenterica*, or *tabes dorsalis*.

another. Or, one part cannot be moved away from another, either at all, or only with very great difficulty. For instance, in the case of joints flabby because of paralysis, or in the case of the eyelids. There may be a difficulty in opening the hands or in opening or raising the eyelids.

§ 172. Museum classification of errors of development.
(Abbott,¹⁰⁵ p. xv.)

1. Foetal structures normally not persistent.
2. Incomplete development.
3. Reduction in size (hypoplasia).
4. Reduction in number (subdactylism, etc.).
5. Persistent foetal structures.
6. Excess of size.
7. Excess in number.
8. Malposition ; aberrant structures.
9. Anomalies due to foetal disease.

4. SOLUTION OF CONTINUITY.

200. The following members may undergo solution of continuity.

1. The *skin* (and the flesh beneath it) : as excoriation, scarification, wounds. If pus is not formed or discharged, it is called a wound ; if a discharge of pus is present, it is called an "ulcer." The presence of pus is due (*a*) to effete matters ("superfluities") being discharged at that spot ; for the reason that it is weak. (*b*) The tissue is not able to digest all the nutriment which is brought to it, the excess being changed into pus.

The terms "wound," "ulcer" may also be applied to solution of continuity in places other than skin and flesh.

2. *Bone.* A fracture into two parts, large or small ; or longitudinally in the form of a fissure.

3. *Cartilage.* The fracture may be in any of these three ways.

4. *Nerve.* Transverse section from incised wounds ; longitudinal, and over a short distance, as "scission." Longitudinal and also extensive—in a contusion.

5. *Muscle.* If near the ends, or in the tendon : attrition. If transverse : severance, or incision. If longitudinal, but small in extent, with the formation of a deep hollow, it is called cavitation. If multiple, with the appearance of several swellings and hollowings, it is attrition with contusion. If the solution of continuity is in the belly of the muscles, it is called attrition or incision, or contusion, whatever be the direction of the injury.

6. *Arteries and Veins.* When these undergo solution of continuity, they are "opened." If the injury is transverse, it is an incision ; if longitudinal, it is called fission. They may be punctured (perforation). There may be a partial solution of continuity, whereby the blood escapes into the surrounding tissue-spaces, until their pressure arrests its further progress ; this is called an aneurism.

7. *Membranes* (including the diaphragm) : disruption.

Note that not every member can undergo solution of continuity with impunity. For instance, in the case of the heart, death ensues.

201. If one of two parts of a composite member be separated from the other, such that there is no actual injury to either, it is called a dislocation. A nerve may be twisted out of place, and this is also called a dislocation. It is also called a contorsion.

202. When a solution of continuity occurs where there are foramina, it may widen them. When it occurs in a place where there are no foramina, such may come into existence.

203. Any solution of continuity, whether it be in the form of an ulcer or the like, will heal quickly if the temperament of the member be good. But if the temperament be not good, healing may be delayed for a long time. Healing is specially delayed in persons with dropsy, or cachexia, or suffering from lepra.

204. If wounds are tightly bandaged, they may end in a very deep ulcer. Ulcers appearing in summer may last on into winter, and exhaust the strength.

Resolution of continuity is referred to in detail later.

5. COMPOSITE DISEASES.

205. Definition.—By the term "composite diseases" we mean—not that several diseases are conjoined—but that a number of morbid states concur, and out of them there emerges one single disease. This is exemplified by cutaneous swellings of inflammatory nature (including boils, pustules). Boils are small inflammatory masses, and ordinary inflammatory masses are large boils.

The following kinds of morbid state go together to make up an inflammatory mass* : (1) a disorder of temperament, this being associated with matter ; (2) a perversion of form ; (3) unhealthy configuration—one never meets with an inflammatory deposit without there being disfigurement, change of size, and

* Hence the popular name for a local inflammatory condition—"gathering."

there is often displacement as well ; (4) loss of continuity. This is the necessary accompaniment of the discharge of superfluities into the tissue-spaces, penetrating as they do into them all, and separating one from the other in order to make space for themselves.

206. *Site.*—Swellings occur in soft members, and sometimes also in bone, in which case the cavities in the bone widen and the exudate accumulates in them.

It is not surprising that a tissue which can accommodate nutrients should also accommodate waste materials if these should by chance penetrate into it, or should form in it.

207. *Causation.*—(a) The primary cause may not be evident, the corporeal change showing that material has been removed from one tissue to another (at a lower level). This is called a “catarrh.” (b) The material cause from which boils and other inflammatory swellings arise may be immersed within other humours, without being deprived of its own harmful qualities.

Good humours may be discharged either by natural processes (as, for instance, in the case of women at the times of parturition and lactation), or by unnatural processes (as when good blood is lost through a wound). The bad humours, however, remain and continue to be harmful ; Nature then expels them. If the discharge is by the skin, pustules form.

208. *Classification of Swellings.*—Swellings may be classified according to the different kinds of matter of which they are made up ; namely according to the six kinds of material cause—the four humours, wateriness, gas.

There are both hot and cold inflammatory swellings. But the fact of their being hot does not say they are derived from biliary humour or blood. Any material intrinsically of hot nature, or any material which has become hot because of putrefaction, can give rise to a hot inflammatory mass.

Swellings = waram = apostema = tumour (used in a general sense) ; any “lump” or excrescence or protuberance. Intumescence, tumefaction, new-growth, nodosities —these are special kinds of swelling. In most passages an *inflammatory* swelling or mass is meant ; waram or apostema is translated accordingly. It may be noted that an apostema is more likely to be coloured, and to feel warm to the touch, whereas a swelling which can be called a tumefaction is colourless and does not feel warm ; that is, it is a “cold” swelling. (211).

209. While it is possible to subdivide these swellings according to the humours concerned, it is better to use special names in special cases. Thus, a mass derived purely from the blood is called “phlegmon” ; one derived solely from biliary

humour is called "erysipelas." When the origin is compound, or dual, a double name is allotted. Thus, phlegmon erysipelatodes, if phlegmon is the chief feature ; erysipelas phlegmonodes, if the erysipelas is the chief feature. When a collection of actual fluid has gathered, it is named an "abscess." This may occur in lymph-nodes (axilla ; behind the ears ; in the groins) which are then nothing but "corrupt" matter ; and this is called a "bubo."

210. Hot SWELLINGS.—The following are the phases of the hot swellings :

i. *The onset.* The humour makes its way to the surface, and increases in size, until the cavity is so distended as to be evident. ii. *The rise* : the size and tension increase. iii. *The acme* : the height of the malady, and stationary period. iv. *The decline* : (a) stage of softening from digestion of the contents and resolution or (b) maturation into pus* ; or (c) a conversion into a hard or indurated mass.

211. COLD SWELLINGS (lit. "swellings which are not hot"):

1. Composed of atrabilious humour :
 - i. induration (generally autumnal).
 - ii. cancer† (generally autumnal).
 - iii. glandular : scrofulous, other nodules and nodosities.
2. Composed of serous humour :
 - i. lax.
 - ii. soft glands ; and winter swellings.
3. Composed of watery fluid : e.g., dropsy, hydrocephalus ; hydrocele, and the like.
4. Composed of gases : tumefaction ; puffiness ; distension.

Puffiness. This stands for tahabbuj (Rome edition), or tahayyuj (Bulaq) ; cachexia (Venice edition) = tumefaction. The Latin glossary explains that it is meant specially as that which results from liver disorder ; when it appears in the limbs it has a different origin. The puffiness of the eyes from lack of sleep or from too much sleep is also different.

212. *The difference between the glandular form and the other two kinds of atrabilious swellings.* The former is either quite loose within the tissues among which it lies, and is therefore easily moved to and fro by the finger ; or there is adhesion, simply to the skin (as in strumous swellings). The other two kinds of swelling are intermingled with, and interfused with, the substance of the tissues among which they lie.

* Note that pus is only one kind of "matter."

† Cancer appears in the Canon as a disease associated with change in the atrabilious humour. Therefore one condition for the production of this disease is the entry of S into the metabolic cycle in a pathological manner (cf. § 147).

213. *The difference between cancerous swelling and induration.* The latter is a slumbering silent mass which destroys the sensation (so that the part is numb), and is painless, and stationary. It may produce weakness of the part. A cancerous swelling progressively increases in size, is destructive, and spreads roots which insinuate themselves amongst the tissue-elements. It does not necessarily destroy sensation unless it has existed for a long time, and then it kills the tissues and destroys the sensation in the part. It would seem that indurations and cancerous swellings differ less as to substance than in the inseparable accidental qualities.*

214. The hard swellings arising from atrabilious humours are usually hard from the outset. They are often autumnal. They often become "indurations," especially if there be sanguineous humour present.—The same sort of change may take place in the swellings arising out of serous humour.

215. *Swellings arising out of serous humour.* These are of two varieties. They are either diffuse or circumscribed (nodular). The difference lies in the fact that the latter form is discrete among the surrounding tissues, whereas the other form is intermingled with them, and is therefore not discrete, but diffuse. Swellings formed of serous humour often arise in winter (the rainy season, or time of stormy weather). (Even) if they are "hot," they are white in colour.

216. *The difference between soft glands and "ganglia."* The latter are more adherent to the surrounding tissues ; they feel nodular to the touch ; they always slip back to the original position after manipulation ; but they may be dispersed by certain strong medicaments, without compression, and then disappear permanently. They are often produced by toil. The application of a very heavy weight such as lead may disperse them.

217. Swellings arising out of serous humour vary in consistence according to the density of the contained fluid. They may be soft, thin, lax, or hard, or resemble the atrabilious type of swelling, or resemble the gaseous form. Tenuous serous humour flows down along the course of the nerve-fibres, and so reaches the muscles beneath the epiglottis and larynx.

218. *Watery swellings.* Examples : dropsy, hydrocele, hydrocephalus, and such-like. [Cysts.]

219. *Gaseous swellings.* These are of two different kinds: tumefaction ; inflation. These differ both in essence and in

* Hence some cases of "Induration" may have been what is now called "scirrhus."

mode of commixture. In tumefaction, the gas is intimately mixed with the substance of the tissue. In inflation it is aggregated, tense, tumescent, and discrete from the substance of the tissue. The former feels soft ; the latter feels more or less resistant.

220. *Papular swellings.* These show the same subdivisions as inflammatory swellings in general. They are formed of (1) blood or sanguineous humour (true pustules) ; (2) purely of bilious humour : miliaria, sudamina, certain forms of eczema ; (3) both serous and atrabilious humour (morbilli, myrmecia, clavus, scabies, warts, and the like) ; (4) watery fluid (bullæ, vesicles) ; (5) gaseous material (emphysema).

The points of distinction which apply in regard to the kinds of pustules will be adequately dealt with in the fourth Book, should Allah be willing for its accomplishment.

6. DISFIGUREMENTS

221. There are some states which are not "disease," but are classed as such. These are conditions in which the beauty of the form of the body is impaired, either in respect of hairiness, colour, odour, or form.

i. *Affections of the hair.* Alopecia ; stumpiness ; scantiness ; shortness ; scission ; fineness ; coarseness ; curliness ; lightness ; colour-changes, such as greyness.

2. *Affections in which there is an abnormal colour of the body.*

i. Due to an intemperament :

(a) material : jaundice.

(b) non-material :

(1) very cold intemperament : chalkiness ;

(2) very hot intemperament : citron-yellowness.

ii. Due to extraneous agents : scorching sun, extreme cold ; much exposure to wind ;

iii. The presence of unnatural colours in the skin : (a) brought into the skin (vitiligo nigra), (b) arising in it (freckles, maculæ) ;

iv. Relics after the healing of scars : pock-marks ; old ulcers.

3. *Affections associated with bad odours* ; Ex. : fœtor of the mouth, or objectionable odour of the whole or of portions of the body.

4. *Disfigurements.* Ex. : Great emaciation ; excessive bulk ; undue thinness and fatness. (Malformations.)

"Excessive corpulence and excessive leanness are especially worthy of condemnation" (Charaka-Samhita¹⁵⁵ : i. 233).

7. THE STAGES OF DISEASE

222. Many diseases show four stages—onset, increment, acme, and decline. These are distinct from the phases of health.

In speaking of “time of onset,” and “increment,” we do not wish to convey the idea that there are two extremes during which a state of disease is indiscernible. Each stage can be detected by the senses, and each has its own characteristic signs.

1. The “onset” is that period of time during which the disease is becoming manifested, and its characters are commencing to develop. There is no evident change in degree.

“Latent” disease belongs here; “occulta” as compared with the other three stages, which are “declared,” “visibilia.”

2. The “increment” is the period during which the *degree* of illness is hourly becoming more and more decided.

3. The “acme” is that period during which all the characters of the illness have become manifest, and remain so.

4. The “decline” (defervescence; terminal stage) shows abating of the signs of illness; and the further this period advances, the more nearly is there freedom from the symptoms of the diseases.

These stages may be applied both to the illness as a whole, and in regard to each of its component attacks or paroxysms. In regard to the whole course of the disease, they are called “general”; in regard to each of the attacks which occur in its course, they will be called “special” or “particular” or “individual” phases.

8. CONCLUDING REMARKS ON MORBID STATES

223. Diseases are named : (1) according to the member affected (e.g. pleurisy, pneumonia, sciatica, podagra, nephritis, arthritis, ophthalmia, etc.) ; (2) according to the chief symptom (epilepsy, spasm, tremor, paralysis, palpitation, cephalalgia, otalgia, cardialgia, odontalgia, neuralgia, etc. (3) From the originating humour (e.g. atrabilious disorder); (4) from resemblances to animals which the disease produces (e.g. leontiasis, elephantiasis, satyrimus); (5) from the first historical example of the disease; Telephic ulcer—Telephus, son of Hercules wounded by Achilles’ spear, but healed by its rust; Chironia ulcer—Chiron, the first who successfully treated ulcers medically; (6) according to the substance and essential nature of the disease—fever, inflammatory swelling.

224. Galen classified diseases into : (a) manifest, or evident to the senses; (b) hidden, or internal : (i) easy to recog-

nize (e.g. gastric pains, lung pains) ; (ii) difficult to recognize because not evident to any of the senses (e.g. diseases of the liver or of the air passages within the lung) ; (iii) only discernible by careful judgment (disorders of the urinary passages).

225. Diseases may occur in single members or in more than one. In the latter case there are the following possible relations : (i) association by natural connections ; ex.: stomach and brain, which are associated through nerves ; the uterus and breast which are connected by the veins.

(ii) One member is the channel for the other. Thus, the groin is the natural channel for inflammation to travel into the leg. The weaker of two of so related members will take up the excrementitious matters from the stronger ; for instance, the axillary region from the heart.

(iii) Simple contiguity ; e.g. the neck and the brain.

(iv) One member initiates the function of another. For instance, the diaphragm is concerned in the drawing of air into the lungs. (v) One member is the servant of another ; thus, the nerves serve the brain. (vi) Some third member is associated with two related organs. Thus, the brain is related to the kidney, and both these organs are related to the liver. (Disease in one is likely to have deleterious effects on the others.) (vii) *Vicious circles.* Disorder of the brain affects the activity of the stomach and impairs the digestion ; consequently the stomach supplies morbid vapours and imperfectly digested aliment to the brain, so increasing the disorder of the brain. Hence from the original illness, the malady spreads and continues, and runs in a circuit.

226. There are the following six degrees, ranging from health to disease :

1. Blameless health.
2. Not absolute health.
3. A state neither of health nor of disease, as people assert.
4. Potential illness ; where the body is on the verge of illness.
5. Slight ill-health.
6. Declared disease.

227. Diseases are curable or incurable. A curable disease is one which offers no resistance to treatment. An incurable disease is one in which there is some impediment to complete cure, so that whatever the doctor applies, the desired effect is not reached. For instance—headache which is due to “rheumatism.” A disease is more likely to be curable when the temperament, the age, and the season are in proper relation.

If not, there must be a serious causal agent at work. One can only hope to cure or disperse the diseases of one season during the contrary season.

228. Some diseases turn into new ones, and so themselves disappear. This is very satisfactory. *One disease becomes the medicament for curing another.* Thus, quartan malaria often cures epilepsy [cf. G.P.I.] also podagra, varices, and arthralgias. A spasmodic disease may be cured by scabies, pruritus, and furunculosis. A certain type of diarrhoea is cured by inflammation of the eyes. Lienteria cures pleurisy. Bleeding piles removes atrabilious disorders, including sciatica, renal and uterine pain.

But the passage from one disease to another may be a serious matter. For instance, when an empyema spreads into the substance of the lung ; when meningitis becomes lethargia.

229. Transmission of disease from person to person.

A. *Transmission by infection.* (i) From one house to an adjoining one. Here belong, lepra, scabies, variola, pestilential fever, septic inflammatory swellings and ulcers ; (ii) from a house in the wind-track to another ; (iii) when one person gazes closely at another (e.g. ophthalmia) ; (iv) fancy : e.g. when a person's teeth chatter because he thinks of something sour ; (v) such diseases as phthisis, impetigo, leprosy.

B. *Hereditary transmissions.* Vitiligo alba ; premature baldness ; gout ; phthisis ; lepra.

Place in Family as a factor in the causation of disease (*Lancet*, 1928).

C. *Racial transmission.*

D. *Endemic transmission.* The sweating sickness of Anglia ; elephantiasis in Alexandria ; aurigo in Apulia ; endemic goitre, and many the like.

230. Do not forget that weakness of members, and a frail body may supervene upon intemperaments.

§ 173. This classification of the types of disease still holds good to-day. The nomenclature is rather different, because now made more definitely in accord with pathological findings.

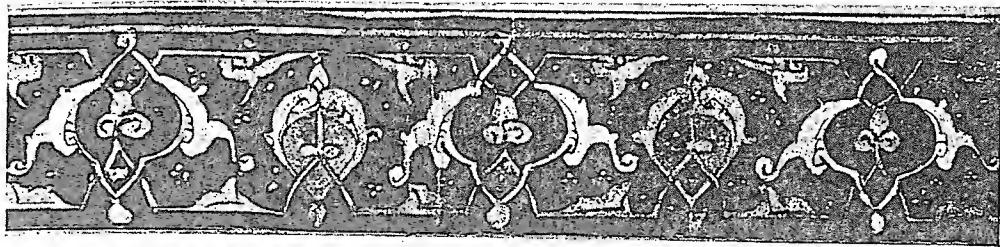
Some confusion as to the scope of the various terms still exists even in the minds of those who are no longer students. Clinical and pathological conceptions do not agree in scope. On the one hand, there is an underlying endeavour to specify "diseases," and to separate out new entities in accordance with variations in the clinical manifestations. In pathology, the distinction between general and special is more clearly adhered to, and the latter is described as much as possible according to the former—which is proper.

In regard to an actual case before us, however, the pathology cannot be elucidated at once ; the clinical manifestations therefore receive the chief consideration. But such manifestations are limited in range, are of general character (universal, not particular), and should rank with genera in natural history ; the pathological character or process would furnish the specific name. Clinically,

diseases naturally comprise swellings, deformities, discolorations, displacements, ulcerations, various solutions of continuity, aches and pains, and the like. Pathologically, there are only four main groups of lesions—inflammations, new-growths, nutritional changes (degenerations and hypertrophies), and errors of development. (The short list presented by Avicenna is not a real fault, when considered from such a point of view.) If such a system cannot be allowed either by academic medicine or the laity (who insist on a “name” for a “disease”) it has at least the advantage of enabling one to visualize from the first what is important to the patient and to concentrate on it.

The opposite procedure—that which rules the day—is that of describing diseases in all their forms and types, typhoid fever being awarded the crown. The literature is always receiving reports on new types of disease. This method has the advantage of being capable of unlimited extension, for the number of types is (as *should* be obvious) exactly the same as the number of individuals affected thereby. In other words, all these types are simply the expressions of the individual's make-up and have nothing whatever to do with the infective organism, except in so far as it varies in virulence (i.e., in the composition of its “excreta”).

The idea that treatment cannot be correct unless the “disease” is correctly named is also very widely spread, and has the same effect—that of blinding the mind to the real simplicity of truth. The unknowing abhors simplicity; he ever seeks to “improve”—that is, to introduce more and more complexity.



THESIS II.—THE CAUSES OF DISEASE ETIOLOGY

"Correlation, adverse or absent or excessive, between time, mental faculties, and objects of the senses, constitute in brief the threefold causes of disease affecting either the body or mind."—(Charaka-Samhita¹⁶⁶, i. 5.)

"If the activity of the life-principle takes place in a harmonious and regular manner, unimpeded by any obstacles, such a state is called 'health.' If its activity is impeded by some cause, and if it acts abnormally, or irregularly, such a state is called 'disease.'"—(Paracelsus²², p. 181.)

I. DEFINITION OF TERMS



231. There are three groups of causes of those states of the body which have been referred to as : health, disease, a state intermediate. These groups are : (1) *Primitive*, or extra-corporeal causes. These befall the body from without (trauma, heat, cold). (2) *Antecedent* causes. These befall the body from within (repletion, starvation). (3) *Conjoined* causes. Here disease is present only as long as two causes occur at the same time. When either is absent, the diseased state comes to an end (e.g. sepsis, in fevers).

The primitive causes are extra-corporeal ; namely : (a) from exterior agents, such as blows, exposure to very hot air, use of hot or cold viands ; (b) from the mind, which is here considered as distinct from the body. Here belong the causes of states of anger, fear, and the like.

Other examples : privation of food, shelter, covering ; environment (monotony, solitude, restraint, neglect, subjection, and their opposites). These are predisposing causes.

Resemblances.—The primitive causes resemble the antecedent in that there is a certain intermediate condition between each and the three states of the body named above. The primitive causes sometimes resemble the conjoined, in that there is no intermediate condition between them and the three states of the body. The antecedent and conjoined causes resemble one another in both being corporeal, or humoral ; that is, either temperamental or compositional.

Differences.—The antecedent differ from the primitive causes in being corporeal and in requiring an intermediary between them and the bodily state. Such an intermediary is not necessary in the case of the primitive causes.—The conjoined causes differ from the primitive in being corporeal, but without an intermediary between them and the bodily state. An intermediary may occur, but is not essential in the case of the primitive causes.—The antecedent differ from the conjoined causes in that with the former the state does not become immediately manifest, but only after a number of other intermediate causes have come into operation, these being nearer to the state than are the antecedent causes.

The above groupings of causes are the expression of a mode of thought now foreign to us. We seek more practical statements, and rightly. But when he thinks of causes, Avicenna goes back to fundamentals. This patient is before him, and the illness owes its origin to external factors which that patient cannot escape—the atmosphere, the weather, the climate, the drinking-water, the soil over which he lives and works; or to factors operating within the body, producing aberrations in the physiological processes.

The external factors naturally fall under the categories of the four elements (five, if we include "æther," represented by sunlight), and the memory is securely aided by thinking of each in turn.—The internal factors are classified according to the qualities—heat, cold, moisture, dryness. These also serve as aids to memory, since many aberrations in physiological processes amount to disturbances in these several qualities in the different parts of the body.

Changes of vitality as causes of disease are not here specified because they are secondary to the other causes. It is true that disease is evidence of loss of vitality, of loss of *radiance* of the "breath," but this is the effect of "antecedent" causes—repletion with humours; depletion of humours; and these again can be traced back to interactions of qualities and changes in the proportions of the "elements."

The following table is added for clearness :

Name of Cause.	Nature.	Relation to bodily state.	Examples.
1. Primitive.	Non-corporeal.	May be direct, or may only be through an intermediate state.	Solar heat. Violent exercise. Heating articles of food (e.g., garlic). Sadness. Wakefulness. Blows. Cataract. Fever.
2. Antecedent.	(1) Corporeal (i.e., a humour). (2) Temperamental. (3) Compositional.	Is indirect, via an intermediate state.	Suffusion of the orbits. Lachrymation. Repletion in fever.
3. Conjoined.	Corporeal.	Direct; immediate.	Blockage of an aperture by a humour. Blindness from obstruction of the optic nerve. Sepsis with fever.

282. Essential causes are such as pepper, which warms ; opium, which cools. Accidental causes are such as cold water, which warms because it closes the pores of the skin, and hence the heat is retained ; hot water, which cools because it opens the pores and liberates the heat ; scammony which cools by expelling the calefacient humour.

An essential cause is one which alters the "nature" ; that is, that on which the primary qualities of the body (heat, cold, moisture, dryness) depend.

283. It does not follow that a causal agent will alter the body even if it reaches it. Before the agent can act one of three conditions must be fulfilled. (1) The agent must be powerful enough ; (2) the preparatory power of the body must be adequate ; (3) there must be an appropriate time-factor. The agent must be exposed to the causative agent long enough for the latter to act. The states of the causes vary in their results. One single causal agent may give rise to quite different diseases in different persons, or at different times.

The Time-factor.—The time occupied before a given agent can produce its effect varies with different individuals, just as some persons have a long digestive time-factor and others a short one. This was spoken of very long ago (*Charaka*¹⁵⁵, ii. 793) ; the lesson being, in the case of digestion, that the number of meals per day should depend on the time-factor and not on popular custom.

A. UNAVOIDABLE CAUSES OF DISEASE

(i) EXTRACORPOREAL

2. THE ATMOSPHERIC AIR AND ITS INFLUENCE WITHIN THE BODY



AIR (234) is an element which is in our body and in our breath (ruh). It is also continually being contributed to the breath. It is the agent which modifies the breath, not simply as element, but in virtue of its constructive and attempering nature.

235. We have made it clear already, and emphasize it again here, that the term "breath" is not synonymous with what philosophers (and theologians) term "soul."

236. There are two processes whereby the breath reaches its attempered state from the air—namely depuration and ventilation. Ventilation is the means whereby the temperament of the breath is modified in respect of the undue warmth which is

usually the effect of condensation and imprisonment of the breath. (By temperament we mean that relative temperament which has been defined for you.) This attempering is attained by means of the air drawn in at the lungs and the pores of the skin, and by means of the distribution of that air through the arteries by means of their pulsation.

237. Compared with the temperament inherent in the breath, the air around us is very much cooler than it is compared with the temperament arising from the imprisonment or condensation of the breath. When the outer air enters the breath, it drives it on and mingles with it, and so prevents its transformation into the astringent fire-element ; for such a transformation would render the temperament of the breath faulty and unfitted for receiving the impressions of the sensitive soul (i.e. for maintaining life), and would interfere with the dispersal of the moist vapour of the substance of the breath.

238. Depuration is the process going on during expiration, and by it the separation of the fuliginous vapour in the breath is secured. The fuliginous vapour is to the breath what superfluous humour is to the body, and it is expelled (as bad air). During inspiration, the air enters into, pervades, and aerates the breath ; during expiration, the breath is purified into the air. (In this way the temperament of the breath is maintained.)

239. When the air is first drawn in, it necessarily cools the breath, but after the air attains the quality of the breath, through continued contact with its heat, it ceases to be an adjuvant, and is superfluous. Hence new air is needed, and when breathed in supplies the place of the other. The old air must be expired in order to give place for the new, and at the same time remove with it the superfluities of the substance of the breath.*

240. As long as the air is attempered and pure, and has no substances admixed which would be contrary to the temperament of the breath, health will come and remain. Otherwise the contrary occurs.

241. The air is liable to natural as well as non-natural changes, and may even undergo preternatural changes. The natural changes are those of the seasons. At every season the air changes to a new temperament.

* It appears that the idea of gaseous interchange within the lung was not grasped. What we know as "residual air" comes to be what Avicenna speaks of as "breath" (*ruh*). Hence the description in the text is right in idea, but lacking in exactitude.

Antyllus remarks that the air is different in character (*a*) at the seasons of the year, (*b*) at the changes of the moon, (*b¹*) at the rising and setting of the stars (Aegineta), (*c*) at the hours of the day and the night, (*d*) according to its thickness or tenuity, (*e*) during movement or repose (winds or calm), (*f*) if admixed with terrene exhalations, (*f¹*) admixture with mists (Aegineta), (*g*) the kind of country, and its physical characteristics (Aegineta).

(*a*) NATURAL MUTATIONS

3. THE INFLUENCE OF THE SEASONS ON THE ATMOSPHERE

242. The word “Season” has a different meaning for the physician than for the astronomer. According to the astronomer, there are four seasons, which are reckoned according to the position of the sun in the zodiac. According to the physician, spring-time, in temperate climates, is the time when warm clothes are less necessary, and yet no precautions are required against heat. The trees begin to leaf at this season. It is the time of flowers and leaves, and the beginning of the formation of fruits. To be more exact, it is the portion of the year between (or about, or slightly before, or slightly after) the vernal equinox and that at which the sun has reached the middle of Taurus.

Autumn is the opposite portion of the year in our latitude. §

§ This chapter is taken by Andreas de Alpago Bellunensis as the proof that Avicenna was a native of Persia. (cf. footnote to 369).

It is the time of change of colour in the leaves, and the beginning of their fall from the trees.

In some countries spring may come sooner and autumn later.

The summer and winter, from the point of view of medicine, are the portions of the year remaining—and the interval between spring and autumn is much shorter than that between autumn and spring.

Summer is the whole of the hot season, and winter the whole of the cold season. It is the season opposite to summer, being less or greater in duration according to the latitude.*

Summer and winter are the “strong” seasons, spring and autumn are the “weak” seasons.

243. The temperament of spring is equable, and not hot and moist as some think. The proof of this rests with natural philosophy.

The temperament of summer is hot, because the sun is

* This passage is slightly rearranged.

nearly vertical, over our heads, at this period. The power of the rays of the sun may be thought of as being concentrated in summer because instead of being refracted they form only a very acute angle, or are reflected back along the line of incidence itself. The effect is different according as the solar ray is axial, like the axis of a column or pyramid (in which case the ray is thought of as coming from the centre of the sun into an exactly opposite spot on the earth's surface), or is oblique. The axial ray is stronger because its impression is added to by the incoming rays from all other points. The oblique rays are the weakest (because in this case rays from other points do not join and add to them). In summer we are exposed to rays almost or quite axial. This is the longest season in our (southerly) climes. In winter the rays are nearly circumferential (tangential, oblique).

244. In summer the light is very intense, and yet the sun is more distant from the earth, for the sun is on the increase. However, I discuss the subject of the distance or nearness of the sun in the astronomical section of my book on mathematical philosophy. The proof of the intensity of the heat and of the light of the sun is set forth in my book on natural philosophy.

245. *Influence of summer.* Summer makes the air hot and dry, because (1) its great heat disperses the water vapour ; (2) it attenuates the " substance " of the air, and makes it more like " fire " ; (3) there is little in the air at this season to separate out as rain or dew.

246. *Influence of winter.* Winter makes the air cold and moist, for contrary reasons.

247. *Influence of autumn.* In autumn, the heat subsides and the cold is not yet at its greatest because we live at a latitude where the rays are between the equatorial axis already referred to and the circumference. That is why the temperament of the air is between hot and cold, but not between moisture and dryness. When the sun has rendered the air dry, how could there remain behind in the air any humectants which would counteract the source of desiccation ?

248. A state of the air tending towards coolness is not like one tending to moisture, because the change to cold is only slight, whereas the change to moisture is further. The change towards moisture which coolness induces is not as easily effected as one towards dryness, which heat induces. The latter is facilitated by heat because heat itself is a drying agent. Coldness is not a humectant. Humectation is facilitated by a certain degree of heat provided there is some substance present which possesses

a certain degree of coldness. A certain amount of heat allows evaporation, but does not disperse (water vapour); and there is a certain amount of cold which is inadequate for bringing about inspissation, cohesion, or union.

249. Consequently, the state which enables the air of spring to remain at the same degree of moisture as in winter is not like the state which enables the air of autumn to remain at the same degree of dryness as in summer. The moisture of the air in spring is attempered by heat as much as the dryness of air in autumn is not modified by cold. Moisture and desiccation, therefore, are alike in regard to the action of "habit" and privation but not in regard to the action of their respective contraries. For, in this case, desiccation is simply "destruction of moist substance"; but humectation is not "destruction of dry substance," but "acquisition of moisture."

250. In speaking here of air as being "moist" or "dry" we do not, of course, refer to "form" or "natural quality." Such a question is remote from our present purpose. In calling air "moist" we mean that much aqueous vapour is admixed with it, or that its density has reached that of aqueous vapour. In calling air "dry," we imply (i) that the aqueous vapour formerly present has been dispersed, or (ii) that the air has become rarefied or attenuated until it comes to resemble the substance of Fire, or (iii) an air with which earthy vapours (which resemble Earth in being dry) are admixed.

251. Consequently, the moisture in the atmosphere which remains over from the winter is lessened in spring by a certain amount of heat accruing to it by the fact that the sun is approaching the middle of the heavens, and coming to be nearly overhead. But the dryness which remains over from the autumn does not encounter any moisture from the approaching coldness of the winter.

252. Further, would dry things become moist as quickly in cold air as moist ones would become dry in hot air, supposing the ratio between the cold and coldness to be about the same as that between heat and hotness? Obviously there would be a difference.

253. A third and better argument is that moisture cannot remain longer in hot air than in cold unless it were continually being reinforced by further additions of watery vapours. Dryness, however, needs not such continual emanation for its maintenance.

254. The reason why moisture disappears from bodies

exposed to the air, or from the air itself, unless there is a continual reinforcement with further moisture, is that air is only cold in comparison with our body. It is not sufficiently cold in the places we inhabit to enable the moisture to be dispersed from the atmosphere. It is the power of the sun and the stars which disperses it. Consequently, though the supply of moisture ceases, the dispersal goes on until a state of dryness is rapidly reached.

255. *The atmosphere in spring.* In spring, there is more loss by dispersal than by evaporation. The reason is (1) there is little heat, and that is dispersed widely in the atmosphere ; (2) much heat is shut up in the bowels of the earth. Hence rarefied vapours are continually being *breadth out* towards the earth's surface.*

256. *The atmosphere in winter.* During winter the amount of heat concealed within the earth is very great—as is proved in treatises on natural science—whereas there is only a negligible amount of heat in the atmosphere. So there are two factors which together contribute to moisten the air—sublimation and condensation. This is the more so, because the substance of the air in winter is so cold that it becomes more dense, and adaptable for evaporation.

257. In spring, attenuation (dispersion) in the atmosphere exceeds evaporation. There is much less heat concealed in the earth. This is clear from the fact that something suddenly comes to the earth's surface at this time† which is more potent than the evaporating or the rarefying agent. This great access of material delays the evaporating process, and brings the (moisture) longer into contact with the abundant atmospheric heat ; and this completes the dispersion of the moisture.

This is the chief explanation of the fact that the vernal air fails to retain the bulk of the winter moisture, and that the autumnal air fails to retain the bulk of the summer dryness—apart from other reasons over and above what we have named.

Furthermore, there is not enough material to replace what has been sublimed and rarefied. The result is that the nature of spring necessarily tends to an equipoise between moisture and

* Note the accuracy of this conception.

The fancy or jest that summer-heat and winter-cold are the result of “the greatness of the boiling of ‘Hell’ (i.e., the interior of the earth) makes a breathing twice a year, expiring in summer and inspiring in the winter” (Night, 487, Burton) may be here recalled.

† “The vapours of the sky descend, and vapours rise up out of the earth” (in spring). “The two co-operate in the work of renascence of vegetable life” (Li Ki, IV, i. 14).

dryness, as much as it does to one between heat and cold. Still, one cannot deny that in spring there is at first a tendency to a certain degree of moisture. But in spring the moisture is *nearly* at equipoise, just as in autumn the dryness is nearly at equipoise. Even if there is in autumn not an exact equipoise between heat and cold, it will not be far from that, because in autumn the periods of the day just before and just after noon are like those in summer. The autumnal air, you see, is very dry, and can readily become warm and fire-like, summer having already disposed it to be so. But the nights and morning hours in autumn are frosty, owing to the obliquity of the sun's rays, and also because the tenuous matter in it is well disposed to undergo infriagation.

Spring air has these two qualities in almost exact equipoise, because its air does not take up the heat and cold which the autumnal air so easily receives. That explains why the autumn night is not very different from the autumnal day. And if anyone should ask for why is an autumn night colder than a spring night, as one would expect the atmosphere to be then hotter, because it is so attenuated—he may have the reply that extremely attenuated air becomes hot or cold more quickly, exactly as does extremely rarefied water. For, if you heat water, and then wish to freeze it, it will do so more quickly than cold water would, because the cold penetrates more easily between the particles separated from one another by the preceding heat.

258. The human body is not as sensitive to the cold of spring as it is to that of autumn, because in spring the body passes from a coldness to which it is already acclimatised, to an increasing warmth. In autumn, the reverse is the case, for after being relaxed by the summer heat, the body is suddenly hit by cold ; this in spite of the fact that autumn approaches winter, whereas spring recedes from it.

259. Change of seasons has to do with the kind of diseases peculiar to each climate. Consequently the prudent physician will carefully study his own climate (atmospheric conditions day by day and month by month) and country in order the better to treat the diseases and maintain his patient's health by an appropriate mode of life, and (in order the better to choose) the regiminal measures appropriate to that climate and country.

260. Sometimes one day of a season is like some one day of another season ; and sometimes it is not. Some days in

winter are spring-like ; some spring days are summer-like ; some days in autumn are hot and cold during the course of a single day.

§ 174. The changes which the seasons produce on the human body are ascribed in this chapter at least in part to the changes which the seasons produce in the ground itself. We are introduced to the idea of "ground-air," "ground-water," "ground-fire" (mod. ground-temperature). That which the Canon here hints at is found to be entirely accurate in the light of modern investigations.

§ 175. *Movement of ground-air.* In the interstices of the soil there is an abundance of "vapour," which moves in and out of the earth into the atmosphere, as the ground-water moves up and down. We may rightly picture the earth as a huge lung. It exhales ground-air into the air we breathe, and if the former is humid, owing to a high ground-water level, the exhaled air will be "damp"; if the temperature of the earth be low, the exhaled air will be cold; if the ground-air be polluted the air we breathe will become fouled. The conception of the earth as a lung is given in almost those very words by Avicenna (255).

§ 176. *Movement of ground-water.* The ground-water may move merely up and down, or it may travel horizontally even to great distances. Its height varies with the rains, the season, the nature of the rock beneath, the character of the subsoil, and the presence of vegetation (crops, undergrowth, woodland, forestland). The movement up and down may be compared with tidal movements. The "waters under the earth" move, as do the seas. Clearly, then, floods and droughts, swampland and gravelly land, all have wide effects. The interference with vegetation also alters natural conditions, whether beneficially or detrimentally to human welfare. Lane-Notter (Enc. Brit. 25, p. 348), states that it has been estimated that an acre of cabbages will absorb from the land, and transpire from its leaves more than ten tons of water per day, when the weather is fine. The destruction of trees arrests the upward movement of ground-water, which previously was carried high up into the air as if by so many chimneys, and so affects other places at considerable distances.

§ 177. *Practical bearing of these facts.* Innumerable living things pass the whole, or part of their lives in the ground-water. They are carried along with it, both to the surface, and horizontally underground, possibly to great distances. The following groups may be specified : (1) Bacteria. These are derived from (a) the earth's surface from refuse in the neighbourhood of habitations, from excreta, trade-effluents, slaughter-houses, (b) deeper strata : cess-pools, which do not necessarily filter off the organisms. (2) Protozoa. (3) Moulds and spore-bearing organisms generally. (4) Invertebrates of many orders.

These all flourish according to the presence of putrefactive

matters in the soil (vegetable or animal), according to the ground-temperature, and according to degrees of anaerobic state (which has to do with cycles of development).

"The earth is a great stomach, in which everything is dissolved, digested and transformed, and each being draws its nutriment from the earth; and each living being is a stomach that serves as a tomb for other forms, and from which new forms spring into existence."—(Paracelsus, *Paramirum*²⁹, p. 205.)

Organisms gain access to the human body (*a*) directly from the surface soil, from the drinking water, from insufficiently cleansed vegetable foods, in partly decayed vegetables or vegetables which have become stale in the markets, from the inhalation of infected dust (especially the dust of earth pulverised by being parched in times of drought), (*b*) indirectly, by contamination of food by insects whose larvæ infest the soil to an extraordinary extent; by use of vegetables infected by invertebrates which themselves harbour pathogenic organisms.

§ 178. *Diseases associated with ground-water.* Damp soil favours putrefaction, with ultimate pollution of the air. Phthisis is favoured in such localities. When the soil is actually wet, from the rising of the ground-water, typhoid epidemics have been noted (Pettenkofer). Fleas on rats which burrow into soil polluted by plague-infected ground-water become infected themselves.

§ 179. *Diseases associated with variations of earth-temperature.* Cold soil favours bronchitis and other chest complaints. Warm soil favours the multiplication of certain organisms—those which flourish best at certain temperatures, and anaerobically. (Favoured by admixture of the soil with manure.)

§ 180. The subject is therefore plainly of importance both in regard to the study of pandemics, epidemics and endemic diseases and in regard to the daily condition of the individual patient, the progress of his disease, and even the exact form which a disease takes in his case. As Avicenna says, the practitioner would benefit by noting the successions of weather-changes, the type of the season and the seasonal cycles, especially interpreted in terms of movements of the water, air, and "fire" in the earth.

4. THE INFLUENCE OF SEASONAL CHANGES ON THE BODY

261. When a season is harmonious* for a person of healthy temperament, it is appropriate for him, but not so if the

* "Harmonious."—Cf. "conformity with the laws of nature" (Li Ki,⁴⁷ VI, p. 535). In this case the season is considered as the variable, and the human temperament the constant. But it may be noted that the whole of our life is a matter of "conformity with the laws of nature," from highest to lowest. If the "Government" conforms in all respects, thus exhibiting the Great Conformity—requiring master minds and master wills—and if each individual in turn conforms, the society would become the ideal state. The application in regard to the incidence of disease in the individual being is very wide, and this section of the Canon becomes suggestive to a most interesting extent when the Classic just quoted is considered in association with it.

person is of unhealthy temperament. But* if deviation from equipoise be marked, then the season will be harmonious or not correspondingly, but the person may become debilitated.† When a season is appropriate for a person of unhealthy temperament, the contrary holds.

262. When the nature of two seasons at the commencement is opposite to that at their termination, and yet the alteration from the mean is not great (because not of long duration), as, for example, when a southerly winter is followed by a northerly spring, the second season will be more beneficial to the human body than the first, and will attemper the body. This is because the northerly spring is opposite in action to the southerly winter. If the winter be very dry and the spring very wet, the latter modifies the dryness of the former. But if the spring is not very humid and does not last long, then its modifying moistening influence will not be deleterious.

263. A single seasonal change is less injurious to life than are repeated changes—supposing the change in question is liable to prove mortal, and not one which reverses a previous change.

264. Among the temperaments of the atmosphere one that is hot and moist is more favourable to putrefactive processes.

265. Atmospheric changes are common in some regions, especially in the depths of the valleys ; they are only rare on hills and high mountains.

266. It is better when seasons are normal in character ; it is better that summer should be hot and the winter cold ; so with each season. If seasons are not normal in character, serious maladies will arise.

267. If all the seasons in one year are of uniform quality (for instance, wet, dry, hot, cold, all through the year) it is a bad year ; there will be many diseases in conformity with the quality of the year. The subsequent seasons will be fortunate. If a single season can arouse much illness of corresponding type, how much the more will not a whole year arouse ?

268. A person of phlegmatic temperament is liable to develop epilepsy, paralysis, apoplexy, trismus, convulsions and the like, *in a cold season*.

269. A person of choleric temperament may develop delirium, mania, acute fevers, acute inflammatory swellings *in a*

* i.e., Taking the human nature as the variable, and the laws of nature as the constant.

† i.e., A non-proportional season would make a very non-equable person weak.

hot season. How much the worse would it not be if the character of that season persisted throughout a whole year?

270. With a premature winter, winterly diseases come on early. With a premature summer, summer diseases arise early. The diseases of the corresponding season will change accordingly.

271. An unduly prolonged season predisposes to many illnesses, especially in the case of summer and autumn.

272. Note that the effects of the changing seasons are not due to the season itself, but to the quality which is changed along with them, for this exerts a marked effect upon the states of the body. A change from heat to cold in the course of a single day, produces a change in the body accordingly.

273. A rainy autumn followed by a temperate winter (not without some cold, and yet not too cold, considering the geographical region) is more healthy. A rainy spring followed by a moderately rainy summer would be more likely to be healthy.

See also 581, where the effect of the seasons on the pulse is discussed.

5. THE PROPERTIES OF HEALTHY AIR

274. The substance of the air is good when (1) it is not contaminated with extraneous matter, such as the vapours [from marshes or lakes, or from canals or open sewers : Aegineta ; or the gaseous products from chemical works, etc. : modern], or smoke and soot.* (2) It is open to the sky [i.e. not shut in by high mountains: Aegineta; and, generally, is able to circulate freely round us : Nash]. (3) Is not confined in caves [cf. Grotto del Cane], or between high walls, or shut up in houses (or in underground cisterns).

275. Once a putrefactive process has begun in the air, it is more likely to continue if the air is free and exposed than when it is enclosed and concealed. Except for that, it is better that air should be free and exposed.

276. Healthy air remains clear unless there be admixed with it vapours from lakes or from stagnant and deep waters or marshy lands, or from places where potherbs are cultivated—especially cabbages and herb rocket ; or where certain resinous trees or trees of bad temperament (box, yew) grow, or where nuts or figs grow, or where there are offensive odours and evil-smelling

* One may also add: germ-laden dust, or particles of saliva and exhaled particles of moisture charged with possibly pathogenic microbes. Note that exhaled air contains 0.5 per cent. of organic impurities, which are much more a source of disease than the carbon dioxide gas produced by respiration.

winds. In short, the air remains clear if healthy winds, coming from high or level ground, blow over the district.

Such air is not retained deep in the earth. It becomes warm quickly after sunrise, and becomes cold quickly after the sun has set. The air found confined within the walls of recently built houses, is not likely to be healthy, as the air is not quite dry owing to the lime in the walls.

Air is good when it does not interfere with one's breathing or cause the throat to contract.

277. You have already learnt that changes occur in the air which are (1) in accord with its nature, (2) contrary to its nature (preternatural), (3) neither the one nor the other.

Of the changes in the atmosphere which are not in accord with its nature, these are either contrary to or not contrary to it. Sometimes the changes run in cycles, sometimes not ; they may occur at certain seasons ; they may be periodic, and sometimes not.

It is more healthy if the seasons accord with the nature of the atmosphere, for otherwise illnesses come about.

§ 181. The effects of the different climates (hot, cold, damp, dry) on the body, and the diseases associated with each are given by various ancient writers, but the statements often are at variance with one another. It is sufficient to consider the possibility that, apart from infective agents, the temperature and humidity of a region affects the nutrition of the body, the vigour of the body, and is accompanied by liability of certain organs to disease (gastric, pulmonary, cerebral, cardiac).

The humidity of the air has been studied in modern times in its relation to liability to induce disease. The average normal relative humidity is 75 per cent. ; excess of moisture makes the air feel chilly. Mists are detrimental because they absorb the warming rays of the sun.

Stagnant air produces "stuffiness," for instance in rooms. This is due to the air heated by the skin remaining close to the skin, and preventing the latter from cooling. The surface circulation fails to receive its proper stimulus in consequence.¹²³ (p. 120.)

The following passage in the *Su-wén* is of interest : " *Huang Ti* asked in what manner cold and heat, dryness and moisture, wind and fire operated on man, and how they produced the transformation of all things." *Ch'i Po* replied : ". . . the Five Fluids come forward in turn, and each of them takes precedence once. When they do, do not keep in their proper spheres, there is disaster ; when they do, everything is well ordered," etc. (Forke,²³ p. 250-252.)

6. THE INFLUENCE OF THE CHANGES IN THE QUALITY OF THE ATMOSPHERE ; THE DISEASES INCIDENT TO THE SEVERAL SEASONS AND KINDS OF WEATHER

278. *Hot atmosphere.* A hot atmosphere disperses the breath and has a relaxing effect. A moderate degree of heat induces redness by drawing blood to the surface of the body. A great degree of heat results in a yellow colour because it breaks down (the components of) the blood which has been drawn to the cutaneous vessels. It also evokes sweating, diminishes the amount of urine, impairs the digestion and induces thirst.

Cold atmosphere. A cold atmosphere has a constricting effect. It strengthens the digestion, and increases the amount of urine. The reason for the latter is that it causes the humours to become imprisoned, so that only a small portion of them can become resolved into sweat. Another reason is given presently. Cold induces constipation because the anal muscles remain tightly contracted and the rectum does not respond to the call of the intestines ; hence the faeces linger long in the intestines instead of descending (out of the sigmoid), and their watery constituent is re-absorbed and passes into the urine.

Moist atmosphere. This has a softening effect on the skin, and renders the body moist as a whole.

Dry atmosphere. This has a drying effect on the skin, and renders it rough and dusky.

279. *Fogs.*—Foggy air has a depressing effect on the mind, and disturbs and confuses the humours. This kind of air is not the same as “dense” air, for the latter is dense in substance, whereas foggy air is so because the particles with which it is mingled are coarse (nearly or actually visible). The sign of such an air is that stars of small magnitude are scarcely seen through it, and even the brilliance of the planets is reduced to the luminosity of fixed stars. Murky air is produced (when it is very cold) by the presence of much fuliginous vapour, and of smoke, or by absence of good winds.

This will suffice about this subject for the present ; we shall return to it later in speaking of preternatural changes in the air.

280. *THE SEASONS.* Every season has its own proper characteristics. The characters occurring at the end of one season, and the diseases associated with this, agree with those occurring at the beginning of the next season.

CHANGES WHICH SPRING PRODUCES IN THE BODY.

281. When the temperament of the spring conforms to type, it is a very healthy season ; its temperament corresponds to that of the breath and of the blood, although the fact of its being in equipoise, as already explained, makes it tend towards the tenuity and enervating character of hot air, and also towards moisture. It renders the skin ruddy by drawing the blood to the surface to a moderate degree, and yet it does not effect that degree of dispersal of the breath which an overhot summer does.

At this season of the year, the humours of the body, hitherto stagnant, bestir themselves and circulate. Chronic disorders are therefore met with. In persons of atrabilious temperament the atrabilious humour comes into activity. Persons who have overfed during the winter without taking much exercise, so that the humours are redundant, are liable to spring-time diseases because these immature humours now become active and disseminated (through the tissues).

A spring which is prolonged without losing its attempered character will be followed by few diseases in summer.

282. *The diseases of spring.* Nosebleeding, effusion of blood, fermentation in the atrabilious humour or in the biliary humour. Inflammatory deposits ; carbuncles ; anginas (which may be of severe type) ; abscesses of various kinds. Varicose veins may "burst," there may be haemoptysis, and a cough becomes increasingly troublesome especially if the early part of spring be winterly. Those persons who have such disorders, and most of all, phthisis, will be in a worse state.

[Bronchitis, Bronchopneumonia, Influenza. In early spring : Measles.]

In persons of a phlegmatic constitution, the season of spring brings movement of the serous humour, and there is a tendency to apoplexy, paralysis, and joint trouble. Such disorders are more likely to arise if there be any vigorous corporeal or psychic movement (emotion), or if calefacient articles of food are included in the diet, for all these enhance the effect of the atmosphere at this season.

The most efficient means of averting maladies incident to spring : venesection ; purgation ; semi-starvation, or restriction of food, increasing the fluids (especially syrups), but reducing the intoxicating liquors, and even then taking them only diluted.

283. *Relation to periods of life.* Puberty and the time of life thereabout are benefited by spring-time.

CHANGES WHICH SUMMER PRODUCES IN THE BODY.

284. In summertime* the humours are dispersed ; the faculties and natural functions are impaired owing to the excessive dispersion. The blood† and serous humour are diminished in amount ; the bilious humour increases in amount ; and, towards the end of the summer, the atrabilious humour increases in amount as a result of the dispersion of the attenuated matters, whereby the heavier particles stay behind in increasing amount. This is why old persons and those of similar nature feel stronger in summer.

The colour of the body becomes citron-yellow as a result of the dispersal of that which the summer heat draws out of the (surface) blood.

285. *Effect of Summer on the course of diseases.*—In summertime diseases show shorter stages. For, on the one hand, in robust persons, the warm air helps to disperse and mature the disease-matter, and also discharges it from the body. On the other hand, in weakly persons, the atmospheric heat only adds to their weakness by its relaxing influence. The sick person will therefore lose his strength and die. Furthermore, if the summer be hot and dry, illnesses are quickly broken up ; whereas if it be wet, the humours becomes glutinous in character, the stages of the diseases are prolonged, and recovery is delayed. In that case the disease comes to be of long duration. For instance, a simple ulcer may become obstinate, may spread, and may deepen. Dropsy and lienteric diarrhoea, and looseness of the bowels are liable to occur. This is all because of the flow of redundant humours downwards from the upper parts to the lower.

286. *Diseases specially associated with the hot season.* If very hot : tertian, continued, and burning fevers ; emaciation ; pains in the ears ; ophthalmia. If cupping be not done : erysipelas is common ; also furunculosis. (These are of like nature to summer.) If spring-like : mild benign fevers, in which the tongue and fauces do not become rough and harsh, and there is no dryness of skin. This is because the sweating continues in plenty, especially at the crisis. For the heat and moisture co-operate with it—and the former resolves the humours, the latter softens the skin and opens the pores.

If southerly : deaths are frequent. Variola, morbilli, and similar serious diseases are common.

* In summer the ground temperature is highest (up to 63 deg. F. at the end of August or in September).

† The blood is "thin" in summer ; "thick" in autumn.

If northerly : this is favourable to health. If diseases arise, they are diseases of "expression" ; that is, disease-matter is caused to circulate by the action of the innate heat as well as by the exterior heat ; then, being exposed to the cold atmosphere, it is expressed from the body. This occurs in rheumatisms, catarrhs, and their sequelae.

If northerly and also dry : this is beneficial for persons of phlegmatic constitution, and also for women. Persons of biliary constitution are liable to develop eye-trouble, acute fevers of long duration, and diseases due to the oxidation of an excess of biliary humour (which has accumulated in such persons), and diseases arising from a redundancy of the atrabilious humour.

[Summer diarrhoea, and bowel diseases, and enteric.]

§ 182. That the frequency of disease in hot weather is to be partly ascribed to the multiplication of flies under the favouring influence of the ground heat and warm air was of course not known in Avicenna's time. On the other hand, the cause of souring of milk in hot weather is still not understood, and the incidence of some febrile conditions is parallel.

CHANGES WHICH AUTUMN PRODUCES IN THE BODY.

287. The autumn season brings many diseases for these reasons : (1) there is exposure to a hot sun by day, and the nights are cold. (2) The humours are vitiated by the following : (i) abundance of fruits in the dietary. (ii) bad articles of diet. (iii) dispersion of attenuated matter, leaving dense particles behind and these then undergo oxidation. (iv) in summer the fermenting humours pass to the skin and the natural faculties can be brought to bear on them so as to disperse and expel them ; but in autumn, the cold atmosphere causes the humours to be thrown back into the interior parts, where they accumulate and are (as it were) imprisoned. (3) The vigour of the body has been impaired by the preceding summer.

288. In autumn, the blood is much less in amount because this season is contrary in temperament to the blood. Consequently it cannot help blood to form, and that which the summer has already dispersed is not replaced. On the other hand, the biliary humour becomes relatively increased during the summer, and predominates during autumn. The atrabilious humour is more abundant at the end of summer because of the oxidation of the humours during summer, and this produces ash-like residues, which tend to sediment under the influence of the autumnal cold.

289. *List of autumnal diseases and disorders.* (i) Fevers : composite ; quartan—due to abundance of atrabilious humour and the agent already described ; associated effects—enlarge-

ment of the spleen, oliguria (the urine only passes drop by drop owing to the temperament of the blood being diverse—between heat and coldness), dysuria (partly because the urine only comes drop by drop), lienteria (because the cold drives the rarefied portions of the humours into the interior parts of the body); simple hectic fever; this is more severe during this season because it is desiccant in character.

[Scarlet fever: diphtheria.]

(ii.) *Diseases of the individual organs.*—*Skin*: impetigo, excoriating scabies; “canker”; pustules (especially if the autumn be dry and the preceding summer was hot).—*Throat*: acute “choleric” angina.

(Cf. the corresponding disease in spring, in this case due to serous humour the reason of the difference of humour in the two forms lies in the fact that the season preceding in each case favoured the prevalence of that humour, and it is this that constitutes the “soil” upon which the anginal infection thrives.)

Lung: Autumntide is harmful for persons suffering from phthisis and chronic pulmonary affections. If a person had such a disease latent in him at the onset of autumn, he would show the signs of it at the end of the season. *Brain*: apoplexy; mental disease is common because the biliary humour is unhealthy and atrabilious humours are admixed with it.

[*Intestinal tract*: diarrhoea, etc.]

(iii.) *Pains*: in the joints; sciatica; pains in the back and hips (due to the stagnation and subsequent imprisonment of the insoluble parts of the humours which summer brought into circulation).

Worms.—These multiply because digestion is deficient, and there is lack of expulsive action.

290. Autumn is, so to speak, the foster-mother for the disorders left by the summer-time. Autumn is more healthy if the weather be very damp and rainy, and is more unhealthy if the weather be dry.

291. *Relation to Periods of life.*—The first part of autumn is to some extent beneficial for old people, but the last part is very injurious for them. (In the first place there is the cold, in the second place there is the residue of the oxidation of humours of summer-time).

CHANGES WHICH WINTER PRODUCES IN THE BODY.

292. Winter is a help for digestion, because the cold weather as it were embraces the innate heat and fosters it, and makes it more concentrated and less prone to dispersion.

That is why fruits are scarce, and why people feel the need

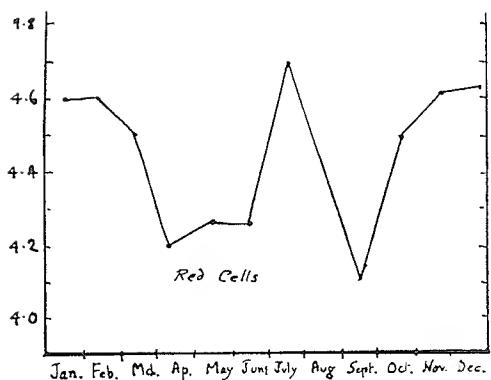
only of light aliments, and take little exercise after a good meal, and gather together in warm places.

293. In winter there is much sediment in the urine, as compared with the summer, and the amount passed is greater. The bilious humour is lessened in winter because it is cold, and the day is short and the nights long. The insoluble portions of the humours are more confined. During the winter, therefore, the diet should include more incisive and more attenuant aliments.

294. *The disorders of wintertime.* These are chiefly phlegmatic in character. The serous humour is plentiful at this period. Thus, it is very often present in vomited matter ; inflammatory foci are usually of a whitish colour in wintertime ; coryza is common, and begins when the autumnal air is changing. Less common are : pleurisy, pulmonary inflammations, hoarseness and sore throat. Less common still are : pains in the chest, side, back and loins ; nervous disorders (chronic headache) ; especially apoplexy ; epileptic seizures. In all these cases the serous humours are aggregated and confined, besides being increased in amount.

295. *Relation to Periods of Life.*—Winter is inimical to old persons and to those akin to them in nature.* Middle-aged persons are likely to be in health in this season.

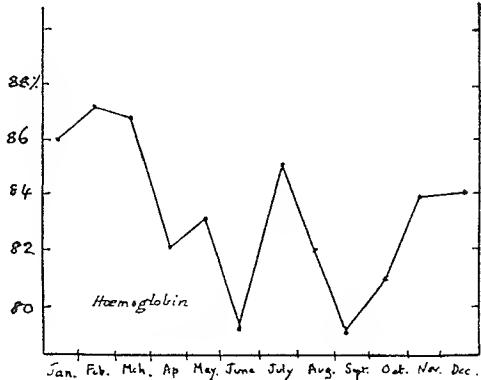
§ 183.—The following curves showing the seasonal variations in the character of the blood (red cell content ; haemoglobin) as made out by modern investigations, are of interest in connection with the above (280-295).



A

A. Curve showing the variations in red cell count in the same person throughout the year. 1-12, the successive months of the year ; 3.9-4.8, number of million red cells per c.mm.

B. Curve showing the variations in haemoglobin content from month to month. 1-12, as in A : 78—88, percentage of haemoglobin. (From Lippincott, *Journ. Lab. Clin. Med.*, 1927, 679.)



B

* Note that in winter the ground temperature is lowest—41 deg. F. at end of February.

**7. THE INFLUENCES OF SEASONAL SEQUENCES
(SEASONAL CYCLES)**

296. When a northerly spring follows a southerly winter, the summer will be very hot, and waters will accumulate, various matters being carried on from the spring into the summer. Hence in the following autumn, there will be an increased death-rate among adolescents ; and dysentery and intestinal ulcers and tertian fever will be frequent.

297. If the winter was extremely rainy, those due to give birth in the spring will be liable to abort, but if they carry to full time, the offspring will be weakly, or suffer from a fatal or dangerous illness. Men are liable to eye diseases and haemorrhages. Old persons are liable to catarrhs which pass down into the interior organs ; indeed they may meet with sudden death from a sudden obstruction to the flow of the breath through channels which have become overfull.

298. If the spring is rainy and southerly, following upon a northerly winter, there will be many cases of acute fever in the summer, and there will be eye affections, nose-bleeding, looseness of the bowels. Most of these depend on the flow of serous humour—imprisoned during the winter—passing down into the interior organs and then caused to move on by the heat. This is specially so in persons of moist temperament, like women. Sepsis and septic fevers are also common.

299. Should the summer become rainy at the time of the rising of the dogstar, followed by northerly wind, there is a prospect of good health and of the resolution of illnesses. Such a season is worse for women and for juveniles, for if they escape these illnesses, they run the risk of being afflicted with quartan, because the humours become oxidised, and a sediment or ash results, upon which dropsy, pains in the spleen, and weakness of the liver supervene. Such risk is only slight in old persons or in persons susceptible to cold.

300. If the autumn after a dry and northerly summer is rainy and southerly, it disposes people to suffer from headache, cough, sore throat, and coryza in the winter.

If the autumn after a dry and southerly summer be rainy and northerly, there will be many cases of headache, rheumatism, coughs, sore throat, in the winter.

If the autumn after a southerly summer be northerly, the prevailing diseases are those of “expression” (see 286) and of congestion of humours, as already stated.

301. If both autumn and summer were southerly and wet, humours will multiply so that the diseases of expression will appear in winter which we have enumerated (294), and it will not be long before the disease-matter becomes coherent, aggregated, and imprisoned ; for not only are the humours plentiful but there are no vapours to expedite them away from the body. This produces a risk of septic diseases. The winter will not fail to bring out many disorders because of this very cohesion of the undue amount of morbid matter.

If both autumn and summer are dry and northerly, the winter will be beneficial to a person for whom moisture is injurious, and also to women. Such persons will, however, be liable to dry eye-affections, prolonged catarrhs, acute fevers, and mental disorders with depression.

302. A cold and rainy winter produces burning of the urine.

303. A very hot and dry summer produces the following disorders in the following season : anginas (pernicious, and non-malignant) ; anginas which produce a discharge (these may burst externally or internally), anginas which do not produce a discharge ; variola ; morbilli (both these last two are favourable) ; eye-affections ; mental depression ; difficult micturition ; retention of the menses ; retention of the expectoration ; hæmoptysis.

304. If a dry spring follows a dry winter, this is bad. The trees and herbage are liable to decay and they are injurious to the animals which feed on them ; and, in turn, to the human beings which feed on them.

§ 184. *Abnormal quality of the seasons.* This idea is developed in an interesting manner in the Chinese Classic "Li Ki"⁴⁷ (VI) as showing the consequences in terms of weather (storms, floods, droughts, hurricanes, etc.), and in regard to the prospects in the crops (maturing too soon, maturing too late to yield any produce, diseases of crops, or infections by various larvæ, or insects), as well as the possibility of pestilential outbreaks, or the prevalence of such diseases as bronchitis, rheumatism, skin diseases, general ill-health (debility). Flourishing of certain objectionable weeds among the grain or cereals.

§ 185. Seasonal cycles have to do with the sequences of development noted among the very low forms of life in Nature, e.g., the growth of various orders of fungus (saprophytic, parasitic, non-pathogenic, sub-pathogenic, and pathogenic) in various types of soil, or landscape, depends on the existence of cold, cold and wet, warmth, warmth and wet, warmth and dryness, as they are traced through their various cycles (basidium, with basiodiospores, mycelium with gametes, and æcidiospores, uredospores and teleutospores). The cyclical changes

which result in the apparent transformation of one "specific" micro-organism into another "specific" schizomycete require investigation in the open field of Nature. Bacteriology may be said to have been imprisoned in the doctrine of immutability of species, which is only upheld within the limitations of artificial culture-media and inoculation experiments in warm-blooded animals. Many of the types so familiar in human bacteriology may be looked on as terminal phases of cycles, capable of being maintained at the same rank for almost indefinite periods. The remaining nine-tenths of the cycle are unknown, from inability to cause the types to re-enter it artificially.

(b) INCIDENTAL MUTATIONS

8. CLIMATE

305. We now proceed to complete the discourse about the other changes in the quality of the atmosphere, not preternatural and yet not natural. That is, changes dependent on the celestial factors as well as on terrestrial ones.

306. *Celestial factors.*—The changes dependent on celestial bodies, such as the stars, are thus :—if many luminous stars rise in one region of the sky, and the sun approaches towards that region, the people living directly or nearly directly under the sun's rays are exposed to greater heat. But if the rays are oblique, the heating effect is lessened. The effect of a vertical position of the rays on the head is not nearly so great, unless they continue vertical for some time, and are direct. (Joannitius says : the rising and setting of the stars alters the nature of the atmosphere because when the sun approaches them or they it, the air becomes hotter. Under contrary conditions, the air becomes colder).

§ 186. *Solar, planetary and stellar influences on man, and their relation to disease.*—The subject may be summarized as follows.
(A) *Genuine influences.*—(a) *Solar.* Modern observations (Abbé Moreux), voiced by H. W. Newton (Quart. Journ. Royal Meteorolog. Soc., 1928), show that the existence of planetary influences on this earth is only ridiculed by the ignorant. The observation of sun-spots shows that there is a relation to the character of the weather in certain regions, a relation to the development of earthquakes, and also a relation to mental states. This authority traces an eleven-year cycle of change both in the earth's magnetic changes and in the sun-spot cycle. The sun-spots are described as tornadoes of white hot gas, and affect both ultra-violet ray activity and electric radiations. He also suggests that there may be another cause concerned which controls both solar storms and terrestrial magnetic storms.

(The relation may be made more tangible by suggesting that after all there are actual flames of fire emerging from the sun and extending in a tenuous and yet real form right across space into our own atmosphere, with inevitable effects both in inorganic and organized worlds. Hence to suggest a relation between sickness, suicide, and crime and solar storms or even planetary disturbances is not new and cannot be lightly set aside).

(b) *Solar and lunar.* Everyday experience shows that the atmospheric conditions vary according to the time of day and night. The bearing of this on health has therefore been seen from the earliest times (*Ayurveda*, 1924, Aug.; p. 53). (c) *Planetary* rise and setting, *lunar* phases, positions of stars and constellations (Arcturus, Pleiades, etc.) are all data for the study of the progress of the seasons. Hence two kinds of cycles come to notice—the cycle of climatic changes, with an apparent relation to health and disease, both in cattle and in man; (ii) the cycle of extra-terrestrial changes. Naturally the observers of ancient times, who were so convinced of the unity of the visible universe, sought to reduce to rule certain coincidences in these cycles. Even if their association is irregular or only discernible from generation to generation the subject would invite study. Even nowadays it is unsafe to decide that there is nothing at all to study in it.

§ 187.—(B) *Fictitious relations.*—(a) *Symbolical*, permissible, but superfluous. (i) Stars may be spoken of as "healthy" or "unhealthy," "propitious" or "unpropitious" (*Cantica*, i. 104; Costaeus Annotations to Avicenna), as a convenient abbreviation for a more or less complex group of concomitant *climatic* conditions. (ii) The names of planets, or constellations may be used to represent certain types of mental constitution (Modern astrology). Thus, combativeness (fiery temper), ambition and pride, love and desire, melancholy, dreaminess, intelligence and wisdom. These are seven types assigned to as many planets. Again, the term "astral" may be claimed appropriate because common to the "stars" and the "astral form" of man. The same idea occurs in Paracelsus⁷² (Hermetic writings, ii. 291), where he speaks of the senses and intelligence and wisdom of the offspring being its "sidereal body," and derived "from the stars." Such usage of names implies that there is some specially "deep" learning being propounded which is denied to the ordinary student, who has not been initiated into the inner circle of some cult—hermetic, rosicrucian, theosophical, and the like. The fact is, however, that the phenomena of the so-called "astral plane" are those of the "sensitive life" of scholastic psychology; careful and thorough study of this will show that the other obscurities are superfluous. (b) *Fallacious.*—Those who take the symbology of (ii) to be literally correct are "of the erring people" (Q. 6, 78). The poet voiced this error in his words: "A moon which blights you if you dare behold" (Night 34, annotated by Burton, in i. 315).

But in these days it is easier to fall into the error of supposing that there is *no* relation whatever between this world and sun, moon,

and stars, than to mistake purely terrestrial relations for the transcendent.

307. Terrestrial factors. (a) Latitude ; (b) Altitude.—High or low ; (c) Mountainous regions ; (d) Maritime countries ; (e) Exposure to winds ; (f) Nature of soil.

(a) *Influence of latitude on Climate.*—If the country in question be between the Tropic of Cancer and that of Capricorn, the summer will be hotter than in a country further from the torrid zone. The countries within the equinoctial zone approach equipoise, for while the vertical incidence of the sun's rays does not make much impression, the fact of this position being maintained for several hours enhances their effect. The heat is greater at the middle of the eighth hour (the evening) than at noon. Consequently, when the sun is at the end of Cancer, or in the beginning of Leo, it is hotter than it is at the end of its course. When the sun passes from the tropic of Cancer to a place of less declination, its heat is greater than when it has not yet reached the tropic of Cancer but is at the same declination. In the countries in the equinoctial zone, the sun is only vertical for a few days, and beyond that becomes rapidly oblique. For the declination increases much more rapidly towards the two poles than it does in the tropics. Yet, in the tropics, there is hardly any movement perceptible to the senses during any three or four days, so long does the sun linger ; and all that time the heat is continuous. Hence one may consider that countries whose latitude approaches complete declination are hotter than all others, and next to these countries lying within fifteen degrees on either side towards the two poles. In the equinoctial line the heat is not so very excessive as it is in those countries which are within the tropic of Cancer, and countries which are still further north are still colder.

This concludes what must be discussed in regard to the latitudes of countries, supposing them to be alike in all other respects.

(b) *Influence of the altitude of a country, whether high or low.*—Lowlands are hotter, highlands are colder. The strata of air nearer to the earth round here, where we live (Persia) are hotter because the sun's rays are more powerful ; the rays are more oblique on the highlands, which are therefore colder. This is explained in the work on natural philosophy. Low-lying places take up more heat, and are therefore hotter.

(c) *Influence of mountains on the climate of neighbouring*

country.—The climate of mountainous countries from the point of view of residence, is discussed in 325.

High mountains influence the climate in two ways : (i) they reduce the power of the solar rays on the country, and afford protection from them ; (ii) they serve as a wind-screen. The former holds good when the mountains are on the northerly aspect of those countries which are in the north. As the sun runs its course across such a northerly country its heat is reflected from the mountains, and so the country is warmed in spite of its being in the north. The same applies when the mountains are in the west, leaving the country exposed on the east. If the mountains are in the east, the heat which the country receives is less than when they are in the west, because as the sun rises, hour by hour passes before its direct rays reach the country, and by the time they fall vertically upon it, the sun is already about to wane, and the heating quality of its rays declines (*p*). When the mountains are on the west, however, the rays are more vertical with every hour.

(ii) Windscreens.—A northerly cooling wind may be screened from a country by a mountain-range, in which case a southerly warming wind gains the advantage. If a country lies between two mountain peaks the force of the winds across it will be much greater than if it were entirely flat. For when air enters a narrow channel it usually goes on blowing without ever stopping, just as water and the like would. Natural science furnishes the explanation of this.

Countries whose climate is rendered mild by mountains are exposed to some winds, and protected from others. If exposed on the east and north, they are protected on the west and south.

(d) *The influence of the sea on maritime countries.* The atmosphere in such countries is always more humid. If the sea is on the *north* side of the country, that will help to make the country cool, for the prevailing north wind is cold in character, having come over the face of the water. If the sea is on the *south* side of the country, a heavy southerly climate prevails, especially if a mountain range intervenes between the sea and the country.

If the sea is on the *east* side, the climate will be more humid than when it is on the *west* side, because the sun will not cease increasing the evaporation of water as it rises in the heavens, whereas this would not be the case if the sea were on the west.

To sum up, proximity of the sea makes the climate of a country damp, and if there are no mountains to prevent constant

winds, the air is less liable to undergo putrefactive change. Were there no winds (because of an intervening mountain-range) the air would be liable to undergo putrescence (of the organic matters suspended in it), and the humours of the inhabitants would also tend to undergo putrescence.

Hence it is clear that it is better for the prevailing wind to be northerly ; it is next best if the wind is easterly ; then westerly, and it is worst if the prevailing wind is southerly.

(e) *The influence of winds.* (i) *On all countries in general.* In most countries a southerly wind is hot and moist. It is hot because of the sun's rays, and it is moist because usually the sea is to the south, and the strong heat of the sun on the equatorial seas disseminates water vapours which become carried on by the winds. This is why southerly winds are relaxing.

The northerly winds are usually cold because they have traversed mountains and snow-clad territories ; they are also dry because very little water-vapour is admixed. This is because there is very little evaporation of water on the north, and there are no seas intervening. On the contrary, they usually traverse frozen waters and desert places.

Easterly winds are between cold and hot in character ; they are drier than westerly winds, because there is less sea in the north-east than in the north-west, and we live in the north.

Westerly winds are moist in quality because they traverse seas and the sun, passing over the seas, warms them and evaporates the water ; but since the movements of the sun and the winds are in contrary directions, the evaporation is not as great as it is in the case of the easterly winds. Added to this is the fact that easterly winds are strongest at the beginning of the day, and the westerly winds blow strongest at the close of the day. That is why the westerly winds are not as hot as the easterly, and more inclined to be cold. The easterly winds are hotter, and yet, comparing both east and west with the south and north winds, they are temperate.

Sometimes the character of winds varies in a given territory as a result of other factors. It is sometimes an advantage, in some countries, for the south winds to be cooler, as happens when there is a snowclad mountain range on the south ; these winds are cooled in passing over the mountains. When a country is enclosed in burning deserts, the northerly winds are hotter than the south winds.

The simooms* are of two varieties : (i) those which have

* Simoom, "the poison wind," from Samn, poison, venom. (Burton, iv. 36.)

traversed very hot deserts ; (ii) winds like a sort of smoke, producing strange "terrifying" atmospheric effects simulating flames of fire. They are heavy and sultry. A sort of kindling and combustion occurs in them whereby the light part is separated and the heavy part (in which the burning fieriness remains) sinks down to the lower strata. All these are powerful winds. That is why wise philosophers believe them to arise in the upper parts of the atmosphere, although the material basis is from below.* But the movement, the blowing and whirling, begins in the upper regions of the atmosphere. This is the usual explanation, and its proof is to be found in my book on natural philosophy.

(ii) *The special climatic characters of the several countries.* This subject is deferred to a later chapter (318).

(f) *The soil.*† Countries present varied characters according to the dominant kind of soil. The following varieties of soil may be enumerated : clay, chalk, sandy (humus), rocky, or stony, miry or slimy, muddy, evil-smelling. The characters vary according to the mineral content.

Each kind of soil has its own effect both on the atmosphere and on the water.

This statement contains an important truth. Certain spas and health-resorts (Carlsbad, Bath, Droitwich, Baden, Bourbonne-les-Bains, Nancy, Wiesbaden) owe their virtue not merely to the chemical composition of the water which is taken by the patients, but also to the locality itself. The radiations which pass outwards at those parts of the earth produce a beneficent influence upon them as they walk over the ground.

§ 188. The soil may be described as the breakdown products of rocks or rock-formations of various kinds. Different kinds of soil differ in the size of their particles : coarse sands show particles from 0.1-0.2 mm. in diameter ; fine sands 0.5-0.05 mm. ; silts have particles varying from 0.04 to 0.004 mm. in diam. A soil composed of the four groups (sand, clay, chalk, humus) is called "loam" if good for crops, and is then specified as clay loam, or sand loam, according to the dominance of clay and sand respectively. It is the size of the particles which determines the movements or circulation of air and water through the soil. The amount of humus determines the fertility in regard to micro-organisms, whether beneficial to vegetation, or whether pathogenic to man. The presence of 4 per cent. of moisture in soil is the optimum for processes of decomposition in it. Cold wet soils favour diphtheritic infection (Lane-Notter).

Gravel soil is sought after as favourable for dwellings ; but if

* The lower strata are near "earth," and the highest strata of this world are "fire" (see § 54).

† The soil may be described as elementary substance with which are intermingled the decaying remains of animal and vegetable matter.

it be befouled by polluted waters, micro-organisms then flourish more easily than in other soils, and it becomes more inimical to health.

§ 189. The inorganic elements in plants are really *very finely powdered stones* (limestone, iron-stone, magnesium-stone, potash-stone, etc.), which have entered into a condition of food-substance under the influence of light and heat, and life.—(Gilbert.)

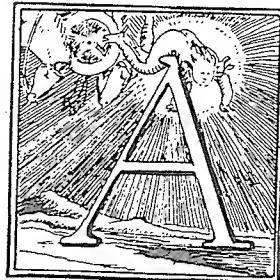
(g) *Misty districts and marshes.* Joannitius refers to these, saying that where there is decomposition in such regions, diseases and various plagues befall man.

§ 190. The factors on which the climate of a place depends, in modern thought, are as follows: (1) the earth heat: the range in this is 41-63 F. in England. When hot, the earth reflects ultra-violet rays (2) the radiant energy of the sun. "Sun-power," which is reflected from the sky and sea and earth. The rays are classified as visible, ultra-violet (actinic or chemical), and infra-red. The ultra-violet rays are arrested by smoke, mists, window-glass. (3) The cooling power of the air. This depends on the rate of movement of the air, as currents artificially induced, or wind; the amount of humidity; the actual temperature of the air. Cold air tries the heart and chest, more heat having to be produced; hot air tries the digestive organs and kidneys, because of the difficulty of getting rid of the superfluous heat. (4) Altitude. The air is thin or rare at high altitudes. (5) Ventilation of the dwelling-house.

To these must be added: prevalent winds; proximity to sea; scenery; nature of the ground—whether rocky (cold and dry), fertile (hot and moist), muddy (cold and moist); whether porous or impermeable; water-holding or not; actual chemical composition.

(c) IMPRESSIONS PRODUCED BY OTHER CHANGES IN THE ATMOSPHERE

9. THE EFFECT OF UNFAVOURABLE CHANGES IN THE AIR WHICH ARE CONTRARY TO ITS ORDINARY NATURE



IR (308) may be changed in (1) substance, (2) qualities.—The substance may become depraved apart from any increase or decrease in some of the intrinsic qualities. Such an air is named "pestilential."^{*} One must remember that putrefactive processes can occur in the atmosphere just as they do in stagnant water.

* Though we now know that "pestilential" air is so because it is germ-laden, that does not render this chapter "out of date." The general principles remain the same. At the present day it is assumed that the air is always contaminated from without—from the dust, e.g., on the ground that sunlight destroys germ-life. However, facts speak otherwise in open Nature.

309. By the word "air" we do not mean the simple (imponderable) element, but the atmosphere around us. Were the atmosphere absolutely pure, the word "air" might be used synonymously. But elemental substances cannot putresce; they can only change from one to another (as "water" which changes to "air," e.g.); and they do this by a change either in quality or in substance. The word "air" in this chapter, therefore, as "atmosphere," is a composite substance, with spatial relations, composed of true (elemental) air, watery vapour, terrene particles (both of which form fogs and clouds, and smoke), and fiery particles—all together. In the same way, when we speak of "sea" as "water," "lakes" as "water," and so on, we do not mean elemental water, but a composite substance, in which "water," though predominant, is mixed with air, earth, and fire.

This carries the reader back to 19-25, and the comments thereon. The writings of the Chinese philosophers on the one hand, and of European alchemists on the other, may be interpreted accordingly, as Avicenna would have done. Examples of "earth": soil, metals, naked creatures; "water": spring water, rain water, ditch-water, lake water; the sea; millet; shellfish; "fire": wood, oil, stones, lightning, the glow-worm, will-o'-the-wisp, trees, flowers, beans, feathered creatures. Seemingly there is very little in common; Forke²³ (p. 275, 276) discusses the subject, at the same time referring to writings by Agrippa von Nettesheim.

310. The air so present in water may undergo putrescence, with degradation of its substance, just as the stagnant water in pools decomposes, with degradation of its substance.

311. Air generally becomes pestilential from putrefactive changes towards the end of summer and during autumn. The symptoms which such air produces in the human body will be referred to later.

312. *Change in primary qualities.* Heat or cold may become insupportable by destroying the crops and the fecundity of nature. This change may be in the same direction as the quality of the season (for instance, the summer may become fiercely hot), or it may be in the contrary direction (for instance, a spell of very cold weather may arise during the summer season).

313. *Effect on the human body.* Changes in the character of the atmosphere produce changes in the human body. Putrescence of air induces septic changes in the body-fluids, beginning with the pericardial fluid, because this is exposed to it first.

Hot atmosphere. Great heat in the air renders the joints flaccid and causes the humours to disperse. There is increase of thirst, dispersion of the breath, failing vigour and digestion, all because the innate heat is the instrument used by the vegetative

soul. A citron-yellow appears in the skin because the sanguineous humour becomes dissipated and loses its red colour, while at the same time the bilious humour increases in amount relatively to the other humours. The heart becomes warmer (over and above the innate heat), so that the humours flow and undergo decomposition, and in that state they enter the interspaces of the body and the weaker members. This is therefore not beneficial to persons in health. The following diseases are (however) benefited by this change : dropsy, palsy, cold catarrhs, tetanus, and certain (humid) spasmody conditions.

Cold atmosphere. This drives the innate heat into the interior organs, unless the air has sufficient driving force itself to penetrate them. This would be morbific. Cold atmosphere does not interfere much with the circulation of the humours, or imprison them. But it favours catarrh, and is weakening to the nerves. It has a very injurious effect on the trachea. If the atmosphere is not so cold, it strengthens the digestion and all the interior functions, and improves the appetite. On the one hand it is more beneficial to a healthy person than a very hot atmosphere, and on the other hand it is detrimental to nerve-function. It closes the pores and causes matters within the bones to pass outwards to the surface.

Moist atmosphere. A moist atmosphere benefits many temperaments. It improves the colour and makes the skin clear and soft. The pores remain open. However, it favours septic processes.

Dry atmosphere. A dry atmosphere has contrary effects.

A dry climate, with warm soil, where the sun power is good and the cooling power is moderate (e.g. places with pine forests and sheltered valleys) is beneficial for chest cases.—Dry uplands in places where there are not periods of unsettled weather, and not near the sea, are beneficial for rheumatic cases.¹²³

Choice of food according to climate.—For hot climates : no meat ; use vegetable oils instead of animal fats. For cold climates: meat, animal fats. For dry climates : fruits are needed. For wet climates : sugar is needed.¹²³ (p. 1076).

Note that the *weather* affects *animals* as well as man. Cold, hot, damp, dry weather, thunderstorms, affect domestic animals.⁴⁸ (ii. 307.)

10. THE INFLUENCE OF THE WINDS ON THE BODY

In dealing with the changes in the atmosphere, we have discussed the characters of the various winds. We now proceed to deal with them from another point of view.

314. *The North Wind* braces and hardens the body ; it prevents the flow of visible excretions ; it closes the pores, strengthens the digestion, causes constipation, increases the urine, and makes septic pestilential atmosphere healthy. If the south wind precedes the north, the south wind excites mucous discharges, but the following north wind drives these fluids inwardly. A discharge may appear externally. Hence a catarrh [-al exudation] may become abundant, and chest troubles are common.

Diseases liable to occur when the north wind prevails : neuritic pains, pains in the side of the chest, in the joints, in the bladder and uterus ; difficult micturition ; racking cough ; shivering attacks.

315. *The South Wind* is relaxing for the strength ; it opens the pores ; makes the humours agitated and confused, so that they move from within outwards ; the senses become heavy ; it induces sleepiness. It is one of the causes of breaking down of ulcers, and makes them itch. It causes diseases to relapse, and debilitates. It produces itching in podagra. It excites migraine attacks. It causes fevers to become septic. It does not, however, induce sore throat.

316. *The East Wind*.—If east winds prevail towards the end of the night, and in the early part of the day, they will have already been modified by the sun, being made more rarefied and less humid. They are, therefore, drier and lighter in nature. But if they occur at the close of the day, and at the beginning of the night, the reverse is the case. On the whole, east winds are more beneficial to health than are westerly ones.

317. *The West Wind*.—If west winds prevail at the end of the night and in the early part of the day, the atmosphere will not have received the heat of the sun, and is therefore denser and more heavy. If they occur at the end of the day and at the beginning of the night, the reverse holds good.

III. THE INFLUENCE OF PLACES OF RESIDENCE ON THE HUMAN BODY

In a previous section we have considered the characters of certain inhabited regions. We now consider them from another point of view, in more detail, without troubling to avoid some repetitions.

318. *Characters upon which the effect of habitable regions on people depends.*

i. Whether high or low-lying.

2. Type of adjoining country (mountainous, maritime, open or sheltered).
3. State of soil (clayey, muddy, mineral, damp, marshy).
4. Whether the water is plentiful or scarce, stagnant or flowing.
5. Local factors (trees, mines, cemeteries, dead animals, putrescent pools).
6. Purity or impurity of the atmosphere.

As we have also learnt, the temperament of the air is revealed by the latitude of a territory, its elevation or lowness, proximity of mountains and seas, the prevailing winds, the kind of soil.

In short, whenever the air becomes quickly cold after sunset, and quickly warms after sunrise (we know it) is attenuated. If the opposite is the case, the nature of the atmosphere is the contrary.

The most harmful of all kinds of air is that which contracts the heart and hinders inspiration, and makes breathing difficult.

We now discuss each kind of locality in turn.

319. Hot countries. The hair becomes dark or black and frizzly, and becomes gathered into tight clumps like pepper-flowers ; the digestion is weakened. Old age comes on early, owing to the great dissipation of breath, and the draining away of the bodily moisture. This is seen in the land of the blacks (Ethiopia, Abyssinia). Persons who reside in such countries become aged at thirty, are timid (as the breath is so much dispersed), and the body becomes soft and dark.

320. Cold countries. Persons who go to live in cold countries become robust and stronger, and bolder and more courageous. The digestion improves. If the climate is also damp the people will become obese and fleshy and coarse. The veins will not show under the skin of the hands, and the joints are indistinct in outline. The body becomes pale and delicate.

321. Damp wet countries. Here the summer is not very warm, nor the winter very cold. People living in humid countries have beautiful faces with soft smooth complexions. They soon get tired with exercise. They are liable to develop protracted fevers, with looseness of the bowels and menorrhage. Piles, which are common, often bleed. Septic ulcers, fistulas, and aphthous and pustular stomatitis are common ; also epilepsy.

322. Here the summer is very hot and the winter very cold. People who live in dry climates develop a dry temperament. The skin becomes dry and dusky as a result of the great

dryness and roughness of the atmosphere. The brain soon becomes dry in temperament.

323. Residence in rocky and exposed places. The climate in such places is very hot in summer, and very cold in winter. The body becomes hardened and sturdy, very hairy, strong, with large prominent joints. Dryness rules in such persons ; they are very wide-awake, and resist bad habits, are pertinacious, warlike, skilful in the arts, and are energetic in character.

324. Residence in high altitudes. People residing in high altitudes are healthy, strong, and capable of much physical work ; they are long-lived.

High altitudes are beneficial for nerve cases, but unfavourable for heart cases.

325. Residence in mountains and snow-clad places. People living in such places resemble those living in cold countries, being of great stature, strong, fierce, and given to toil, for the seasons vary much. These countries are windy, the winds being good as long as the snow lasts, but unhealthy when it melts, especially if there should be mountains to screen off the winds. In this case, the place becomes hot and damp.

326. Residence in low-lying countries. The air is very damp ; and in summer is sultry, without modification by winds. The inhabitants are therefore unhealthy and debilitated, liable to be depressed and gloomy in disposition. The climate is unfavourable to the functions of the liver. Water is plentiful, and not cold, especially if it is stagnant, lagunal or marshy. The air is then unhealthy, as you already know.

327. Residence in maritime regions. The heat and cold of these regions is modified by their moisture ; hence injury is resisted, and the body is inreceptive for whatever would otherwise invade it. As regards moisture and dryness, no doubt, such regions tend to be damp. If the country faces the north and has no protection against north winds (the sea being on that side, and the country being low), the climate will be more temperate. If it faces to the south, the climate will be hot and insalubrious (morbific).

Maritime places are beneficial for nerve cases.

328. Residence in northerly countries. Persons who live in the north resemble in character those who live in cold countries with cold seasons. Diseases of "expression" (286) and those due to confinement of the humours in the interior parts are liable to occur. Digestion is usually good. Such persons are long-lived.

The repletion with, and the lack of dispersion of, the humours predisposes to epistaxis and rupture of varicose veins. Ulcers readily heal owing to the vigour of the body and the purity of the blood ; the external conditions are also favourable to healing, because there is nothing to relax or moisten (the tissues). The fact that the innate heat is plentiful in such people prevents epilepsy from occurring, but if fits should occur they will be correspondingly severe, for it would have to be a very powerful agent to bring on such fits at all in these regions.

The great degree of heat in the heart makes such persons leonine (wolfish) in disposition.

Effect on the female sex. Menstruation is defective owing to constriction of the channels and the absence of the stimulus to menstrual flow and to relaxation of the channels. Some assert that this makes the women sterile; that their wombs do not open. But this is contrary to experience ; at any rate as regards the Germans [Turks, Parthians—in other readings]. My opinion is that the great amount of innate heat makes up for the absence of the stimulus to flow and to dilate the channels. Abortion, it is said, is rare amongst women in these climates, and this fact further supports the opinion that their vitality is great. However, parturition is not easy because the organs in question remain hard and will not open easily. If abortion should occur, it must be ascribed to the cold. The milk will be scanty and thick, because the cold prevents the blood from flowing easily enough to the breasts.

When the vitality is impaired, people in these regions (especially parient women) are liable to develop puerperal tetanus, and wasting diseases, because the difficult labour makes them strain so much, and consequently risk tearing the veins in the chest, and the nerve and muscle-fibres. The former leads to pulmonary ulcers; and the latter to spasmodic affections. Another effect of the excessive straining during parturition is ventral hernia.

As regards the age of puberty (in these countries) : hydrocele arises, but disappears as the persons grow older. Female slaves are liable to develop ascites and hydro-uterus ; but these also pass away as they grow old. Ophthalmia is rare, but is severe when it does occur.

329. Residence in southerly countries. The climatic features in these cases are those of hot countries and climates. The prevailing winds are not beneficial to health.

The waters are usually salty and sulphur-containing.

Moist humours accumulate in the head in people living in these regions, as that is an effect of the south ; they pass downwards and render the intestines loose. The limbs are weak and flabby ; the senses are dulled ; the appetite for food and drink is enfeebled ; and the lack of heat and weakness of the stomach accounts for the fact that wine is readily intoxicant. Ulcers heal and soften slowly.

Effect on the female sex : Menstruation is profuse and is arrested with difficulty. Pregnancy is rare. Abortion is frequent, simply because illness is so frequent.

Effect on the male sex : There is a liability to severe diarrhoea ; bleeding of piles ; humid ophthalmia. But these are quickly recovered from. Persons over fifty years of age are liable to paralysis, which follows on catarrhal conditions. At all ages there is a tendency to asthma, spasmodic diseases (tetanic spasm, epilepsy), because there is this tendency for serous humour to accumulate in the head.

Both sexes are liable to develop fever in which heat and cold occur simultaneously. Prolonged fevers come on in the winter, and are nocturnal. Acute fevers are rare because of the liability to diarrhoea, so that the more attenuated part of the humours is continuously dispersed.

330. *Residence in easterly countries.* When a district is exposed to the east, and is sheltered (by trees) on the west, it is healthy and the climate is good. This is because the sun is high over it in the early part of the day, thus rendering the atmosphere clear. The purified air passes on and gentle winds blow over it in advance of the rising sun, their direction being corresponding.

331. *Residence in westerly countries.* When a district is exposed on the west, and is sheltered (by trees) on the east, it does not receive the sun till late in the day, when the rays are already oblique. Hence the air never becomes rarefied or dry, but remains dense and humid. The prevailing winds are westerly and nocturnal. The climate of such places is therefore as of damp countries, and the residents have a moderately hot and heavy temperament. The climate is heavy because the air is heavy. Were it not for that, the climate would be spring-like in nature.

Such districts are not as healthy as easterly ones, and they tend to become more unhealthy. Some say that this kind of country is spring-like in its character, and very healthy compared with other kinds of country. But to my thinking the climate has very bad characters, and this is because the sun's rays

do not reach them until they are no longer strong enough to warm the atmosphere ; and then the sun sets at once, and a cold night then suddenly sets in. As the air is of humid temperament in such countries, the inhabitants are liable to have husky voices, especially in autumn ; for they are prone to catarrhs from stagnation of the serous humour.

332. *How to choose a place of residence, and what type of house should be selected.* The choice of a place of residence depends on : (1) the soil (see 307f) ; (2) position—whether high or low-lying (atmospheric pressure, see 307b) ; (3) whether exposed or sheltered, bare or covered with trees or woodlands or forests (forests harbour moisture and foster the decay of vegetation) ; (4) the water-supply—its quality, whether the water is covered in (artificially) or exposed to the air, whether concealed or deep, marshy, whether thick or limpid, whether flowing from a height or running over stones ; whether salty or “crude” ; (5) the prevailing winds—whether exposed to or sheltered from the sun ; whether salubrious or not ; fresh (cold) and bracing or dry and sultry (having blown over wide tracts of land), or moist ; whether cold and healthy ; (6) the neighbouring country (maritime, marshy, presence of lakes ; mountainous, or flat ; rich in minerals or not ; forests, jungles, etc.) ; (7) whether the ground air is pure and healthy, impure and unhealthy, making the natives prone to illness ; what sort of illnesses prevail ; (8) whether the natives are robust, have a good appetite and digestion, and are accustomed to food of good quality ; (9) the construction of house : whether with large, roomy or with narrow entrances ; good ventilation, wide chimneys. Do the doors and windows face east and north ? One must be specially careful to arrange to have the easterly winds able to enter the house and see that the rays of the sun can enter all day, because the sun’s rays render the air pure.

One should be close to plenty of sweet running water, open to the sky, frozen in winter, and warm in summer, as all this is favourable to health. Nearness to stagnant water and that to which light has no access is unfavourable.

(10) Amount of light ; temperature (hot, warm, cold) ; rainfall—average humidity of the atmosphere (see 249).

§ 191. *Type of house.* The importance of this is well-known, but not as often practically attended to. Overcrowding of houses is well-known to be a source of continual illness and loss of working capacity, yet only very slowly remedied. It is not sufficiently realized that the befouling of the air through lack of air-space between the houses is as dangerous as close contact with the organic emanations from the human body. Such emanations cling to walls, floors, furniture, fomites, and foster the multiplication of infective organisms. The relation between mouldy walls and phthisis was insisted by Nash¹³⁶ (p. 52).

We have now discussed the atmosphere and the geographical influences sufficiently. We now proceed with the corporeal factors.

(ii). CORPOREAL CAUSES UNAVOIDABLE BECAUSE PHYSIOLOGICAL.

12. THE INFLUENCE OF EXERCISE AND REPOSE.

§ 192. There are three kinds of Movement :—(1) Local ; successive and continuous reception of new positions in space ; here belong exercise, gymnastics, bathing ; (2) In quality : alteration ; this consists in the reception of new qualities ; (3) In quantity (increase or diminution). A certain amount of matter is acquired or lost. (Mercier^{**} 2, 517).

333. The effect of exercise on the human body varies according to (i) its degree (strong, weak), amount (little, much), and according to (ii) the amount of rest taken, (iii) the movement of the humours associated.

334. All degrees of exercise (strong, weak, little, or alternating with rest) agree in increasing the innate heat. It makes little difference whether the exercise be vigorous or weak and associated with much rest or not, for it makes the body very hot, and even if exercise should entail a loss of the innate heat, it does so only to a small amount. The dissipation of heat is only gradual, whereas the amount of heat produced is greater than the loss. If there be much of both exercise and repose, the effect is to cool the body, because the natural heat is now greatly dispersed, and consequently the body becomes dry. If the exercise entail the handling of certain material, that material usually adds to the effect of the exercise, though often there is a lessened effect. For instance, if the exercise be in the course of performing the fuller's art, there would result an increase of coldness and moisture. If the exercise be in the course of the performance of the spelter's art, there would be more heat and dryness.

335. Repose always has (a) a cooling effect, because (i) the enlivening life-giving heat passes away, and (ii) the innate heat is confined. It has (b) a choking and moistening effect, because of the lack of dispersal of waste matters.

13. CONDITIONS ASSOCIATED WITH SLEEP AND VIGILANCE.

336. The effect of sleep is very similar to that produced by repose ; that of vigilance is very similar to that produced by exercise. In each case we must consider certain properties.

337. Sleep (i) strengthens all natural functions (digestion of the food and the elaboration of the digestive products into

good blood), by aggregating the interior heat and by relaxing the sensitive faculties. (These are in abeyance, in sleep). It does so because it renders the channels of the (mind-) breath moist and relaxed. (2) It *makes the substance of the breath turbid*, and prevents the exit of the vital breath (so that the vital heat accumulates in the interior parts). (3) Sleep removes all types of lassitude (821) and it *restrains strong evacuations*. If then followed by appropriate exercise (gymnastics), the power of running is increased unless (effete) matters accumulate which only the skin can remove. (4) Sleep sometimes *helps to expel these effete matters*, in that it imprisons the interior heat and procures the dissemination of the nutrients throughout the body, and the expulsion of the effete matters which are under the skin, as well as of those which are deep in the interior parts of the body. These innermost matters push on those which are in front of them in successive waves, until they finally reach the subcutaneous tissues and are thence discharged from the skin. The same action is achieved by wakefulness to a still greater degree, but in this case the effete matter is removed by dissipation, whereas sleep removes it by inducing sweating. (5) Sleep induces *sweating*. It does this by a process of overcoming the effete matter, and not by a process of continuous dispersal of attenuated matter. When a person sweats heavily during sleep, without obvious cause, nutrients accumulate in excess of the bodily requirements ; when sleep encounters matter adapted for digestion and maturation, it turns it into the nature of blood and warms it, and in consequence innate heat is engendered, and travels through and warms the whole body. (6) If there are hot bilious humours, and the period of sleep is prolonged, the body grows *warm by extraneous heat*. (7) If at the time of sleep the stomach is empty, the sleep will exert a *cooling effect*, in that it disperses the heat. If at the time of sleep there is a humour not amenable to the digestive power, the sleep will exert a cooling effect because of that to which this humour gives rise.

Factor associated during the time of sleep.	Effect on body.
Profuse sweating. Gastric contents digestible.	Accumulation of nutrients. Completion of digestion and blood-formation : formation of innate heat.
Hot bilious humour. Empty stomach (fasting) Indigestible humour.	Formation of extraneous heat. Cooled ; heat is dispersed. Cooled ; expansion of heat.

§ 193. Aetius adds:

Among the good effects of sleep are : forgetfulness of mental sufferings, rectification of the distracted powers of reason ; relaxation of contracted tissues.

The best time for sleep is after a meal ; it should end when the food is digested (shown by percussion over the stomach), after which the bowels should be emptied.

The best time for sleep during the 24 hours is the night, because the humidity and drowsy stillness of night contribute to perfect digestion. The worst time is the day-time, because in that case one does not sleep long enough to enable the digestion of the food to be completed. The result is acidity, flatulence, gurgling in the bowels.

338. *The waking state* acts in the contrary way in all these respects. If it occur to an excessive degree, the temperament of the brain changes to a certain dryness, with weakening and confusion of the reasoning power, oxidative changes in the humours and acute illnesses resulting. An excessive degree of sleep, on the other hand, exerts an opposite effect, for it dulls the powers of the mind, induces heaviness of the head and a cold intemperament. This is owing to the hindrance of resolution which such sleep brings about.

339. The waking state (1) disperses the matter, and so increases the appetite and sense of hunger ; (2) disperses the digestive power, and so impairs digestion.

During the waking state the body becomes hot exteriorly, cold and dry interiorly (Joannitius).

Insomnia (lit. tossing about in bed), a state between watchfulness and sleep, is bad for all the bodily states.

340. Undue somnolence entails an imprisonment of the innate heat, and makes the body become cold exteriorly. This is why so many blankets are needed to keep the limbs warm during sleep, which are not required in the waking state.

The indications furnished by somnolence, and its various aspects, and states, will be fully dealt with in subsequent volumes, Allah willing.

14. THE INFLUENCE OF PERTURBATIONS OF MIND.

341. Changing states of mind (*nafs*), and the associated "motions" of the breath are either interior or exterior, sudden or gradual.

When there is coldness interiorly, it moves outwards with the breath ; hence if the breath were suddenly dispersed, the coldness becomes excessive, and both exterior and interior cooling occur, which may be followed by syncope or even death.

When there is coldness exteriorly, and heat interiorly, the coldness moves inwards with the breath.

342. Great confinement of the breath, with both exterior and interior cooling, results in severe syncope and even death.

Movement of the breath.		Direction.	Associated emotion.
Sudden and forcible	Expansion.	Outward	Anger.
Gentle and gradual	"	Outward	Delight and moderate joy.
Sudden and forcible.	Contraction	Inward.	Fear, terror.
Gentle and gradual.	"	Inward.	Gloom ("contracted heart") mental depression.

343. Confinement and dispersal of breath only occur suddenly ; languishing of breath only develops by degrees. By "languishing" I mean a slowly progressive confinement or coarctation of the breath. When I say "the nature declines,"* I refer to a gentle, gradual, step by step dispersal of the vitality.

344. If two motions of the mind occur simultaneously, the breath may move in two directions (contraction within itself, and enlarging) at once. This happens (1) when there is fear, dread, and anxiety about the future. (2) when anger and gloom occur simultaneously. The two opposite movements may produce a sense of shame, because there is first the confinement of the breath in the interior parts, and after that the power of reason returns, and resolution appears, allowing the contracted breath to expand again, and bring heat to the surface. The skin now becomes red.

345. *Influence on the body of mental disturbances of a different category.* The state of the mind of the parents affects the body of the offspring ; as for instance, phantasies. As a rule, it is some natural object which impresses the body. For instance, some image of a boy pictured by both parents at the time of conception may be realised in the infant when born ; or the infant's breath may have a "colour" very like the colour seen (mentally) by the mother whilst the seminal fluid was flowing into her at coitus, or by the father during the time of this flow.† Many persons hate to believe such things, and suppose they can understand the states of the body without having realised the fundamental state. The physician who seeks wisdom does not deny these and allied things.

* See footnote to 199 (ii).

† Superficially, the suggestion that conception is synchronous with coition would seem an instance of mediæval ignorance. Costaeus, in annotating on the passage, accepts the opinion that a strong desire on the part of either parent to see self or partner repeated and reproduced is capable of securing that the conception shall yield a child in whom the desire is ultimately realized. Favourable patency of the internal ducts (cervix, etc.), whether anatomically or emotionally, in association with voluntary control of supposedly purely involuntary muscular tissue, are co-operative factors whereby the above suggestion is not error but sometimes fact. The law of jelal and jemal plays an important part which is ultimately, in due time, manifested by the sex of the product of conception. Thus when the male is jelal

346. Other instances of the influence of the phantasy on the bodily state : (a) a movement of the mind which is intent on considering red things induces a corresponding state of readiness for a movement of the sanguineous humour. [Exanthems may be associated with such a movement of sanguineous humour (Costaeus)]. (b) energetic character : eating acrid things : hardening of the teeth. (c) introspective character : dwelling on aches and pains in the limbs : aches and pains in the limbs. (d) timid character : fearing lest some imagined event should happen : change of temperament corresponding. [Fear of catching a certain complaint : actually developing the disease (Costaeus)]. (e) hopeful disposition : rejoicing in the thought of something one would like to realise : change of temperament corresponding.

DIETETICS

15. THE INFLUENCE OF FOOD AND DRINK.

"Most illnesses, even those which lead the sufferer to the specialist, arise solely from long-continued errors of diet and regimen."

347. Food and drink influence the body in regard to (a) quality ; (b) material composition ; (c) "substance" as a whole.

It is essential to define each of these three terms exactly.

(a) *Influence in regard to quality.*—Heating and cooling food and drink respectively make the body hot in virtue of their own heat ; cold in virtue of their own coldness ; and yet these qualities do not become an integral part of the body.

(b) *Influence in regard to material composition.*—The food and drink in this case change from their own nature, so as to receive the "form" of one or other of the human members (tissues) ; and the matter of which the food is composed receives the "form" of the member, without losing its own dominant primary quality right through the whole process of digestion

the product is female, and vice versa,—the jelal or jemal relating not only to physical affection, but to "anguish of love" ; and the physiological cycles in the two organisms have also to do with the chances of conception. The subject is dealt with more particularly in the fourth Book, in a form which is only apparently obsolete.

The belief that maternal mental states affect the growing embryo, both physically and psychically, is natural, though rejected by some physicians. It is a valuable saying that "we can control the attributes and thoughts of the offspring," and give it a far more valuable inheritance thereby than by any material fortune." It applies as an admonition to both parents.

"The woman produces an offspring like that being upon whom her thoughts dwell at the time of conceiving."—(Charaka-Samhita, ii. 704.)

By contemplating on beautiful scenes of nature, beautiful pictures, pious persons, etc., the mother contributes to make her child beautiful and virtuous and possessed of other desirable qualities (*ib.* 745).

The whole subject bears on the causation of deformities, or malconformations (496).

to the end of assimilation. Thus, the temperament of lettuce is colder than that of the human body, and yet lettuce becomes blood, and is thus capable of being converted into tissue. The temperament of garlic is hotter than that of the human body and it also becomes blood.

(c) *Influence in regard to "substance" as a whole.*—The specific "form."—This is an action according to what food is in itself, as apart from its four primary qualities, and apart from whether it becomes like the tissues or not, or apart from whether the body becomes like to it or not. Matter does not enter into action in virtue of its quality of action. But action ensues in virtue of its matter when the matter is changed by a transforming faculty in the body, from the substance it originally possesses, and (1) first renews whatever has been used up in the body, and so (2) increases the innate heat in the blood. Then (3) the effect of the primary qualities which remain in the food after that comes into play.

348. Action occurs in virtue of the substance when the "form" of its "species"—resulting from its temperament (for the elementary components are intermingled, and one single thing emerges therefrom)—is made ready for receiving the species; a certain "form" is now super-added over and above the form possessed by the primary qualities. But this "form" is neither (1) the primary qualities of the matter, nor (2) the temperament proceeding from those primary qualities. This "form" is that perfection which the pattern of the ailment receives according to its capacity, and its capacity is the outcome of its temperament. Example: the attractive faculty of the magnet; the nature inherent in the various species of plants and animals (the nature emerging from the temperament). Nor is this "form" (3) any of the simple temperaments by themselves, for it is not hotness, moistness, dryness, or coldness, either alone or in combination. Really speaking, it is something comparable with colour, odour, or intellect, soul, or some other "form" imperceptible by the senses.

349. The "form" which arises after the temperament has formed may be perfected by passive action. In this case the "form" = "passive property." But it may also exhibit active perfection. In this case "form" = "active property" (active principle). This active property may be exerted upon a human being, or it may not.

350. Any property may produce an effect on the human body which is either desirable (useful, harmonious) or undesir-

able (inharmonious). Such an effect is not entirely derived from its temperament ; it is also derived from the specific "form," over and above the temperament. Hence we speak of such an effect as derived from the substance as a whole (that is, the "specific form"), and not from any of the primary qualities or from a temperamental intermingling of the qualities. For instance, the action of peony in annulling epileptic seizures is desirable. The action of aconite in destroying human "substance" is an instance of undesirable action.

* * *

351. Returning from our digression, then, when we say that a substance which is eaten or is introduced hypodermically (*e.g.* by inunction) is "hot" or "cold," we mean not only that it is so virtually (not actually), but that it is virtually hotter or colder than are our bodies.

352. "*Power*," "*potentia*lity," is a term with two kinds of meaning. (a) It may be used in reference to the action of the innate heat of the body upon it. As soon as the potentiality encounters the action of the innate heat it submits to that, and so becomes act.

(b) The word potentiality may also be considered in reference to its utility or advantage to the body. Thus we say that sulphur is hot in potentiality ("virtually hot").

353. When we say that a thing is hot or cold, we may mean that one of the four imponderables is dominant in its temperament ; and we do not refer to the effect which it has on our bodies.

354. We may say that a certain medicine has such and such a potentiality, thereby meaning its utility or otherwise to the body. Thus, a scribe who has stopped writing still has the potentiality for writing. So we say that aconite has a destructive potentiality. In the one case, there is no act till after the body has become evidently changed. In the other, the action occurs at once, from the mere presence of the agent (*e.g.* viper poison), or some time later, after it has undergone some certain change in quality (*e.g.* aconite).

(c) Between these two potentialities there is a third—that of poisonous medicaments.

* * *

355. There are four *orders of medicaments*—whether eaten, or taken in the fluid state, or whether given by inunction.

i. The *first degree*. The action of the quality of a medicament on the body is imperceptible to the senses. Thus,

a warming or cooling effect is not perceived by the senses unless it is given repeatedly, or in larger dose.

2. *The second degree.* A greater degree of action, without perceptibly interfering with the functions of the body or changing their natural course (excepting incidentally, or because given in large doses).

3. *The third degree.* There is evident interference with function, but not markedly enough to produce breakdown or death of tissue.

4. *The fourth degree.* Destruction or death of tissue is produced. This is the degree produced by poisons. A poison is lethal in all respects (that is, in all parts of its "substance").

§ 194. (Another classification would be (a) medicaments which produce change without destruction of function or tissue, (b) those which actually destroy function or tissue. In each case there are two degrees—one imperceptible to the senses, the other plainly evident.—This is Galen's grouping. The grouping into four degrees still survives in the classification of burns.)

Substances which are definitely poisonous may be classified into four groups as follows :

(1) *Corrosives.* These produce immediate and violent irritation. Ex.: mineral acids, alkalis, corrosive sublimate.

(2) *Irritants:* (a) *Metallic*, such as lead, copper, arsenic, phosphorus; (b) *Vegetable*, such as drastic purgatives (aloes, colocynth, croton oil); (c) *Animal*, such as cantharides. This group produces effects which simulate natural disease, such as gastric and intestinal disease, peritonitis, abdominal catastrophe.

(3) *Neurotics.* Ex.: hydrocyanic acid and the cyanides, opium, strychnine, aconite, belladonna.

(4) *Gaseous.* (a) Irritant: halogens, ammonia; (b) Anæsthetics; (c) Coal-gas, carbon monoxide, etc.

There is another group classifiable under 355, 1 and 2, exemplified by common salt, which is injurious or even toxic in cases of kidney disease (¹⁴¹, p. 390); and by those foods against which some persons have idiosyncrasies, or "protein sensitivity" (shell-fish, fruits, etc.).

356. *Fate of medicaments taken into the body.*

A.—They are changed by the body (passive change).

(i.) The body itself is not changed nor restored to health

(a) Medicament changed into the likeness of the body - pure nutriment.

(b) Medicament changed, but not into the likeness of the body - attempered medicine.

(ii.) The body itself is also changed (active action).

(a) Change in medicament produces change in body, and interferes with or even arrests function.

(a) the change is into the likeness of the body - medicinal food.

(β) not into the likeness of the body - pure medicine.

(b) The change in the body continues till life is destroyed - venomous medicine.

B.—They are not changed at all by the body, but they

produce a (deleterious) change in the body (active action on the body)

- - - - - pure poison.

Ad. B.—In saying a medicament is "not changed by our body" we do not mean that it does not induce a formation of heat in the body by affecting the innate heat, for, as a matter of fact, most poisons only act on the body in that way, thereby

producing warmth. We mean that its "form" is not changed, and that in consequence its power continues to influence the body until the latter has destroyed the "form." For instance, if the nature of the medicament be hot, its nature reinforces its property of dispersing the breath. Examples : viper venom ; aconite. Again, if the medicament be cold, its nature reinforces its property by congealing or enfeebling the breath. Ex. : scorpion venom, *hyoscyamus* (or, hellebore).

Ad. A. i.a.—Anything that is nutritious will eventually change the temperament of the body, and in a natural manner. It warms the body because when it becomes blood that is the natural effect ; and the body becomes warmer. Lettuce and gourds warm in this way. So in saying "warm" we do not mean "warm the 'form,'" but "warm that which arises out of its own intrinsic quality—the 'species' remaining."

Ad. A. ii. a.—Medicaments which are foods are altered by the body first in quality, and later in "substance." This change in quality may be in respect of heat, so that the medicament warms (e.g. garlic) ; or it may be in respect of cold, so that the body becomes cold (e.g. lettuce). Afterwards, when the digestion and conversion into good blood has been completed, the medicament produces warmth to the same extent to which it has added to the volume of the blood, thereby increasing the "substance" of the innate heat. How could it do otherwise than furnish heat when it has itself been made hot, and its coldness thereby abstracted ?

But even after the medicament has been changed in substance there still remains some of its innate quality (some hot, some cold). There is some of the coldness of the lettuce left in the blood which has been made from the lettuce, and there is some of the heat of the garlic left in the blood which the garlic has given rise to. This holds good for a certain period of time.

357. Some nutrient medicines are medicinal in quality rather than nutrient, and others are nutrient rather than medicinal. Some of the latter are more like the "substance" of blood in nature (e.g. wine, egg-yolk, meat-juice), and others are less so (e.g. bread, meat) and others are entirely different to the substance of the blood (medicinal foods).

Food changes the state of the body both in quality and quantity. Changes in quality have been discussed.

358. *Changes in quantity* are in two directions. Either the nutriment increases in the body until there is an aversion to food ; obstructions therefore arise, and putrescence results.

Or it diminishes in amount until the body wastes away, and the tissues dry up.

An increase in amount of nutriment is always cooling in effect unless decomposition supervenes in it, so giving rise to warmth. This warmth, due to putrescent changes, is extraneous ; for such changes [in the superfluous nutriment] are the means by which extraneous heat [as opposed to innate heat] enters the body.

359. CLASSIFICATION OF FOOD-STUFFS.

(This passage is arranged in tabular form).

Texture of nutriment.	Nutritious quality.	Name of Aliment.	Notes.
Attenuated (i.e., produce attenuated blood).	Rich.	Meat juice, wine. Eggs (raw or lightly cooked). Pottage.	These are considered rich in nutriment because most of their substance is utilized by the body.
	Poor.	Potherbs. Juleb. Fruits (matian, pomegranates, and the like).	These are attempered in substance and quality.
Dense (i.e., thicken the blood).	Rich.	Hard-boiled eggs ; veal.	
	Poor.	Cheese, salted meat, egg-plant and the like.	These are considered poor in nutriment because only a small portion of them becomes blood.

360. ARRANGED ACCORDING TO QUALITY OF CHYME.

1. Making good chyme : egg-yolk, wine ; meat-juice, are highly nutritious ; they are attenuated.

Lettuce, matian, and pomegranate are feebly nutritious. These are attenuated.

Boiled eggs, year-old lamb are highly nutritious. These are dense in texture.

2. Making bad chyme : newly-killed meat of sucklings, pheasant, partridge, lung ; these are highly nutritious, and attenuated.

Radish, mustard, and many other kitchen-herbs ; these are nutritious, and attenuated.

Veal, duck, horseflesh ; these are highly nutritious, and dense in texture.

Salt meat is feebly nutritious and dense in texture.

It will be easy to find the foods which occupy an intermediate position between the attenuated and densely textured foods.

§ 195. The study of food should include the following aspects.

(1) *Digestibility.* This depends on the density or tenuity of texture of the food-stuff, as well as on the materials with which it is

associated. Thus the more fat-content, or fat-addition (from foods combined with it), the less digestible, because the less permeable. Again, digestibility may be completely removed by so simple a procedure as taking certain liquids (among them, pure water) at an unsuitable time after digestion has begun, or liquids which are incompatible with certain foods before digestion, or in a state of partial digestion. Avicenna's conception of the gastric contents as a "broth" or "emulsion" is legitimate, and if these contents are "torn off" the mucosa by foods or fluids taken after the digestion of the meal has got under way, the whole process may stop beyond power of renewal. The same holds good for the process in the small intestine. This idea, ruling in the Canon, can be verified by anyone in his daily experience.—Palatability has to do with digestibility.

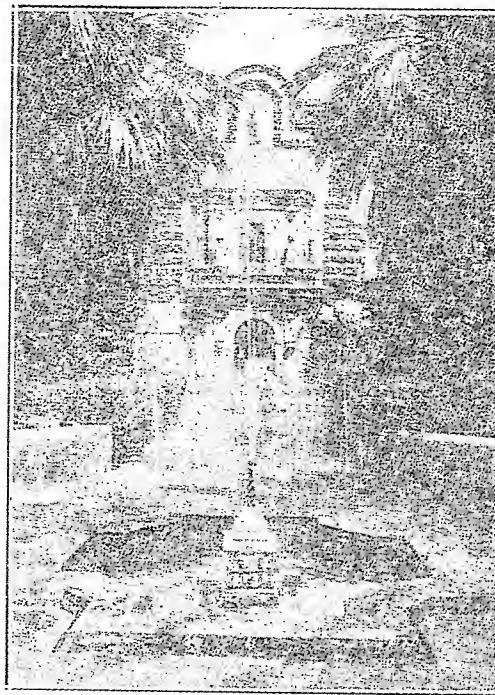
(2) *Assimilability*. This depends on the kind of chyme which will result.

(3) *Nutritive value*. This, according to the Canon, will depend on the kind of "humour" which the food yields; how much residue it leaves (therefore, whether constipating or relaxing). Thus we have the classification of foods, according as they (1) enrich the blood: cereals; dairy produce, such as soft boiled eggs, milk; fleshmeat; fowl; certain vegetables. (2) Enrich the serous humour: mutton, pork, one-year lamb, the potherbs *triplex* and *purslane*. (3) Increase the amount of bile made, or excite a flow of bile: chicken, fish with few scales and agile in habits, the potherbs garlic, mustard, nasturtium. (4) Increase the amount of atrabilious humour: goatflesh, newly-killed meat, cabbage, lentils. In each class there would be subdivisions according to the digestibility—whether digestible within two hours, or four hours, or later.

(4) *Physiological value*. This is a more general aspect, in that the other aspects contribute to its assessment. The old division of foods into proteins, carbohydrates, fats, salts, water is not necessarily to be rejected in favour of the modern division of foods according to energy-values, heat values, and "accessory factors." Chemical analysis of foods suffers from the fallacy that the substances so found do not exist as such in the food—a statement based on the same principle as will be discussed more carefully under the subject of "drugs." Moreover, were these substances present as such, they certainly do not circulate in the body, or function in the tissue cells in the chemical form found under artificial conditions. Physiological values may be assessed according to whether an ash is left in the tissues after oxidation or not. Thus, body-building foods leave an ash, heat generating foods do not. The important matter is the formation of ash, because of the risk of this lingering in the body, or even becoming firmly imprisoned in its tissues. Foods may also be studied in regard to their depurative properties, according to their alkalinity or acidity, etc. See also 768, 773, 795, and §§ 248-252.

Thus there are other considerations than the popular ones of work-production, and the practical objects which rule properly only in the management of domestic animals.

16. THE VARIOUS KINDS OF DRINKING WATER.



Note the very great importance which the Moors attached to proper water-supply. Having been accustomed to the life of the desert, they appreciated the value of water better than any other peoples.

361. Water is the only one of the elements which has the special property of entering into the composition of food and drink—not that it is itself nutriment (although it will by itself prolong life for some time), but rather that it enables the aliment to penetrate into the human body and permeate and purify its substance.

We do not wish to imply that water does not nourish at all, but we mean that it is not, as nutriment is, potential blood giving rise ultimately to tissue-substance. As an elementary substance, it is not changed in state in such a way as to become able to receive the "form" of blood or of tissue. This can only occur with a true compound.

362. Water is really a "substance" which helps to make aliment fluid and attenuated, so that it can flow easily into the blood-vessels and out of the excretory channels. Nutrition cannot be effected without it ; it is the handmaid of nutrition.

There is much to be said as to the part played by water in the economy. Though apparently simple, its chemical structure is

complex. It is a mixture of units of varying molecular complexity, each unit being called a "hydrone." The number of molecules of hydrone and polyhydrones constantly varies, even at steady temperatures, so that equilibrium regarding them is easily disturbed. The foreign matter always present in the water of Nature is essential to life, assimilation being only possible in virtue of such constituents. Apart from this, water is essential to metabolism—absorption, digestion (enzyme action depends on it), osmosis, temperature regulation, the maintenance of the salt concentration of the blood at a constant level. The necessary reservoir of water in the tissues is furnished by the muscular tissues, and their depletion has serious consequences (502, § 274-279), and their repletion entails important interference with the physiological functions. It may be noted however, that the idea that plentiful consumption of water "flushes" organisms out of the body is not reliable. (Hemmeter, Med. Rec., May 22, 1920.)

363. The various kinds of water differ (1) not merely in the substance of aquosity, but (2) in admixed matters, (3) their own individual dominant primary qualities.

364. The best water is that from springs, provided they arise in places uncontaminated by extraneous qualities. Waters from rocky places are only good if they are not admixed with earthy matters of putrescible nature which might cause the water to putresce. Spring water from the open ground is healthier than water from a rocky place, provided it is flowing. But not all flowing water is good ; it must be also exposed to the sun and winds. Water acquires nobility from the region whence it flows.

365. Stagnant water is not as bad in quality when exposed to the air as when it is deep underground. Yet running water is not necessarily exposed to the air ; it is only so when it breaks out from underground and flows out over the soil. Note, too, that water running over soil is more wholesome than that which runs over stones, because the soil cleanses it by filtering off the admixed extraneous matters in a way which stones do not. But the soil must be open to the sky ; it must not be fetid or boggy or nitrous, or the like, for should a large volume of water flow rapidly over such soil, the admixed matters would pass into its own nature. If the direction of the flow were eastwards, and in summer, it would then be reputed as better in quality, especially the further away from its source it is collected. Such water readily becomes warm or cold in the body. The next best water is that which runs northwards. Such water passes slowly through the stomach and is indigestible, and becomes warm or cold in the body only slowly. Water which runs westwards or

southwards is bad, especially if the winds are southerly at the time.

366. Water which comes from high regions and has other good qualities is more healthy. It is sweet, as it were. It will not bear being mixed with wine except in small amount, and unless the wine is light. It quickly becomes cold and quickly warm because its "substance" is attenuated. That is why it is cold in winter and warm in summer. It is tasteless and has no odour. It passes out rapidly as urine, because whatever there is in it which requires digestion is rapidly digested and dispersed.

367. You must note that the quickest way of assessing the quality of a water is by its weight. Light water is healthier in all respects. The weight may be ascertained by measure or by means of the following procedure. Soak a linen cloth of like weight in each of two waters to be tested. Dry thoroughly. Weigh. The water belonging to the cloth which is lighter is the more satisfactory.

The characters of pure water, therefore, are: (1) Aspect: limpid,^{ss} clear, pellucid, "diaphana,"^{ss} (2) Taste: tasteless, or "sweet,"^{ss} pleasant to drink, and refreshing. (3) Odour: none. (4) Touch: soft, or gentle^{ss}; cool.^{ss} (5) Other properties: weight (367); vegetables boil quickly in it; the place from which it is obtained is neither too hot nor too cold; "fertilizing" and "calm" (Honen^{ss}, p. 633); passes out of the body quickly (366).

368. Purification of water. Bad water may be purified by sublimation and distillation. If that is not feasible, boiling will suffice, for boiled water, as the learned know, is less likely to cause inflammation and passes more rapidly through the body. Ignorant persons believe that when water is boiled the attenuated part is dispersed, and that therefore it is made denser; hence they think it is better not to boil water. But as you know, the very nature of "water" means that its particles are alike in attenuation and density. It is pure, simple [in the scholastic sense], and will not thicken by boiling except in virtue of a cold quality being dominant in it, and of earthy particles being plentiful in it, which, although extremely minute, are not easily separated out or precipitated. They are not plentiful enough to break the continuity of the water and are too small to separate out by standing. Hence they are bound to remain admixed with the substance of the water. Boiling removes the density which the quality of coldness produced; the particles of water are then forcibly rarefied and the substance of the water becomes more and more rare, until the heavy earthy particles hitherto suspended burst loose and fall down and sink to the bottom. A nearly quite pure water remains behind.

369. That which has been separated by the distillation is like (or very nearly like) in texture to that which remains behind, for the particles of the water which has been distilled off are of the same tenuity as the particles of that which remains. The process of boiling does not attenuate or rarefy water directly ; it does so only because it allows the cold quality to aggregate, after which the admixed matter settles out. The proof of this is that if a thick water be left to stand for a long time, hardly anything settles out of it, but as soon as one boils it there is an abundant precipitate and the water becomes light and clear, because the boiling has made it rarefied. So, too, have you not noticed that the waters of such a big river as the Jihon,* especially if collected a long way from its source, are very muddy at the time, but in a short time suddenly clarify by sedimentation, and if you pour off the clear water and leave that standing, practically nothing settles out of it ?

370. Some people praise Nile water very highly. They enumerate four virtues in it : (1) the length of time which has elapsed since it left its source ; (2) the good character of the soil of the countries through which it travels ; (3) the fact that it runs from due south to due north, so that a continual rarefaction of its waters is taking place ; (4) the incredibly enormous volume of the water pouring into it.

371. If one should pour bad water every day from one vessel to another, one would see as much deposit on the last day as on the first. There is so little deposit during a day that it never clarifies properly. The reason is that the admixed earthy particles easily separate out from rarefied matter, for that is free of heaviness, viscosity or oiliness, but not so easily from dense matter. Boiling increases the rarefaction and so do the shaking-movements incident to ebullition.

COMMENDABLE WATERS.

372. *Rain water* is the best of waters, especially when it falls during summer or during a thunderstorm. [Others say the

* The river Jihon, or Oxus (modern Amu Darya), is one of the great rivers of Central Asia. It runs through the country of Khorasan, between Samarcand and the country called Bactria, as stated in the Glossary to the Venice edition of the East Canon. Arising in the enormous glaciers of the mountainous ranges between East Turkestan and Afghanistan, and receiving important tributaries from the northern slopes of the Hindu Kush, it emerges into open country, being here bounded by Bokhara on the north. It varies from 1,000 yards to a mile in width in this region, and the stream flows from $2\frac{1}{2}$ to 5 miles an hour. It empties into the Sea of Aral. So great a river would naturally be prized by the Persians, who regarded it as the equal of the Nile. The fact that the great trade route of Central Asia from Khorasan to China joined this river in the above-mentioned region made it well-known to Avicenna, though virtually unknown to Europe until 200 years later, when Marco Polo and his companions entered this country.

rain which falls in the spring, and that which falls during winter are best, then that which falls during the fruit season, whereas that which falls in summer is worst.] Rain falling during stormy weather is very polluted and impure in nature, for at this time the violent winds agitate those clouds whence the rain comes.

373. Rainwater readily undergoes putrescence in spite of being called laudable. This is because it is so rarefied that corruptible terrene matter and air quickly act upon it and set up decomposition in it; the humours of the body therefore undergo putrescence, and obstructions arise in the chest and the voice becomes husky.

374. Some say that the reason for the putrescence is that rain water is formed from the vapours which evaporate off from various kinds of moisture. But were this the case, rain water would not be laudable but uncommendable, and that is not so. The real reason is that the substance of rain water is very rarefied and tenuous, and when a substance is tenuous it has more receptivity (and is therefore liable to putrescence). But if boiled promptly, this risk of putrescence is lessened. (Aegineta adds : rain water is very light, sweet and limpid ; it is tenuous because it has been drawn up by the heat of the sun, and therefore only the lightest particles of sea-water, lake-water enter into it). Rain water is soft to the touch.

375. *Well water and water conveyed along aqueducts.* These are of bad quality as compared with spring water, because they are confined and have been exposed to earthy matter for a long time, and consequently cannot help being to some extent putrescent. For in the process of being drawn, they are shaken up by the power entailed (that is, by the mechanical contrivances used) or by the influence of gravity rendered possible by the slope of the channel. Of such waters those which are conveyed by leaden pipes are more harmful, because they acquire certain properties from the lead, and this makes them liable to bring on a form of dysentery.

376. *Snow water and water from melted ice.* These are coarse in texture. When pure and free from admixture with deleterious substances, such water is good and healthy ; it is also useful for cooling water, either by placing such water in it, or by adding it to the water. There is little difference in the visible character of these two kinds of water ; but they are denser in texture than other kinds of water [because the finest particles are squeezed out by the freezing (Aegineta)]. This kind of water is harmful for persons suffering from neuritis. Boiling renders

such water wholesome. If ice water be made of bad water or if the snow has attracted some bad property from the places upon which it has fallen, it would be better to use water free of such injurious admixture.

River water was preferred before others by Rhazes; Aetius preferred Nile water to all others (see 370).

Spring water: the qualities vary according to whether the water comes from north, south, east or west (Hippocrates).

NON-COMMENDABLE WATERS.

377. Marshy water : This is of worse quality than well water because it stays a long time putrefying in the channels of the decomposing earth, and diffuses out and moves up very slowly, and then not by its own power, for it is so rich in (alluvial) matter. Moreover, it only occurs in decomposing decaying earth. Well-water on the other hand is cleansed by contact with that which separates out from it and by the gases which bubble up out of it, thereby keeping it in constant (molecular) movement. Well-water does not remain in a confined state long and does not linger in the channels and openings of the earth.

378. Stagnant water : Water in reedy marshes. This is unhealthy and heavy, especially if in exposed situations, for these do not become cold in winter unless and only in so far as snow happens to fall on them. They therefore give rise, in the body, to serous humour. In summer, the sun makes them hot and so they putresce and then they will give rise, in the body, to biliary humour. There are three reasons why they cause disease : (1) their inspissated character ; (2) admixture with earthy matter ; (3) dispersion of their subtle particles.

379. The following are the diseases liable to develop after drinking such water : (a) diseases of the spleen. These result in heaping up of the viscera and stretching of the peritoneum—the belly being hard and tense ; wasting of the arms, legs and neck—for the nutrition fails because of the state of the spleen despite the excessive appetite and thirst ; constipation ; vomiting is difficult to induce. (b) dropsy : from retention of the water. (c) inflammatory deposits in the lung and spleen. (d) dysenteric ailments, with the result that the hands and feet become dry, and the liver becomes enfeebled and nutrition is impaired. (e) quartan fevers (in summer). (f) piles, varices, lax swellings of inflammatory nature, insanity (especially in winter).

380. The effect of such water on women. Conception and parturition are both difficult. The offspring will be male and

will be liable to develop inflammatory masses and then waste away.—Moles are liable to occur because impregnation is often faulty ; the offspring is found to have rupture.—Varicose veins and ulcers of the leg ; these heal with difficulty. The appetite increases and there is constipation leading to intestinal ulceration. Quartans are common.

381. Effect on old persons. "Ardent" fevers occur, as accords with the dryness of their nature, and of the stomach.

382. All stagnant waters, from whatever source, are injurious to the stomach.

383. *Channel water.* This is very like stagnant water, but is healthier because it does not linger so long in one spot. If it is not actually flowing, this was because of some heaviness in it. In many of these waters (i.e. including water in aqueducts, water in irrigation channels) there is a certain stypticity, and they quickly warm the interior organs. Hence they are not utilisable in cases of fever or for persons in whom the bilious humour is predominant. They are more applicable for cases of disease where the treatment is to foster retention and maturation.

384. *Waters containing metallic substances.* These are injurious, though in some cases there is a certain value in them. Thus, ferruginous waters impart strength to the internal organs, prevent stomach trouble, and stimulate the appetite. They resolve the spleen and are beneficial for those who cannot cohabit properly.

Waters containing salts of ammonia are aperient, and carminative. They may be either swallowed as a drink or given as an enema, or used in a sitz-bath.

Waters containing alum suppress excessive menstruation and haemoptysis and the bleeding of piles. But they render persons who are liable to take fevers still more liable to develop them.

385. *Waters in which leeches live.* These are injurious.

386. *Salt water.* This makes the body dry up and become wasted. Its abstersive power makes it first laxative, and afterwards constipating—because dry in nature. It decomposes the blood and so gives rise to pruritus and "scabies."

387. *Acetous water,* added to rain water which has to be consumed arrests putrefactive changes in the water and provides immunity from such ill-effects.

388. *Milky water* gives rise to calculus and obstructions. Hence one should make use of diuretics after it. In fact, one

should take diuretics after drinking any coarse and heavy waters, because they linger in the bowel. Fatty and sweet things (e.g. theriacs) are also correctives for such water. The fact that milky water brings on constipation makes it of value for some persons.

389. Cold water.—Water which is only moderately cold is more healthy than all others, because it stimulates the appetite and strengthens the stomach. Nevertheless it weakens the nerves and is harmful for cases of inflammatory disease in the interior organs.

[*Very cold water* should be taken after food and then only in small quantity (Aegineta).]

390. Tepid water incites nausea.

Warm water (that is, water which is a little warmer than tepid water), taken on an empty stomach, is cleansing both to stomach and intestines. But it has a weakening effect on the stomach if taken often.

Hot water is beneficial for the following conditions :

(a) Head : "cold" headache ; inflammation of the eye ; parotitis, quinsies ; "dry" gums ; postauricular inflammations. Mental conditions—epilepsy and "melancholia."

(b) Chest : asthma, solutions of continuity in the thorax ; ulcers of the diaphragm.

(c) General : rheumatic pains. Diuresis. It relieves painful micturition.

(d) Female ailments : it evokes menstruation.

Hot water interferes with digestion and makes the food swim about in the stomach. It does not quench thirst. It may lead to dropsy, and hectic fever, and emaciation.

Very hot water is of great value in colic ; it also disperses flatulence.

391. Aerated waters : these are useful for certain temperaments.

When various kinds of water, good and bad, are mingled, their effect varies according to which proves dominant.

392. Correction of impure water : The correction of impure water is specially referred to under "regimen for travellers"—see 891.

Note also the following, from Aegineta : (1) add decoction of chick-peas ; (2) boil wild carrots with some small fish and fennel ; (3) beet, gourds, salts and diluted wine. Marshy, saltish and bituminous water should be strained. Fetid smelling waters should be boiled or mixed with wine.

When good and bad waters are mingled, the stronger dominates.

Other matters relative to water and its properties and

modes of action will be discussed in the chapter on "Water as one of the simples" in Book II—Allah permitting.

17. THE RESULTS OF RETENTION AND EVACUATION.*

393. The following are the causes of retention of waste matters : (1) weak expulsive faculty, (2) unduly strong retentive faculty : the latter occurs in (*a*) weakness of digestive power, so that aliments remain too long in the stomach, the natural retentive faculty holding them back till they are sufficiently digested, (*b*) narrowness and (*c*) obstruction of the channels, (*d*) coarseness or viscosity of the waste matters. The former holds in the case of (*a*) superabundance of the waste matters, so that the expulsive faculty cannot deal with them, (*b*) insufficient informing sense for defecation, this act being aided by voluntary effort. The result may be that the effete matter is (compensatorily) removed to other parts of the body by the action of the vegetative faculties. Thus jaundice follows [gall-stone] colic ; the colic depends on the retention, the jaundice is the compensatory evacuation. Again, at the crisis of a fever, there may be retention of urine and faeces, and a critical evacuation occurs elsewhere.

394. *Diseases consequent upon retention of waste matters.*—

(i) Compositional : constipation, diarrhoea or laxity of the bowels, spasmus humidus and the like ; inflammatory processes ; furuncles. (ii) *Intemperaments* : septic conditions ; imprisonment of the innate heat, or mutation of this into igneity. There may be so marked a coarctation that the innate heat is extinguished altogether, and coldness of the body supervenes, with the transference of too much moisture to the surface of the body. (iii) *General conditions* : tearing or rupture of locular spaces and crypts.

When repletion (as from great plenty during fertile years) develops after a long period of inanition (as from times of great famine, in barren years), it is one of the most effective causes of such illnesses.

395.—The *causes of the evacuation (depletion)* of matters which are normally retained. (1) Vigorous expulsive faculty, (2) defective retentive faculty, (3) unfavourable quality of the matter: (*a*) too heavy, because superabundant, (*b*) too distending owing to flatulent action, (*c*) corrosive and acrid in quality, (*d*) attenuation of texture making it too mobile and too easily expelled, (4) widening of the excretory channels. This occurs in the case of the seminal flow. It also occurs if they are torn

* Cf., repletion and depletion (442, 497, 502).

longitudinally or transversely, or because their orifices become too patent (in epistaxis) from either extraneous or interior causes.

396.—The possible *effects* of evacuation of this type are :

(1) The temperament becomes cold, because the matter is lost which would otherwise increase that which maintains the innate heat. (2) The temperament becomes hot, if the evacuated material is cold in temperament, like serous humour or mucus. (3) The temperament becomes equable like blood, if there is undue accumulation of the heating bilious humour, so that the heat becomes superabundant. (4) The temperament becomes dry. This is always intrinsic in origin. (5) The temperament becomes moist in a manner analogous to that mentioned in regard to accidental increase in the body-heat. Namely, either the evacuation of desiccant body-fluid has not been too great, or the innate heat is too scanty, with the result that the aliment is not adequately digested, and serous humour becomes relatively increased. But a moist temperament of this kind is unfavourable to the maintenance of the innate heat, and foreign heat will not serve as a substitute for innate heat, because of the difference of its nature.

397. The effect of excessive evacuations on the members of the body.—(1) Coldness and dryness of their substance and nature ensue, even though they receive extraneous heat, and moisture beyond their need. (2) Diseases : obstruction of the vessels due to undue dryness and narrowing of the veins. Convulsions and tetanic spasms may therefore arise.

398. When retention and evacuation are equally matched, and occur at the proper times, they are beneficial, and maintain the health.

§ 196. *Venery. Coitus.*—Galen placed this in the first rank among the obligatory causes of disease, but most physicians group it partly under "exercise," and partly under "evacuations" (excretions).

It causes "dryness" of the body; weakens the vegetative faculties; infrigidates (usually). Sometimes the concomitant emotional excitement entails a heating effect. (JOANNITIUS).

Having now given a general description of the obligatory causes of disease, we proceed to the facultative causes.

B. 18. *FACULTATIVE CAUSES OF DISEASE.*

We now come to causal agents, not necessarily injurious, to which the body is not inevitably exposed. They cannot be classified either as natural or as contrary to nature. They influence the body from without. Excluding the atmosphere, to

which one is necessarily exposed, such agents are referred to as baths, friction, and the like.

399. Influences on the human body from without act in these ways :

I. By penetration into the body (**400-414**)

- (a) Attenuated matter in the pores enters the body by its own penetrative power.
- (b) The tissues themselves draw it in through the pores.
- (c) One of these factors assists the other.

II. The primary quality of the agent itself is able to produce a change in the body. (**415-431.**) There are three aspects of such a quality :

- (i) It may be actual, e.g., an epitheme of cooling character ; a plaster which is calefacient.
- (ii) It may be potential. Here the innate heat stirs up the power into actuality.
- (iii) A specific property.

III. Things acting in both ways (a) producing a harmful effect both externally and internally. (b) Harmful when applied externally, but not when taken internally ; and vice versa.

Example of an agent which affects the body when applied externally, but harmless when taken by the mouth : onions applied as a plaster cause ulceration ; as food, they are harmless. Example of an agent of a contrary kind : white lead. This is a virulent poison when swallowed, but is harmless when applied as an ointment.

Explanation of this.—(1) When a substance like onions is taken as food, the alterative faculty breaks it up and changes its temperament into a weaker one, until it is too weak to exert a harmful influence. Hence there is no internal ulceration. (2) When taken as food, such a substance is usually admixed with other foods. (3) Its power is broken by being submerged in the other moist substances present in the alimentary canal. (4) A substance applied externally can be kept in one spot, but when it is within the stomach it is kept moving about. (5) A substance applied externally is usually applied very tightly and closely, whereas within the body it is only just in contiguity without any adhesion. (6) When a substance is taken internally, its own natural power determines the quick accomplishment of digestion and quickly expels the excess left after the bulk has been converted into good blood.

The reason why the action of white lead is different is that

white lead is of gross nature and is made of coarse particles. Hence it cannot penetrate into the channels of the body from without, and even if it did enter the skin it would not reach as far as the channels of the breath or the principal organs. Taken in by the mouth the matter is different, for then its poisonous nature is at once brought out by the influence of the innate heat upon it. Such an interaction could not take place externally.

We shall probably refer to these considerations again, in the Book of Simples. (Book II).

BALNEOLOGY

I

19. BATHS. FRICTION. EXPOSURE TO THE SUN.

§ 197. POINTS RELATIVE TO WATER-BATHS.

The bath-rooms : temperature of the air in the different rooms (temperate, warm, hot, cool) ; mural decorations.

The bath-man.

The bath itself :

Quantity of water : full to immersion ; partial ; sitz, etc.

Temperature of water : hot, tepid, cold.

Duration of stay in the bath : long, short, medium.

Kinds of water employed.

Intrinsic quality (cooling, moistening, etc.)

The person bathing : relation to food : fasting or hungry ; immediately after a meal ; soon after a meal ; at the end of the first stage of digestion.

State of the skin : dry, moist ; dropsical.

State of the humours and their quality (cold, immatured).

Frequency of bathing.

Season for open-air bathing.

Effects of the bath :

On respiration.

On pulse.

On innate heat.

On the strength (relaxing effects ; syncope ; impotence).

On the humours : helping maturation ; drawing to surface ; diverting superfluities to different parts.

On the quality of the body : dry, cold, moist.

On the general nutrition : making the body thin, stout, or weak.

Special purposes of the bath. Treatment of hectic fevers ; for affections of the stomach and spleen, etc.

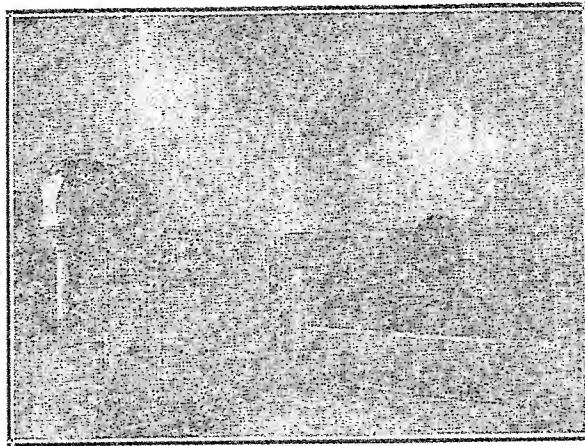
400. Some say that bath-houses should be ancient fine buildings, with vaults and arches, and roomy, airy, spacious galleries, and furnished with sweet water. Others mention that the bath-men should arrange the degree of heat to suit the temperament of the bather.

§ 198.—The *bath-house*, the *hammam*, of Arabian life, agrees in manner with that described among the ancients (e.g. the Romans).

In Lane's notes to the "Arabian Nights," he gives the following description :—"The public bath comprises several apartments, with mosaic or tessellated pavements, composed of white and black marble, and pieces of fine red tile, and sometimes other materials. The inner apartments are covered with domes, having a number of small, round, glazed apertures, for the admission of light. The first apartment is the disrobing room (*maslakh*, or stripping-place : Burton). (Tepidarium, because the air is tepid.) In the centre of this is a fountain of cold water. Next the walls are wide benches or platforms, encased with marble. These are furnished with mattresses and cushions for the higher and middle classes, and with mats for the poorer sort. The inner division of the building occupies nearly a square : the central or chief portion of it is the principal apartment, or *hararah*, which generally has the form of a cross. In its centre is a fountain of hot water, rising from a base encased with marble, which serves as a seat. One of the angles of the square is occupied by the ante-chamber of the hararah. A second angle has the fire and the boiler over it. A third angle has a small chamber, containing a tank of warm water fed by a spout in the dome (cf. calidarium). The fourth angle has two taps side by side, one hot, one cold. A small trough is beneath, and before that is a seat (cf. frigidarium). The inner apartments are heated by the steam rising from the fountain and tanks and by the contiguity of the fire. The chamber of the first-named angle is not as hot as the hararah, and has a door intervening. This chamber is used for disrobing in cold weather.

"In their atmosphere, the four apartments of the Hammam represent the four seasons—Autumn and Summer, and Winter and Spring." (Night 452).

"The bather enters the hararah wearing wooden clogs, a large napkin round the loins, a second round the head like a turban, a third over the chest, and a fourth covering the back. The attendant removes the towels except the first, and proceeds to crack the joints of his fingers and toes, and several of the vertebrae of the back and neck ; kneads his flesh, and rubs the soles of his feet with a coarse earthen rasp, and his limbs and body with a woollen bag which covers his hand like a glove. After which the bather plunges into the tank. He is then thoroughly washed with soap and water, and fibres of the palm-tree, and shaved, if he wish it, in the fourth chamber. Then he returns to the antechamber, and here he generally reclines upon a mattress, and takes some light refreshment, while one of the attendants rubs the soles of his feet, and kneads the flesh of his body and limbs, previously to resuming his dress. During this period of rest, a pipe and a cup of coffee is often taken. The operations in the antechamber are the 'restorative friction' of the text and of Greek and Roman baths. Before the dress is resumed, oils or ointments are rubbed in, and fragrant powders sprinkled on the skin."



Rooms in the private baths of the Alhambra Palace. (a) The Sultan's bath. Through the archway on the left is seen (b) the Calidarium. The "rest-room" of the same suite is shown as an "initial" to 751.

§ 199.—Sir Thomas Arnold, in his recently published work, "Painting in Islam,"¹⁰⁷ (1928, p.88) quotes some medical authors who speak of the propriety of mural decorations in the rest-room. (a) The ideal bath "should contain pictures of high artistic merit and great beauty, representing pairs of lovers, gardens, beds of flowers, fine galloping horses and wild beasts, for pictures such as these are potent in strengthening the powers of the body, whether animal, natural, or spiritual." (b) "All physicians, sages, and wise men are agreed that the sight of beautiful pictures gladdens and refreshes the soul, and drives away from it melancholic thoughts and suggestions, and strengthens the heart more than anything else can do, because it rids it of all evil imaginings." (c) "Beautiful pictures in bright, cheerful colours. These they divide into three kinds since they knew that there are three vital principles in the body—the animal, the spiritual and the natural. Accordingly they painted pictures of each kind, so as to strengthen each one of these potentialities; for the animal power they painted pictures of fighting and war and galloping horses, and the snaring of wild beasts. For the spiritual power, pictures of love and of reflection of the lover on his beloved, and pictures of their mutual recriminations and reproaches, and of their embracing one another; and for the natural power, gardens and beautiful trees and bright flowers." (d) "When in a beautiful picture harmonious colours such as yellow, red and green, are combined with a due proportion in their respective forms, then the melancholy humours find healing, and the cares that cling to the soul of man are expelled, and the mind gets rid of its sorrows, for the soul becomes refined and ennobled by the sight of such pictures."

401. *Natural action of the bath.* The air of the bathroom has a warming action, the water of the bath has a moistening effect on the body. The first change in the body is to cool and moisten ; the second is to warm and moisten ; the third is to make the body warm and dry. It is useless to listen to those who assert that water taken internally does not moisten the interior tissues.

402. *Changes and later effects of the bath.* These are (*a*) accidental, (*b*) essential.

1. *Cold air bath.*—This disperses the innate heat greatly, and so dries the substance of the tissues. It disperses the natural (normal) fluids very greatly, though it increases the extraneous fluids.

2. *Very hot water bath.*—The pores close ; there is goose-flesh. The moisture does not enter the body, and there is not much dispersal of the innate heat. But the water sometimes adds to the warmth of the body and sometimes cools it. To have the former effect, the water must be very hot.

3. *Subtepid bath.*—This cools and moistens the body. As the water cools down, the air of the bathroom becomes less warm, and the effect of the cooling in both directions to which the body is now exposed is to contract the abdominal viscera.

Cold bath.—When taken while fasting, it imparts warmth and moisture. If taken after a meal, it will make the body cold, and remove moisture.

Hot bath.—When taken while fasting, it is attenuant and refrigerant and does not impart moisture. If taken after a meal, the bath is heating and moistens the body.—(Hippocrates.)

Warm bath.—This relieves lassitude, is soothing, and has a warming and softening effect. It dispels plethora, and removes flatulence from wherever it may have lodged. It favours sleep, and promotes digestion.—(Haly Abbas.) It opens the pores. It induces plumpness of the body. It is beneficial for all—men, women, young, old, rich, poor. The best time for it is before food, and after exercise.—(Aegineta.)

403. The frequent use of such a bath will have a *refrigerant effect*. This is because (i) water is fundamentally cold in nature, and even warming of it will not ensure continuance of the “accidental” (scholastic significance) heat, the natural quality remaining, and this natural coldness enters the body and makes it cold. (ii) Whether hot or cold, water is still “wet,” and wets the body (interiorly), so, imparting much moisture, it binds the innate heat even to the degree of extinction.* Consequently the body becomes cold.

Such a bath may have a *warming effect* if (*a*) the aliment previously taken has not yet digested, (*b*) there is a cold humour

* As water quenches fire.

present in the body which is not yet completely matured. For the bath will help the digestion of the aliment, and the maturation of the humour.

404. *State of skin at the time of the bath.*—If the skin be dry at the time of the bath, dropsy or relaxed conditions would be benefited. If the skin be moist to commence with, the bath will have a moistening effect.

405. *Duration of stay in the bath.*—Dryness results if the person stay a long time in the bath. This is partly because of loss of water by the sweating and with the dispersal of the breath so induced. A short stay in the bath will produce a moistening effect, if the skin be wiped dry before sweating begins.

406. *Relation to meals.*—To enter a bath fasting will render the body extremely dry, and make the person thin and debilitated. To enter the bath after a heavy meal, on the other hand, will make a person stout, by drawing the humours towards the subcutaneous tissues. Moreover it removes the obstructions by transferring the undigested aliment from the stomach to the tissues. To enter the bath at the moment when the first digestion has ended and before a sense of hunger returns is beneficial and produces a medium degree of stoutness.

407. *Special therapeutic uses. Bath treatment of hectic fever.*—If the bath is taken for a moistening effect the person should be entirely immersed in the water, unless he is too enfeebled, or his strength will not allow of it. The air of the room should be temperate—neither hot nor cold, but gently moist. The water of the bath should be thrown freely about in order to disseminate the water-vapour through the air and so fill the air with moisture. The duration of the bath should not be long. The patient should be lifted out of the water and rubbed down gently, himself making no exertion ; and he should be laid at once on the couch (in the bathroom) and there be anointed with oil (to increase the moisture of the skin and retain in the pores the aquosity which has already gained entry into the skin, thus fixing it within the skin), using cool perfumed oil. He should then lie in the tepidarium (the dressing room) for an hour until the respiration subsides to the customary rate. After that, he is anointed, robed, and taken into a room (dining-room, 1595 ed.) where he may receive a small draught compounded of humectants, such as barley water and asses' milk.

Disadvantages.—Such patients should not stay too long in the bath, as there is a risk of syncope, because it renders the heart "hot" (and therefore disperses the "breath") and sets the

bilious humour in motion ; it produces nausea ; and other ill-effects. It causes morbific matters to gravitate into the debilitated organs. It has a relaxing effect and is injurious for the nerves. It disperses the innate heat. It removes the appetite for solid food. It weakens the power of sexual intercourse.

[Aegineta says: natural baths are largely desiccant and calefacient, and are therefore good for people of humid and cold temperament].

408. Action of baths in virtue of mineral constituents in the water.—Waters of this kind occur in nature, or may be reproduced artificially. They are all strongly resolvent and attenuant. They make the tissues flabby, and prevent humours from passing into abscesses. They are beneficial for the guineaworm and “ Indian vein.”



Mineral Baths in the Middle Ages⁶² (p. 270).

Aluminous waters [Alum= $MgSO_4 + FeSO_4$: “ hair-alum,” according to Adams⁷⁴] benefit cases of hæmoptysis, melaena, menorrhage, procidentia ani or uteri, repeated causeless miscarriage, cachexias, undue sweating, causeless vomiting. They have a cooling and drying effect.

Bitter waters have a heating and drying effect.

Bituminous waters (“ judaic waters ”) occasion fulness of the head. The person must therefore not immerse his head in the bath or stay too long in it. They render the temperament warmer, especially that of the uterus, bladder and colon. They are all harmful and heavy. [They soothe if persevered with: Aegineta.]

Chalky waters have a cooling and drying effect.

Copper-containing waters are beneficial for the mouth, tonsils and uvula ; for relaxed ocular tissues ; for humid affections of the ears.

Ferruginous waters are beneficial for the stomach and spleen. (They should be entered gradually so as to allow the impression of the water to sink deeply into the body while it is in a relaxed state : Aegineta.)

Medicinal baths, prepared with laurel leaves, stavesacre, juniper berry.

Nitrous (= Na_2CO_3 : Adams⁷⁴) baths and saline baths are beneficial for the head and chest when humours are constantly flowing into them ; for wateriness of the stomach, for dropsy, for swellings left after diseases, and for collections of phlegm.

Aerated waters, ferruginous and saline waters are beneficial for diseases depending on coldness and moisture, for pains in the joints, for podagra. They benefit relaxed persons, asthma, renal disease, carbuncles, ulcers ; they are very beneficial in cases of fracture.

Sulphur baths. These soothe and warm the nerves and relieve pain, lassitude and convulsions. They cleanse the surface of the skin from furuncles and old bad ulcers and purple marks ; they benefit pannus, vitiligo, lepra. They disperse morbific matters descending into the joints, the spleen and the liver. They are beneficial for the womb when unduly hard. They reduce the tone of the stomach and banish the appetite.

409. *Thermal baths.*—Persons desiring to use thermal baths should bathe quietly, gently, and allow the waters to play gently over the relaxed body ; laving, not splashing ; and in this way the interior organs are benefited.

The subject of baths will be considered further in Part III, and again when discussing the use of cold water as a drink.

20. THE INFLUENCE OF SUNBATHS ; SANDBATHS ; OILBATHS ; SHOWERBATHS.

410. Immersion in hot sand, oil baths, spraying of water over the face ; standing or running or walking rapidly, or jumping in the heat of the burning sun—all these are powerful agents for removing superfluities, and for producing sweating, dispersing flatulence, and lax swellings and dropsies. They are

beneficial for asthma, for orthopnoea. They invigorate the brain (whose temperament is cold) and relieve inveterate "cold" headache.

If the seat of the bath is dry, and the floor is left wet, the bath will benefit cases of sciatica, lumbar pain, uterine obstruction. It has a cleansing effect on the womb.

411. *Sun-baths.*—One must not remain too long in the sun, or else the body will become dry, thick, and hard, as the sun acts like a cautery upon the pores of the skin, and obstructs the outflow of the insensible perspiration. The sun burns the skin more if one stands still in it, than if one moves about, and so it inhibits the dissipation of the sensible perspiration still more.

412. *Sea-sand baths, in the sun.*—These are more efficient for drying the humours lodged in the skin. Such a bath may be used in various ways : one may sit on the sand, or bury oneself in it, or sprinkle it over the body. In whatever way it is employed, the same beneficial effect is experienced in all the above-named diseases. If the sand is sprinkled over the body, little by little, it removes pains and other effects of insolation. In the end, there is an extremely marked drying effect on the body.

413. *Oil-baths.*—These are beneficial in lassitude and for persons suffering from long-standing cold fevers, especially if there are pains in the nerves and joints ; for convulsions ; for spasmodic diseases ; for suppression of urine. The oil must be made hot outside the room. These baths are more beneficial for the above conditions if the flesh of the jackal or hyæna is boiled in it. If made as described, it will be an efficient remedy for joint-pains and podagra.

Aetius gives : add a fifth part of heated oil to the water. Such a bath is highly anodyne ; it relieves lassitude and nervous pains. Uses : for prolonged fevers ; for convulsions ; for retention of urine.

414. *Shower-baths, Douching, Spraying.*—If water be sprinkled on the face (or over the body) it restores the vigour of the breath, when that has been lost by dyspnoea and by the inflammatory changes in hot fevers. This sprinkling is especially beneficial for syncope, if rose water or vinegar be used. It may restore the appetite. They are injurious to persons suffering from catarrhs or "cold" headaches.

"He swooned away, and the Wazir sprinkled rose water on him, till the Prince came to himself."—Night, 720 ; Burton, iv. 408.

Douching with emollient herbs is referred to in 719, 732.

II

THE AGENTS WHICH ALTER THE SEVERAL QUALITIES OF THE BODY.

1. Calefacients.
2. Refrigerants.
3. Humectants.
4. Desiccants.
5. Agents causing changes of form.
6. Agents causing obstructions of channels.
7. Agents which open up the channels.
8. Agents causing roughness.
9. Mollificants.
10. Agents causing displacements of parts.
11. Agents preventing apposition of parts.
12. Agents preventing expansion of parts.
13. Agents causing abnormal movements.
14. Causes of numerical increase.
15. Causes of numerical decrease.
16. Causes of loss of continuity.
17. Causes of ulceration.
18. Causes of inflammatory swellings.
- 19-26. The subject of pain.
27. Agents producing retentions or evacuations.
28. Causes of over-repletion.
29. Causes of debility ; asthenia ; lack of vigour in members.

415.—I. *Calefacients.*

(i) Outward heat in various forms : summer heat ; artificial heat ; baths of moderate temperature (the heating effect is produced by both air and water) ; calefacient plasters or local applications.

(ii) Heat produced by movement. Exercise, but not in excess ; gymnastic exercise which is not too vigorous or beyond the right measure and duration ; moderate friction ; light massage with the hands on the limbs ; dry cupping (wet cupping is infrigidant because it removes heat from the body).

(iii) Heat introduced by the mouth. Adequate supply of nutriment ; hot aliments ; hot or heating medicaments (i.e. viâ oxidation within the body.)

(iv) Heat arising from emotional states : anger, gloom in a degree less than would cause infrigidation ; moderated joy. Also sleep and wakefulness in moderate degree.

(v) Heat derived from putrefactive processes. This is neither the innate heat nor derived from combustion. The warming from the innate heat is less in degree than that from combustion ; it can occur apart from putrefaction and prior to a septic state. In the case of putrefaction the heat from the foreign source lingers in the body after the agent giving rise to it has left the body. This heat unites with the moisture of the humours and alters their temperament (in respect of moisture) in such a manner that it will no longer respond to the temperament of the natural breath. The difference between digestion and putrefaction is that in the case of digestion the heat and moisture which are present in matter are altered ; that is, instead of being accordant with the original temperament, they are now accordant with another different one (ϕ).

In oxidation, moist substance is separated from dry by sublimation and evaporation, the dryness going into the residue.

In the process of simple calefaction, the humours simply become warmer without losing their natural breath.

(Galen's classification into five groups is represented by i, ii, iii, iv and v of the above list.)

(vi) The state of the body. When there is sclerosis (*takāthuf*) of the surface, the body tends to become hot because the breath (lit., the steam, *bakhr*) is held in or imprisoned. When there is rarefaction (*takhalkhal*) within the body, it becomes warm because the "breath" (*bakhr*) then expands throughout the body.

The above section has been partly rearranged. The sub-headings are introduced, as usual, for the sake of clearness.

Sclerosis.—This refers to the thickening of the skin, which occurs after long exposure to the weather; it becomes harsh, coarse, and presumably less pervious.

Steam.—Horses "steam" when they have been hard-worked. The exhaled air appears like "steam." The urine and shed blood steam when they leave the body. This steam is the *substance of the breath*, so that it is permissible to translate the word accordingly. This steam, which pervades organs and tissues and tissue-spaces and cavities, is the visible manifestation of the breath.

It is natural to think, then, that if the skin is so hardened that it will not let this vapour out, the latter will accumulate in the body and make it hot, as happens after severe exercise until the body "cools down." It is also natural to reason that if the vapour is able to expand owing to laxity of the connective tissues, it will impart a sense of glow to the body; for everyone has experienced it.

Rarefaction.—When this term is applied to the skin it refers to a condition opposite to "sclerosis"; the skin is unduly soft, supple, and is evidently relaxed instead of tight.

These considerations apply to sub-heading 5 of 416. See also 838.

§ 200. In modern language, the warmth of the body depends on the relation between heat loss and heat gain. Heat enters the body from (a) the external air or surroundings: warm air of summer, artificially warmed air in winter, baths; (b) heat derived from (i) food and drink, (ii) exercise, (iii) toxic action of foreign matter (sepsis, drugs); (c) heat fostered by preventing heat loss: clothing, sleep; (d) local heat (fomentations, etc.); (e) emotional influence.

Heat is lost from the body by (a) excreta: urine, faeces, skin action, exhalation by the air expired; (b) external conditions: cold, wet.

Note that baths vary in their effect. An ordinary hot bath (105° F.) renders the body warm; a brief immersion has a different effect, a long continued immersion is depressant.

416. 2. *Refrigerants*.

1. Artificial cold; this is a refrigerant in act, as it is cold itself.
2. Potential refrigerants. Thus, when the body is hot at the time of exposure to the agent, its heat becomes dissipated. Thermal waters.
3. Calefacients. (a) Excessive: very hot air, thermal waters, hot plasters and fomentations (which disperse the innate heat by

relaxing the body); (b) moderate: staying too long in the bath; (c) agents at present hot but becoming cold later.

4. Excessive exercise: this disperses the innate heat unduly. Excessive repose aggregates and strangles the innate heat, thereby having an infrigidant effect.

5. Certain bodily states. (a) Great rarefaction relaxes the body and disperses the innate heat; (b) extreme spissitude strangles the innate heat; (c) excessive retention (has the same action); (d) undue evacuation from the body, which destroys the material basis of the innate heat and disperses the breath, and allows the effete matters to become obstructions.

6. Mental states: great gloom, too much fear; too much joy; great delight.

7. Aliment. Excess of food and drink; cold aliments; too little food; refrigerant medicines.

8. Mechanical causes: tight bandaging of limbs for some time, which prevents the innate heat reaching them.

9. Crudity; the opposite of putrefaction.

(Galen's classification was: 4, 1, 3a, 5b, insufficient food.)

417. 3. Humectants.

External: baths, especially if taken after a meal.

Diet: food taken to excess; humectant articles of food; humectant medicaments.

Retention of that which should be evacuated.

Evacuation of desiccant humour.

Repose and sleep.

Joy in moderation.

Infrigidants (these cause the humours to be retained); calefacients (slight degree of warmth causes the humours to move).

418. 4. Desiccants.

External: cold congeals the humours and prevents the tissues from attracting nutritive material; it also constricts the channels of the body, and so causes them to be blocked; in consequence nutrient material cannot reach it.

Great heat disperses moisture. Hence too frequent hot baths have this effect.

Bathing in styptic waters has a desiccant effect.

Diet: insufficient food; dry aliments; desiccant medicaments.

Violent evacuations; coitus.

Exercise.

Wakefulness.

Frequent emotional disturbance.

419. 5. Agents causing deformity.

Some of these agents come into play from the beginning of life, because of a defect in the formative power of the sperm. Others

come into force later in life—namely at parturition, during the act of traversing the maternal passages. Others operate after birth (tight binders and wrappings). Others operate in infancy, before the limbs are hard enough to enable the infant to walk (letting the baby fall ; blows).

Diseases which characteristically produce deformities : leprosy, paralysis, nerve-lesions, phthisis.

Excessive deposition of fat ; an excessive degree of emaciation (due to inflammation, or malposition, or from the coalescence of ulcers).

420. 6. Agents causing obstruction of the channels.

(i) Foreign bodies in a channel : calculus. (ii) Too great a quantity of material in a channel : loading with faeces. (iii) Alteration in quality of material : grossness, viscosity, leech-like coagula of blood. (iv) Formation of matter within the channels, whether removable therefrom or becoming fixed therein. (v) Obliteration of the orifices, (a) by cicatrisation after healing of an ulcer ; (b) by formation of new tissue (e.g. proud flesh, fleshy warts) ; (c) by compression by an inflammatory mass in the vicinity ; (d) by the astringent effect of great cold or dryness (styptics) ; (e) by unduly marked retentive power ; (f) by tight bandaging.

Obstructions are common in winter, because that is the season when effete matters are largely retained, and because the cold itself has an astringent effect.

421. 7. Agents which open up the channels.

Channels become dilated either from lack of retentive power or from an excessive action of the expulsive faculty. For example, holding the breath. Medicines which are relaxing, hot, moist, aperient and detergent.

In short, all agents contrary to Group 6.

422. 8. Agents producing harshness of the body.

A medicinal agent may render the body harsh by its sharpness (acidity), like vinegar and acitous waste matters ; or by dispersion (like halcyonium=coral) and acrid waste matters ; or by styptic action (which produces roughness because it is dry ; ex. : bitter substances).

Infrigidants have this effect, by inspissation.

Terrene substances sprinkled over a limb like a dusting-powder may exert such an effect.

423. 9. Mollificants.

(Fatty or) glutinous substances act in virtue of their viscidity ; agents which mildly disperse the humours by attenuating them, cause them to flow, whilst at the same time they carry off the dense particles of matter in the apertures on the surface of the member.

424. 10. *Agents which produce displacements and luxations.*

Displacements of parts are produced (1) by extension—a force dragging on the member and pulling upon it until it is dislocated ; (2) by some unexpected violent movement, aided by the throwing of the whole weight of the body upon the member (e.g. luxation of the foot) ; (3) by some laxity or moistness in a part. This happens in tearing, in corrosion, or septic change or destruction of the substance of a ligament or nerve—e.g. in elephantiasis, sciatica.

425. 11. *Agents which prevent parts from becoming apposed.*

Here belong—congenital factors ; grossness ; viscosity ; looseness of joints ; dryness of humour in a joint ; spasm ; ulcers which are only partially healed ; calculus.

426. 12. *Agents which prevent parts from expanding.*

Here belong—congenital factors, coarseness, spasm, cicatrisation after healing of ulcers.

427. 13. *The causes of abnormal movements.*

(1) Dry intemperament may cause weakness (e.g. dry tremor) or spasm (e.g. dry hiccoughs, or spasm). (2) Effete matters which heat, or cool the surfaces of the muscles. (3) Interception of the power which should have access to a member owing to some form of obstruction. (4) Nocumental effete matter acting in virtue of its coldness (e.g. rigor), or in virtue of pricking property (e.g. shivering), or in virtue of interference with the innate heat, making it either scanty or submerged, so that the surfaces of the muscles become cold, and gaseous matter forms which seeks to be dispersed or expelled. (Ex. : jerkiness, jactitation.)

In such nocumental matter, further, gaseous matter may be deficient. This gives rise to the desire to stretch oneself. Or, gaseous matter may be in excess ; and in this case, if the matter be quiescent, one form of lassitude arises ; if the matter be mobile, other forms of lassitude will arise, which we shall describe later (821). If the nocumental character of the matter be more decided, shivering ensues. If very strong, rigors and spasmodic contractions come on. Should such matter which is held back in the muscles be gaseous, jactitation or pulsatile movements arise.

428. 14. *Causes of increase in size of body.*

Abundant supply of aliments ; great vigour of attractive faculties acisted or not by friction or by calefacient plasters (e.g. plaster of pitch and the like). A powerful formative faculty will increase both the size and the number of tissue-components : e.g. proud flesh, supernumerary fingers. If pathological material* be formed, tumours, ganglia, "atheromas," steatomas, and warts will form. (Costaeus, quoting Galen.)

15. *Causes of numerical decrease.*

(1) Congenital: matter* lessened in amount; faulty or defective formative power. (2) Acquired: lack of nutrition during lactation or later; direct injury—cutting wounds, blows, mechanical destruction of tissue; frostbite; internal causes—eroding ulcers, septic processes.

429. 16. *Causes of loss of continuity.*

(1) Intrinsic: Pathological body-fluids, having a consuming, burning, moistening, relaxing, drying or cleaving action. Fluids which pierce and force themselves into tissues and stretch them apart. Gaseous matters also may force their way into, and stretch, tissues. In each of these cases, the effect produced depends on (*a*) the force of movement, (*b*) the abundance of the fluid or gas, (*c*) the greatness of the expulsive power.

Similar in action to these are: vociferation, leaping exercises; opening of abscesses.

(2) Exterior. Traction by a rope or weight; incision by a sword; burning by fire; contusion by a stone; rupture of a sac by contusion; perforation by an arrow; punctured wounds (scorpion wounds); bites by a mad dog, a viper, or a human being.

430. 17. *Agents producing ulceration.*

The rupture of an inflammatory mass; of a pustule; of an abscess. The bursting out of an ulcer.

431. 18. *The causes of inflammatory swellings.*

Causes relative to the material in a member: superabundance of the four humours; aquosity; gaseous matter.

Causes in regard to the condition of a member. (1) Expulsive power. (2) Weak retentive faculty, which disposes it towards harbouring waste matters. This varies with (*a*) the nature of the organ or tissue (e.g. the skin is so created); (*b*) the texture of the member (the looseness of the flesh behind the ears, in the neck, axilla, and groin is favourable—to deposition of matter); (*c*) the width of the passages and orifices—too great and too narrow respectively; (*d*) low position of outlet; (*e*) small outlet, so that the food residues cannot get away. Some nocument may impair the power to digest the food material coming to the part. Blows may cause the matter to be retained in a member. Lack of exercise may prevent matters from being dispersed as they usually would be. Too much heat in a particular region may attract inflammatory processes—whether it be the natural heat of the flesh or an unnatural heat (causing pain) or heat produced by excessive exercise, or by some calefacient agent.

Inflammation may follow fracture, if the limb has also been contused or crushed or stretched when setting the bone-ends.

* i.e., humours.

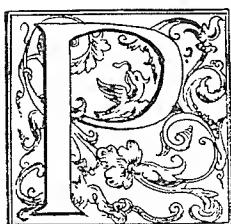
Inflammations often occur in connection with the teeth, as food may collect in them, undergo infusion, and so become putrefied. This may lead to an abscess.

19-26. *The subject of pain.*

These separate Chapters are here gathered into one, with the following subdivisions:—

- i. General discussion of the causes of pain.
- ii. Theory of the nature of pain.
- iii. List of the types of pain, and the explanation of each.
- iv. Agents which alleviate pain.
- v. The effect of pain on the body.
- vi. The causes of pleasurable sensations.
- vii. How movement brings on pain.
- viii. How depraved humours evoke pain.
- ix. How gaseous substances produce pain.

432. *General discussion of the causes of pain.*



AIN is one of the unnatural states to which the animal body (as a sensitive and living thing) is liable. We begin with a general discourse about it.

Pain is sensation produced by something contrary to the course of nature, and this sensation is set up by one of two circumstances (*a*) a very sudden change of the temperament ; or the bad effect of a contrary temperament, (*b*) a solution of continuity.

In saying “the bad effect of a contrary temperament” we mean : the substance of the members of the body has a constant temperament, and then a foreign temperament of contrary character (hotter or colder) supervenes. The sensitive faculties become aware of the change ; this is “pain.” The law is that *there is no pain save as the sensation of contrariety produced by a contrary thing.* A temperament which is constantly unhealthy does not produce pain, or arouse any sensation. That is to say, if the temperament residing in the substance of the members is bad, it destroys the original temperament so that the member is as if it had always had this unhealthy temperament ; consequently it neither produces pain nor is aware of it. The reason is that before sensation can occur, the sense organ must become affected by that which is sensed. But in this case the condition persists. There is no change. So there is no pain. Suffering will only occur if some contrary enters which is able to alter the temperament to one not previously present.

That is why a person suffering from hectic fever does not suffer as much as one who has a one-day or a tertian fever, despite

the fact that the heat of the first is greater than that of the others. In the case of hectic fever the heat is persistent and situated in the substance of the principal members ; in the case of tertian, the heat comes from a hot humour, and so reaches those members which retain their natural temperament. Should the humour recede, the natural temperament will continue in the member, the heat not being fixed in it unless the fever become hectic.

No inequable intemperament persists in a member except according to a certain rule. Such a state may arise during the best of health. Thus, should a person plunge into a bath in winter, and lave himself with tepid water, he would shiver ; which shows that it is harmful. For the primary quality of the body is far from that of the water, and indeed contrary. Afterwards, however, it is beneficial and produces subjective satisfaction. The cold influence lessens step by step until no longer evident to the senses.

But suppose the person were to sit in the bath-house another hour, the water would make his body hotter. And yet in spite of that, if this same tepid water of the above bath were suddenly thrown over him unexpectedly, shivering would result and the water would seem cold to him.

If we study such things carefully, it will be clear that though unhealthy inequable intemperaments form one of the groups of causes of pain, yet not every one of such intemperaments actually does so. A hot temperament is in itself able to cause pain, and so can a cold one ; but a dry temperament causes pain only secondarily, and a moist one is painless. For heat and cold are both active qualities ; dryness and moisture are passive. So that in one case the impression on the body is active, in the other it is passive.

Dryness is a cause of pain secondarily, if another kind of agent comes into play, as e.g., loss of continuity. Dryness itself may be a cause of loss of continuity, in virtue of its power of producing great constriction of a channel.

433. *Theory of the nature of pain.* According to Galen, all this can be reduced to the one essential thing—loss of continuity and nothing more. A hot thing only causes pain by breaking continuity of a part ; a cold thing also only causes pain by breaking the continuity of function or of a part ; it exerts such an astringent and aggregating effect that the particles are drawn together towards a certain place and agglutinated ; and, in consequence separated off from their surroundings. In some of his writings, he seems to hold the opinion that all sensibles are

deleterious from the very fact that in order to experience a sensation there must be a cleavage of particles one from another—agglutination of some entailing cleavage of others ; the fact of cleavage accounting for the sensation called " pain." A black object which gives a painful impression to the sense of sight does so because its blackness is due to an extremely close aggregation of particles ; whiteness is due to the particles being widely discrete.

A bitter, salt, or sour thing, which gives a painful impression to the sense of taste, does so because such things produce vigorous dispersion of particles. Pungent things do so because they aggregate very vigorously, and are therefore no doubt followed by dispersion. So too, with odours ; and sounds—where the movement of the air impinging in the external auditory meatus gives rise to a painful sensation.

To explain it according to my own view :—It is the transmutation of the temperament of a part which determines the presence of, and the kind of, pain proceeding therefrom, whether there is loss of continuity or not. This is best proved by Natural Science, but the following brief explanation may be given here. We may therefore say :—

Pain occurs in a member which is of homogeneous structure. Solution of continuity cannot occur except in members which are not of homogeneous structure. Pain occurs in states of the body where there is no loss of continuity of particles. Hence loss of continuity is not a condition on which the appearance of pain depends. An intemperament will produce it. Cold produces pain if it constricts and agglutinates particles, and the part is cold throughout its substance ; solution of continuity does not occur at the site of infrigidation but at the distal parts of the infrigidated places. Again, pain is the sensation of a sudden impression by the contrary qualities. It is the fact that they are contrary, that accounts for the pain.

Does one not observe how a person who experiences cold to a degree enough to alter the temperament will sense the change in his temperament and also feel pain without there being any question of loss of continuity ? where indeed such a loss is impossible ? It is clear then that a sudden change of temperament will cause pain just as loss of continuity does. Pain arouses heat, and affects the innate heat, and this makes the pain greater still.

After the pain has subsided, there remains a something which provokes the sensation of pain. But it is not really pain.

It is a sum-total of things which are undergoing spontaneous breakdown.

A doctor ignorant of all this, and striving to relieve the pain, may make wonderful mistakes, and fail in his object.

434. *List of the types of pain and the explanation of each.* There are fifteen kinds of pain* (rearranged alphabetically) :

- | | | |
|------------------|----------------|----------------|
| 1. Boring | 6. Heavy pain. | 11. Relaxing. |
| 2. Compressing. | 7. Incisive. | 12. Stabbing. |
| 3. Corrosive. | 8. Irritant. | 13. Tearing. |
| 4. Dull. | 9. Itching. | 14. Tension. |
| 5. Fatigue-pain. | 10. Pricking. | 15. Throbbing. |

1. *Boring pain.* The cause of this pain is the retention of gross matter or of gas between the tunics of a hard and gross member (e.g., the colon) and so continually goading it and tearing its parts asunder, boring into the interstices like a gimlet.

2. *The pain of compression.* This is produced by fluid or gas, when it is confined in too small a space in a member, and so compresses or squeezes the tissues.

3. *Corrosive pain* proceeds from the presence of material between the muscle-fibres and their sheaths, stretching it till it breaks not only the continuity of the membrane, but also that of the muscle therewith.

4. *Dull pain.* The cause is threefold : (1) the temperament may be too cold ; (2) occlusion of the pores so that the breath (of the sensitive faculties) which should come to the member cannot do so ; (3) overfullness of the (locular spaces or) cavities.

5. *Fatigue-pain.* This is produced (1) by undue toil—laborious toil, (2) by a humour which produces tension (in tensive lassitude), (3) by a gaseous substance which produces inflative lassitude, (4) a humour of biting properties (ulcerative lassitude). These pains may arise out of various composite states, as has already been stated in the appropriate places.

* In regard to the kinds of pain, it is of interest here to recall the *eight kinds of pain inherent in human life*, given in the Nirvana Sutra : (1) Birth pangs (Shoku : Japanese ; jātir-duḥkham : Sanskrit) ; (2) The pains of age (Roku : jarā-duḥkham) ; (3) The pains of disease (Byoku ; vyādhi-duḥkham) ; (4) The pain of death (Shiku ; marana-duḥkham) ; (5) The pain of parting with loved ones or things (Aibetsuriku ; priyaviprayoge-duḥkham) ; (6) The pain of meeting with what one dislikes (Onzoeku ; apriya samprayoge-duḥkham) ; (7) The pain of not obtaining what one seeks (Gufutokku) ; (8) The pain of the five elements ; that is, the body itself produces pain (Goonjoku). (The Sanskrit of the last two terms is lengthy).—Ishizuka's notes to Honen. ³²
p. 446.

Lassitude as a result of several combined states, is called in inflammatory lassitude, which is a composite of tensive and ulcerative lassitude (see 824).

6. *Heavy pain.* In this case there is an inflammatory process in an insensitive member such as the lung, the kidney or spleen. The weight of the inflammatory deposit drags on the tissues and surrounding sentient fascia and on its point of attachment. As the member is dragged on, the fascia and its point of attachment experience the sensation. The cause of the pain may be that a sentient member has had its sensation destroyed by the disease, so that the weight is felt, but actual pain cannot be felt any longer (e.g., cancer at the mouth of the stomach).

7. *Incisive pain.* This proceeds from a humour of sour quality.

8. *Irritant pain.* This is produced by a certain type of change in the humours (harshness, roughness).

9. *Itching pain.* This is produced when a humour is acrid, sharp, or salt.

10. *Pricking pain.* The agent producing this is material similar to that which causes boring pain ; it is retained in an organ of similar type (to that which is the seat of boring pain) for a time and then ruptures it.

11. *Relaxing pain* proceeds from matters accumulating in and stretching the belly of a muscle—not its tendon. It is only called relaxing if the belly of the muscle is more lax than the nerve, tendon, or enveloping membrane.

12. *Stabbing pain.* This is the result of transverse stretching in membranes, as if their continuity were being separated, by a humour. It may be an equal or an unequal sensation. In the former case, all the members of the body are uniformly affected. In the latter case, there are four possibilities : (i) Inequality in hardness or softness between the tissue with which the membrane is covered and the membrane itself. Ex.: the clavicle or costal pleura ; in a case of inflammatory process travelling from the pleura towards the upper parts of the chest, the pain is felt in the collar-bone. (ii) Inequality of movement of the component parts (e.g., the diaphragm and the pleura or peritoneum over it). (iii) Inequality of nature between the parts and the member. (iv) Unequal distribution of nocument among the parts and the member affected, in that it affects one and not another.

13. *Tearing pain.* Proceeds from the interposition of

humour or gas between bone and periosteum, or from cold which strongly constricts the periosteum.

14. *Tension pain.* This is produced by a humour or gas stretching the nerve-fibres or muscle fibres asunder.

15. *Throbbing pain.* The cause is a hot inflammatory process. A cold inflammatory process, of whatever type, is either hard or soft, but sets up no pain unless it changes into a hot inflammation. Throbbing pain arises in a hot inflammatory process if the adjoining member is sentient, and has pulsating arteries round it. A member which is healthy does not sense their movement, because they are deeply situated, but their pulsation sets up pain as soon as an inflammation arises in the member.

435. *Agents which alleviate pain.* There are three groups of agents which alleviate pain : (1) Some contrary to the cause of pain—which removes the cause. Ex. : anethum, linseed, made into a poultice and applied over the painful place. (2) Any agent which counteracts the acrimony of the humours, or soothes, induces sleep, or dulls or soothes the sensitive faculties and lessens their activity. Ex. : inebriants, milk, oil, aqua dulcis, etc. (3) An agent which infrigitates and dulls the sensation in the painful part. Ex. : all narcotics and somniferous drugs. The first of the three is the most certain.

This subject is referred to again at the end of Part IV.

436. *The effect of pain on the body.* Pain dissipates the bodily strength and interferes with the normal functions of the organs. The respiratory organs are inhibited from drawing the air in, and consequently the act of breathing is interfered with, and the respiration becomes intermittent, or rapid, or altogether unnatural in rhythm.

The organs are first made hot, then cold ; this is because some of the breath and vitality is dispersed and escapes.

437. *The causes of pleasurable sensations.* The agents which produce pleasurable sensations fall into two groups. (1) Where an intemperament suddenly becomes equable and the senses become aware of the change. (2) Where there is a sudden restoration of the natural continuity.

Sensation depends on sudden change, whether painful or pleasurable. Pleasurable sensation is to sense harmoniously ; and this act of sensation is performed by the sensitive faculties. It is a *passive* act. One experiences pleasure or pain according as the sensation is harmonious or disharmonious. The fact that the sense of touch is the most elementary (crude) of all these

senses accounts for it retaining the harmonious or disharmonious impress longer. When that which comes to the sense of touch is harmonious with nature, the pleasurable sensation is greater ; and if the agent is disharmonious, the painful sensation is greater than would be the case with the other faculties.

438. *How movement brings on pain.* Movement and exercise induce pain when nerves are stretched thereby, or when muscles become contused or lacerated thereby.

439. *How depraved humours evoke pain.* Depraved humours evoke pain either by reason of their qualities (for instance, acridity), or by reason of their being abundant (thereby stretching the fibres of a tissue or making the organ heavy) ; or for both reasons together.

440. *How gaseous substances produce pain.* Accumulations of gas may become painful when they cause a part to be greatly distended. Gases may accumulate in (*a*) hollow viscera (e.g., in the stomach : *gastrectasis*) ; (*b*) the membranes over organs, or nerves (e.g., colicky pain from stretching of the nerves of the intestinal wall) ; (*c*) the sheaths of muscles, serous membranes, or periosteum ; (*d*) the subcutaneous tissues (the place between the muscles and the loose fascia or skin); (*e*) internal members (e.g., the muscles of the thorax).

Gas may be dispersed rapidly, or only after a time. This depends on the amount, and whether coarse or fine, and whether the member itself is dense or rarefied in structure.

27. AGENTS WHICH BRING ABOUT RETENTION OR DISCHARGE.

441. It is easy to know the causes of retention or discharge if one ponders well over what has already been said about retentions and evacuations. The reader should therefore turn back and carefully re-read what has been written about it.

28. THE CAUSES OF OVER-REPLETION (PLETHORA).

Plethora.—“Passive congestion” is over-repletion with blood ; it is associated with stasis.—“Active congestion” is the equivalent of “waram,” “apostema.”—Oedema is over-repletion with lymph (serous humour) ; it is associated with stasis in the lymphatic channels or serous cavities. The practical result is that the channels cannot drain or empty *within the available time*.—Hypertension is a form of plethora.—Corpulence is over-repletion with fat, namely in the connective-tissue spaces. One practical result of this is that supervening disease produces greater affliction than otherwise, as was written in the Charaka¹⁵⁵ (i. 236).—Plethora of the connective tissue spaces with a mucoid change in the fluid may produce the appearance of obesity. This peculiar change is met with in the female sex ; it fluctuates in degree from time to time, and may appear or disappear within a few days.

Intestinal stasis is over-repletion of the large intestine.

It may be noted that the effect of stasis anywhere is to interfere with that

flow of breath which is essential to health, or even life. The breath is "choked" or "strangled." The faculties are also at a disadvantage, for their free operation is conditional on free flow of breath through all parts of the body.—In modern terms, oxidative processes are retarded or arrested.

442. The causes are extrinsic and intrinsic.

1. *Extrinsic* (primitive). (a) A dietary (fluids as well as solids) which gives rise to much moisture beyond the needs of the body ; matter accumulates in the body, and interferes with the action of the emunctories. (b) Taking baths frequently, especially after meals. (c) Repose ; ceasing to take exercise ; ceasing to secure the usual evacuations. These prevent the resolution of material in the body. (d) Improprieties in eating and drinking ; depraved regimen.

2. *Intrinsic*. (i) Lack of digestive power, so that the aliments are not completely utilized. (ii) Feebleness of expulsive faculty. (iii) Undue vigour of retentive faculty, so that humours are caused to linger in the body. (iv) Narrowing of the excretory channels.

29. THE CAUSES OF ASTHENIA AND DEBILITY OF A MEMBER.

443. Weakness may affect (i) the body of the member itself ; (ii) the breath, which conveys power to it ; (iii) the faculty of the member.

(i) The following produce *weakness in the member itself* :
 (a) A persisting intemperament, especially a *cold* one. For even though the member receive some heat, the cold intemperament produces an effect like stupor in it, because it breaks up the temperament of the breath—just as happens when a person stays too long in the bath, and especially when such a procedure brings on syncope. A *dry* intemperament has an inspissating effect, and acts by preventing the faculties from functioning in the member. A *moist* intemperament relaxes and obstructs.

(b) One or other of the composite diseases.
 (c) The most important in all (in man) is neither nocum, nor malady, nor pain. It is an attenuation of texture in the peripheral nerve-fibres of the member, for both vegetative and voluntary actions depend for their achievement on these fibres in all their ramifications. The retentive power which is necessary to secure efficient digestion depends on the condition of these fibres in the stomach.

(ii) *Weakness of the breath itself*. This will occur if it be of bad temperament. There may also be dissipation of the breath,

after an evacuation corresponding. It is also weakened by an abnormal mode of depletion.

(iii) *Weakness of the faculty.* This depends on the number of actions and the number of times they are repeated. The breath is dispersed at the same time. Moreover loss of breath accompanies every agent which produces asthenia.

444. The causes of asthenia may be classified in another way, so as to include the remote causes with them—the causes of causes. We then consider (i) causes of intemperament ; (ii) causes arising from decomposition changes in the air, in water, and in the aliment ; (iii) causes which cause the breath to escape, or become confused, or, as it were, shaken up. Nothing disturbs the breath, or causes it to escape as effectively as does a bad smell, such as the fetor from putrid water, or the presence of poisonous vapours in the air, or in the body. [Under such circumstances, the instinctive action is immediately to “ hold the breath.”]

445. *Evacuations as a cause of weakness.* For instance, loss of blood ; diarrhoea, especially of thin attenuated fluid ; the sudden withdrawal of copious dropsical effusions by paracentesis ; the opening of a large abscess with sudden withdrawal of much pus—whether the opening is by nature or by surgical interference ; excessive sweating ; severe exercise.

446. *Severe pain* disperses the breath and may alter its temperament. The chief kind of pain likely to have this effect is that from distension, or incisive pain—especially in the pit of the stomach. Any pain in the region of the heart will disperse the breath.

447. *Fever*s should also be included among the causes of asthenia. They act either by dispersing the breath, or by loss of blood, or through producing a change of temperament.

448. Widening of the pores often aids in producing asthenia. Long continued semi-starvation has the same effect.

449. Weakness in one member or in a part of a member may cause weakness of the whole body, as is seen in the case of defective function of the cardiac orifice of the stomach, which produces general weakness of the body. Or, if a person suffers severely from some cardiac or cerebral trouble, shortness of breath rapidly supervenes on very slight provocation.

450. Further, a cause of weakness may be that one has endured many illnesses.

451. When one member is weaker than another from birth, or when it is by nature weaker in itself (e.g., the lung, or

brain), then it is receptive for matters which the stronger members reject or discard, or eliminate. The brain would suffer in this way were it not for its position, whereby nothing comes to it which it cannot tolerate, even its virtues cannot persist there.

END OF THESIS II.



C. Retributive or Expiative Causes of Disease.

§ 201. The idea that illnesses were a form of "judgment" or punishment, or retribution for misdeeds, was formerly widespread, but is not regarded seriously in modern Medicine. In the case of all peoples who hold the Buddhist belief in karma, this ancient idea holds good because every event, good or bad, in the individual life is believed to be the outcome of events in a past life—whether in this particular existence or in a previous incarnation. Wherever the theosophical teachings hold, the same view would be held. Moreover, in Islam there is no difficulty in the idea because "there is no second cause," and as is written in the Mesnavi, in speaking of Izrail, the angel of death, God is said to "operate by disease and sickness, and men will not look for any cause beyond these diseases"—in virtue of the truth of text (Quran 56, 84) "He is nearer to you than ye are; yet ye see Him not."

Ghazzali, in his "Alchemy of Happiness" says: "illness is, so to speak, a cord of love by which God draws to Himself the saints concerning whom He has said, 'I was sick and ye visited Me not.' Illness itself is one of those forms of experience by which man arrives at the knowledge of God. As He says, 'sicknesses themselves are My servants, and are attached to My chosen.'"

During mediæval Christian times pandemics were regarded as the manifestations of divine wrath, and the incidence of illnesses is sometimes still explained in similar terms in modern Christianity, the microbial and other tangible causes of disease being taken simply as the instruments whereby the event is achieved. (Cf. § 113.)

As in the case of the idea of "fate" and "destiny," the subject is apt to be viewed incorrectly. Illnesses are sometimes evident warnings; sometimes they belong to the category of expiation, whether in relation to others or to the victim himself. In any case, diseases may be regarded as in some way connected with that experience of life which the sufferer has himself to undergo. In Thomistic terms, such would be the "final cause" of disease.

In the life of Saint Lydwine of Shiedam,¹²⁴ we read how a celebrated physician, Godfried de Haga, endorsed and deferred to "the divine law that every malady is an expiation; that if God does not

regard the expiation as satisfied, the course of the illness cannot be altered by the art of medicine. Cure cannot result from his treatment unless his intervention coincides with the completion of the expiation which has been imposed on the patient by his Lord.” *

In modern times this belief is manifested as a conviction in the pastoral instructions to the Catholic medical man that he is not entitled to continue his ministrations on a patient gravely ill unless his (Catholic) patient has fulfilled his spiritual duties within a certain number of days of the onset of the severe symptoms.

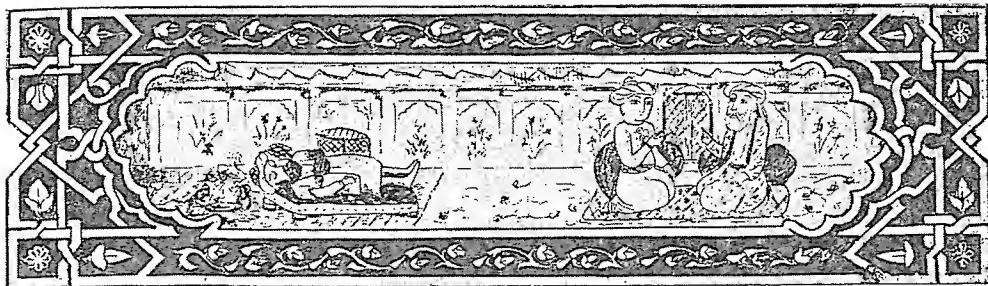
“ Hay muchos decretos eclesiasticos que prohíben a los medicos visitar mes de tres veces, si el enfermo no se ha confesado.” — (Vilarino, 142, p. 645.)

The following advice to the patient himself is less harsh to appearance: “ first when thou feelest any indisposition, accept it as a dispensation of the love of My Heart. . . . Afterwards, unite thy sufferings with Mine. . . . If thy infirmity increases offer to Me thy body as a living victim. . . .” (Arnold, xvi)

This teaching leaves no room for doubt about the true answer to the oft-aired question, “ should the doctor tell ? ” (his patient that his illness is likely to prove mortal).

* * *

* It was subsequent to the named physician’s life-time that Paracelsus wrote the words actually quoted, adding “ when the time for redemption has come, the patient will then find the physician through whom God will send him relief.” Paracelsus classified the causes of disease under five headings: those arising in morbid states of the body; those belonging to the category of poisons (intoxications); those arising from “ astral ” origins; spiritual causes (passions, disordered thoughts, morbid imagination); and retributive.^{28a} (p. 199, 221).



THESIS III. THE EVIDENCES OF DISEASE

I. GENERAL REMARKS ABOUT SYMPTOMS AND SIGNS

"The science of the diagnosis of disease by internal symptoms is founded upon six canons : (1) the patient's actions, (2) the waste of the body, (3) the nature of the pain, (4) the site of the pain, (5) swelling, (6) the effluvia given off by his person."—Night 45^{1.104}

"A physician who is a man of understanding looketh into the state of the body and is guided by the feel of the hands, according as they are firm or flabby, hot or cool, moist or dry."—Night 450.

452.

BY means of the symptoms and signs of the three main states of the body (health, illness, neutrality), we obtain information as to the present, the past and the future of the patient's state. Knowledge of his present state, says Galen, is of advantage to the patient alone, showing him what he must do ; knowledge of the past is advantageous to the physician alone, as proving him to excel in his art, so that his advice becomes worthy of respect (because reliable) ; knowledge of the future serves both purposes—it is advantageous to the patient because it guides him along the road he should follow, and it is advantageous to the physician in showing him to excel in his art.

The signs belonging to the first category are called "demonstrative" ; those of the second category are "commemorative" ; those of the third are named "prognostic."

453. The signs of health. (1) Those which denote an equable temperament. These are referred to in 494. (2) Those which denote equability of the composite : (a) substantial : creaturely form, position, quantity, number ; (b) accidental : comeliness, beauty ; (c) final : (i) that is, fulfilling functions ; (ii) fulfilled function.

Every organ is healthy whose functions are adequately performed.

The evidences that the functional state of the principal organs is adequate is shown by studying their activities. Thus the state of the brain is shown by the state of the voluntary power of movement, by the state of the sense-organs, by the acts of judgment ; the state of the heart by pulse and respiration ; the state of the liver by the character of the excreta and urine. (If the urine appear like the washings of fresh meat it shows that there is deficient liver-function.)

454. *The signs of disease.* 1 Some signs are *pathognomonic* of disease—thus : rapid pulse-rate, in fever, itself indicates fever. 2 Other signs indicate the *position* of the disease. Thus a hard pulse denotes diaphragmatic pleurisy ; undulant pulse denotes inflammation in the substance of the lung. 3 Other signs indicate the *cause* of the disease. For instance, the signs of plethora, or of depraved states in their various forms.

4. Some symptoms are essential to the illness, as they begin and end with it. (For instance, acute fever, piercing pain, dyspnoea, cough and serrine pulse—essential to pleurisy.) Other symptoms show no time-relation of this kind ; they sometimes coincide with the disease and sometimes not (e.g. headache in fever). Other symptoms appear only towards the close of the illness—as for instance, the symptoms of crisis, of maturation, of delayed maturation ; the signs of death. These symptoms are often associated rather with acute illnesses.

5. Other symptoms concern the state of the members. Some of them are discernible by the special senses—colour, hardness, softness, heat, cold, and the like. Others are discernible by all senses together—the form of the member, its position (posture, attitude), its size, its movements, or stillness. Some symptoms point to an interior state, as when tremor of the lower lip reveals nausea. Changes in measure and number reveal internal states ; for instance, shortness of fingers denotes small liver.

6. Morbid states are discernible by the special senses. Thus a black or yellow colour of the excrement reveals a morbid state. Black or yellow jaundice of the whole body reveals an obstruction in the biliary passages.

7. States manifested to the sense of hearing.—Eructations reveal gastrectasis, and defective digestive power.

8. Odours and tastes also enable one to become cognisant of morbid states.

9. Other visible evidences ; curved nails denote ulceration

in the bronchi, phthisis and "hectic." Redness of the cheek-bones suggests inflammatory deposit in the lung.

455. 10. *Movements (gestures, postures, attitudes).*—The states of the body are revealed by its movements, or absence of movement. (1) Motionlessness of the body as a whole—in apoplexy, epilepsy (coma), syncope, palsy. (2) Unusual movements : shivering, tremor, twitching, sneezing, yawning, stretching, cough, trembling, spasms (especially note in which member this begins); (i) some of these are physiological (hiccough); (ii) others are symptomatic (convulsion or spasm, tremor); (iii) some are voluntary (tossing about in bed; turning from side to side); (iv) others are partly voluntary, partly involuntary (cough, micturition, defecation); in some of these the voluntary overrules the involuntary (micturition and defecation, occurring too slowly owing to interference by the will); (v) involuntary movements. Some of these are evident to the senses (e.g. shivering), others are not (e.g. quivering, jactitation). These movements vary (α) in regard to their *nature*; thus, cough is intrinsically more energetic and powerful than quivering; (β) in *extent*: thus, the act of sneezing entails the use of more muscles than the act of coughing does; coughing is accomplished simply by the movements of the chest, sneezing entails movements of the head as well as of the chest; (γ) in degree of *associated mental anxiety*. Dry hiccough is associated with a greater degree of mental anxiety than the movement of coughing, though the latter is more vigorous, being reinforced by the natural faculty. In some cases the movement is aided by an essential primary instrument; thus, defecation is aided by the abdominal muscles; in other cases the aid is extraneous: thus, the natural act of coughing may be aided by the atmosphere; (δ) in *origin*. These movements vary (α) according to the member (cough, nausea); (β) according to the faculties involved (jactitation originates in the vegetative faculties; the act of coughing originates in the sensitive faculties); (γ) according to the humour concerned (thus, cough proceeds from an excretion; twitching from a gaseous agent).

These are all evidences of conditions in the members and are chiefly external in character. Some of them reveal internal conditions; as, for instance, redness of the cheeks is a sign of pulmonary inflammation.

There are also (internal) evidences of external conditions, and to discern these a perfect anatomical knowledge is necessary.

456. One must have a proper knowledge of :—

(i) the *essential structure* of each member ; whether fleshy or not ; what is its normal form. One must know (a) whether the swelling for instance is according to the proper form of the member or not; (b) whether it is proportioned or not; (c) whether it is possible for anything to be retained within the given member or not; (d) whether that which is within (e.g. jejunum) can escape; (e) whether there can be retention in and also escape from the member ; (f) what the material is which can be retained in it or discharged from it.

(ii) Its *site*. From this one judges whether pain or swelling is actually in the part or at some distance from it.

(iii) Its *relations*. By this knowledge one judges whether pain is arising per se or reflexly from the surroundings, or whether the matter in an inflammatory mass arose in it or has entered into it from neighbouring parts. If it be a “superfluity” which escapes, is this the matter itself or is the affected member merely the channel by which the matter finds egress from the body ?

(iv) How to decide whether the discharge could have come from the supposedly affected member or not.

(v) The normal function of a member.—From interference with function one recognizes the diseased state.

This is the purpose of the study of anatomy. And a knowledge of anatomy is also necessary to enable the doctor to control diseases involving the interior organs.

457. The study of the significance of the symptoms of internal diseases should follow the following six headings :

1. *Interference with function.* The functions have already been described in regard to their qualities and degrees. The indications here are primary and constant.

2. *The discharges.* The indications here are constant but not primary. They are constant in that they are always associated with morbid states. They are not primary because they denote maturation, or interference with maturation.

3. <i>Pain</i> 4. <i>Swelling</i> 5. <i>Altered position</i> 6. <i>Special symptoms</i>	} These are neither primary, nor constant.
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458. Details about these headings.

1. *Interference with function.* When a function does not proceed normally, it shows that the agent at work is attacking the faculty itself, and the loss of function is secondary to disease of

the organ subserving that function. There are three ways in which function is interfered with : (a) impairment (e.g. failing eyesight, near sight, digestion impaired in rate or degree) ; (b) alteration (as when the eye sees that which is not there or perceives incorrectly ; when the stomach digests food wrongly and causes it to decompose) ; (c) destruction (as when there is entire loss of vision ; entire loss of digestive power).

2. *Significance of discharges and retentions.*

A. Retention of that which is normally discharged : retention of urine or faeces.

B. Abnormal discharge :

- (i) From the substance of a member
 - (a) itself diagnostic : Ex. : when a piece of cartilaginous tissue is coughed up ; this is a proof of deep ulceration in the air-passages ;
 - (b) diagnostic by reason of its dimensions or amount : passage of flakes in dysentery ; if they are large flakes, the ulcer is in the large intestine ; if fine fragments, the ulceration is in the small intestine ;
 - (c) colour of the discharge. If urinary sediment is red, it shows the disease is in the fleshy organs such as the kidney ; if white it shows the disease is in a muscular organ like the bladder.
- (ii) Not from the substance of a member :
 - (a) entirely unnatural. Thus healthy humours or blood should not be discharged at all ;
 - (b) abnormal in quality. Thus depraved blood may be discharged physiologically, or not ;
 - (c) abnormal in substance ; e.g. calculus ;
 - (d) abnormal in quantity : e.g. polyuria, oliguria, excess of faecal discharge, paucity of faeces :
 - (a) abnormal in quality : black faeces, black urine ;
 - (b) discharge by unsuitable or unnatural channels : e.g. passage of faeces by the mouth in cases of strangulated hernia.

3. *Significance of pain.*

(a) Its site : If right-sided, examine the liver ; if left-sided, the spleen.

(b) Its type, which reveals its cause (see 434; and the doctrine of causes). Severe pain indicates inflammation in a non-essential member, or in a member which has lost sensation, but has become greatly distended by foreign matter. Incisive pain shows that the diseased material is sharp, acid or acrid.

4... *Significance in regard to inflammations.*

(a) As to essence : erysipelatous inflammation denotes biliary humour; "scirrhus" (induration) denotes atrabilious humour.

(b) As to position : whether on the right side or the left (liver, or spleen).

(c) As to shape : a moon-shaped swelling in the right hypochondrium points to the liver ; an elongated swelling refers one to the overlying muscles (rectus and adnexa).

5. *Significance of site and relations.*

The site may be self-evident. The relations vary in significance according to the morbid agent. Thus a lesion in the fingers may result from injury to the brachial plexus in the neck.

6. *Significance of special symptoms* : e.g. of wasting, of black tongue, burning fever.

Joannitius gives a rather different classification of symptoms and signs, though summarizing from the same text. It may be said that every classification is a matter of personal convenience. There is not necessarily any principle involved, for the subject comprises so great a variety that a strictly logical classification serves no special purpose. In some cases symptoms are characteristic of a cause, in others of an error of function, in others of a special disease. To adhere consistently to one rule of classification necessarily entails the relegation of some symptoms which are important in actual practice to a subsidiary or insignificant position in the list.

Hence it may be said that Avicenna's classification will hold good as well as any. The student obtains his knowledge from his own experience, and not from memorizing a given list.

§ 202. The following list of simple ailments, or evidences of disease, may be offered at this point.^{ss}

Pain.—The first evidence of disease or ill-health. Its *localization* is very significant, and charts depicting its possible sites and their meaning are of great use. Thus, headache is very commonly simply a sign of indigestion (gastric or intestinal) or constipation. The *type* of pain is most important. Thus pain in the abdomen, relieved by pressure, suggests gaseous distension due to abnormal fermentation of food, whereas pain increased by pressure suggests inflammation.

Abnormal discharges.—Abnormal in *quantity* (increased or diminished), such as diarrhoea, polyuria; abnormal in *quality*, such as nose-bleeding, haemoptysis, expectoration, nasal discharge, salivation; abnormal in *manner*, such as incontinence.

Abnormal acts.—Vomiting, Coughing, Hiccough, Eruptions, Yawning, Sighing, Shivering, Sleepiness, Insomnia, Altered gait, Altered posture (from palsy, exhaustion, collapse), Tremors, Twitchings, Convulsions, etc.

Abnormal subjective sensations.—In special senses : floating specks before the eyes in dyspepsia ; ringing in the ears in cases of nervous debility, or after certain drugs, or from wax ; bitter taste in dyspepsia ; dizziness arising from nerve derangement, or circulatory errors. In general : nausea, palpitation, throbbing, laboured breathing ; altered appetite, thirst ; sense of lassitude or asthenia ; irritability ; loss of memory.

Outward signs.—Discoloured or "heavy" eyes. Offensive breath in indigestion and constipation. Wasting or obesity. Hot and dry skin in fevers, or

states of mental excitement, or from excess of salt in the diet. Cold sweating from exhaustion, etc. Altered colour of skin. œdema of skin. Skin-eruptions.— Signs derived from examination of the mouth : Pale tongue and gums from blood-deficiency; bleeding gums from excess of salt in diet and other causes; coloured line on gums in metallic poisonings; coated tongue in digestive disturbances; loosened teeth from errors of diet, or the use of adulterated foods, etc.

2. THE DISTINCTION BETWEEN THE DISEASE IN ITSELF AND ITS SECONDARY EFFECTS

459. Diseases may affect a member primarily, or only secondarily. Thus, a disease of the stomach may become associated with one in the head. Hence it is necessary to distinguish between the two conditions, as being respectively primary and secondary. To do this, note which arises first, and then note which of the two morbid conditions persists. The former is judged to be primary; the one which develops later is considered to be secondary. Conversely, the disease is secondary which comes after the first, and ceases when the first is relieved.

460. Errors may arise, however, because a primary disease may escape the senses (being painless) at first, and its effect may not become manifest till after the secondary disease has appeared. Moreover the primary disease may not be able to be perceived until after the secondary one has developed, and so one is liable to regard the secondary one as primary, and overlook the real root of the disease.

461. To guard against this mistake, the physician must know the anatomical inter-relations of the organs, and also the several affections which each member may show. Some of these are evident to our senses, others are not. He must also avoid giving a definite diagnosis of the root of the disease until he has had time to consider the possibility of some of the states being secondary or not.

462. Therefore the physician will diligently question the patient in order to discover signs indicative of the various affections which can possibly occur secondarily in the neighbouring or related organs. If these are not painful (tender), the patient is unaware of them, and the various signs and symptoms may be only distantly related in his mind. He cannot know the relation between remote symptoms and the real root of the disease. The wisdom of the physician alone can determine this.

463. It is easier if one recalls the various points to memory under the heading of hindrances to function. If these are prior in time, the malady is secondary.

464. Some affections of organs are usually secondary to

others. Thus an affection of the head is usually secondary to one or other of the morbid states of the stomach. The converse is only very rarely true.

All the signs of the primary and secondary temperaments will be set forth in a general way now, leaving the signs of each special organ to its appropriate place. The visible signs of a composite disease are detected by the senses, but the internal symptoms of the body as a whole cannot be described in a general way except with difficulty—with the exception of the signs of plethora, of obstructions in passages, of inflammatory masses, and of loss of continuity. It is best to describe all these together when we describe them under their specific organs.

3. THE DIAGNOSTIC SIGNS OF THE TEMPERAMENTS.

465. Signs from which the variety of the temperament is discernible.—These can be arranged under ten groups.

I. THE FEEL OF THE PATIENT

By means of the touch one notes whether the feel of the patient corresponds to health in temperate climes and temperate atmosphere. If it corresponds, the temperament is equable. If the physician is himself healthy in temperament and finds the patient cold or hot, softer or harder or rougher than normal, and this is not to be explained by the state of the atmosphere or of a previous cold water bath, or some other contingency rendering the body soft or rough, though normal—he then knows the finding is due to an intemperament.

466. The state of the finger-nails should be noticed. Softness or dryness of the nails, not due to an extraneous agent, informs one of the state of the temperament. These qualities are not in themselves a sufficient criterion. There must be signs of balance between heat and cold. For (*a*) heat, by its resolving effect, would modify hardness and roughness of feel, and make the patient seem to be attempered and his nature seem soft and moist. Or, (*b*) cold—i.e. the opposite—by reason of the great congelation and inspissation it induces, would make the softness of feel in an attempered person seem hard, and give the impression that his nature was dry. For instance, take snow and the sun. Snow congeals and causes coagulation ; the sun causes aggregation of particles. Many persons with a cold temperament are soft to the feel, and also spare in habit owing to the presence of much crudity in them.

II. THE STATE OF THE MUSCLES, FLESH AND FAT

467. Plentiful muscular development denotes moist temperament, and warm temperament if the muscles are firm. Scanty muscular development with very little fat shows that the temperament is dry. Oiliness and fat always denote cold temperament, and the muscles are then also flabby.

If at the same time there is constriction of the veins and lack of blood, and if there is weakness from lack of food (because there is too little blood to enable it to furnish the requirements of the tissues), this shows that this temperament is inborn and habitual. But if these other signs are absent, it shows the temperament to be an acquired one.

468. Lessening of the amount of oil and fat in the subcutaneous tissues always indicates a hot temperament, because the substance of oil and fat is the oiliness of the blood, and that is derived from cold. Hence these things are less plentiful in the liver-region, and more plentiful over the intestines. There is not more oil and fat over the heart than over the liver, except as to matter ; it is not temperament or "form" which accounts for this ; it is simply that the "nature" of the heart depends for its maintenance on the presence of such-like "matter."

Congelation of oil and fat over the body is greater or less according as the heat is more or less in degree.

If the body is fleshy, and the amount of fat and oil not great, the temperament is hot and moist.

If the body is very muscular, and there is much oil, but little fat, this denotes excessively humid temperament. If extremely fleshy, this denotes superfluity of moisture and cold. It is evidence that the body has become cold and moist.

469. The more spare the body is in habit, the more likely is it to be cold and dry ; or (less likely) hot and dry ; or, dry, for such a body is attempered as to heat and cold. Or, hot, because such a body is attempered as to moisture and dryness.

III. THE HAIR

The points to note are : rate of growth ; amount ; fineness or coarseness of texture, straightness or curliness, colour.

470. *Rate of growth.* Slow growth, or absence of growth, without evidence of lack of blood—denotes extremely humid temperament. More rapid growth denotes a less humid temperament, rather tending to dryness. (Heat and coldness of

temperament are shown by other signs —given above—than the hair.)

If the temperament is both hot and dry the hair grows much more rapidly, and the individual hairs are numerous and coarse. Abundance of hair means heat, coarseness much fumosity. Hence the hair is more plentiful in youthful persons than at puberty, as the humours of the latter are vaporose, not fumose.

The opposite characters denote the respective contraries.

471. *Form of the hair.* Curly hair : denotes hot and dry temperament. It may be that there is tortuosity of the minute channels and pores : and this cannot change even if the temperament changes. But the two primary causes would change if the temperament changed. *Straight hair* denotes cold and moist temperament.

472. *Colour of the hair.*

Colour	Corresponding temperament.	Remarks.
Black.	Hot.	In such cases oxidative processes are in excess of the mean (Joannitius).
Brown. Tawny and red.	Cold. Equable.	There is an excess of "unburnt heat," so that the hairs always grow red (J). Hence the proneness to anger (a form of "heat").
Very fair.	Cold and very moist.	Note how plants lose their dark or green colour when dried, and become grey or white. In man, this change is produced towards the close of desiccant diseases.
Grey.	Cold and very dry.	

473. *Cause of grey hair.* Aristotle stated that hair turns grey because it takes on the colour of serous humour. (Joannitius ascribed it to decomposition changes in the serous humour occurring in old age ; greyness, he says, means excess of atrabilious humour.) Galen ascribed it to a mustiness accompanying the nutriment supplied to the hair, which retards its movement and penetration into the pores (of the hair) (i.e. hair-sac).

As a matter of fact there is little difference between the two views, because the whiteness of the serous humour is physically due to the same cause as the whiteness of the mustiness. The subject really belongs to physics.

474. Observation also shows that atmosphere and geographical situation affects the hair. One would not expect to find the hair red (which denotes equable temperament) in a

black person even though his temperament were equable ; nor would one expect to find black hair (which denotes hot temperament) in a Slav, even though his temperament were hot.

475. *Relation of character of the hair to the age.* In puberty the hair is as in northern countries ; in youth, as in southerly countries ; after the age of fifty it is between the two. Abundance of the hair at puberty reveals the future temperament. As the person grows, it precedes the formation of atrabilious humour, and in the elderly person it shows that atrabilious humour is actually present.

IV. THE COLOUR OF THE BODY

476. Colour.	Temperament.	Accompanying features.
Pallor.	Cold.	Lack of blood.
Yellowish.	Hot.	Lack of blood ; increase of bilious humour.
Ruddiness.	Hot.	Abundance of blood ; sanguine or bilious temperament.
Sub-ruddiness.	Hot.	Dominance of bilious humour. Occasionally it denotes lack of blood, provided there is no bilious humour present in the blood, as is the case in convalescents.
Dark Brown.	Extremely cold.	This is because sanguineous humour is dominant, and there is deficient coagulability of the blood and it darkens and alters the colour of the skin at the same time [Joannitius ascribed blackness to the atrabilious humour].
Brown.	Hot.	The heat is such as follows upon pure atrabilious humour.
Colour of Egg-plant fruit*	Cold and dry.	Serous humour in excess (J. ascribes whiteness to the serous humour).
Chalky.	Cold.	
Leaden.	Cold and moist.	Atrabilious humour is only slightly in excess. This is because there is a trace of green in the whiteness ; the latter depends on the serous humour and moistness of temperament. The greenness depends on congelative change in the blood, for this tends to a blackness which, mingled with serous humour, produces a greenish tint.
Grey and white.	Cold.	
Ivory White.	Cold.	Serous humour in excess, and the choleric humour scanty.

477. Colour of the eyes.

It is not easy, but it is possible, to assess the temperament of the brain from the colour of the eyes.

* Egg-plant ; brinjall ; solanum melongena, or black brinjall. The colour is a purple-black. The fruit is referred to as a colour in Night 357 : " a flabby nose like a brinjall " (Burton). " The vegetable is held to be exceedingly heating, and thereby to breed melancholia and madness " (ib.).

The following details are from Joannitius :

Black : due to : smallness of crystalline lens ; setting of the crystalline lens too far back ; abundance of aqueous humour ; turbidity thereof ; uvea redundant ; peculiarity of the visible "breath" (scanty, or confused).

Brown : due to the contraries of the above—crystalline lens large or further forward ; paucity of albugineous humour ; clearness of this ; deficient quality of uvea ; the visible breath plentiful or clear.

Intermediate colours (black and brown mixed). The visible breath varies in amount and clarity.

Grey : visible breath less plentiful.

478. Changes of Colour

Change to yellow (yellowish-white) : suspect disorder of the liver.

Change to yellowish-black : suspect disorder of the spleen.

Change to yellowish-green : suspect piles (this does not always hold good (marginal reading)). These suggestions only apply for the moment when the change of colour takes place.

479. Colour of the Tongue

It is not easy to assess the temperament of the stomach and intestines and veins from the colour of the tongue, any more than it is to assess the temperament of the brain from the colour of the eyes.

There may be two different colours simultaneously in two members, in consequence of a disease. Thus, the tongue may become white and the countenance dusky. This occurs in jaundice, when this is due to an intense acridity of the bilious humour.

480. Extraneous causes of Colour Change

Cold climate (e.g. in Scotchmen), hot climate (e.g. negroes).

Emotional changes : fear, rage, sadness, etc.

V. THE FORM OF THE MEMBERS

481. Hot temperament : big broad chest ; large limbs ; no narrowing or shortening of the hands or feet ; conspicuous full veins ; big strong pulse ; the muscles round the joints large (for growth and the form of composite structures requires heat).

Cold temperament : the contraries of all the above. The natural faculties and the formative faculty are impaired by cold, so that the natural functions are not perfectly carried out.

Dry temperament : roughness, curvature of form ; joints conspicuous. Adam's apple prominent. Nasal cartilages conspicuous ; nose of medium size.

Moist temperament : the contraries.

Joannitius adds : fleshiness (excess of heat and moisture in the temperament); Fatness (excess of moisture and intense coldness) ; Leanness (hot temperament, and intense dryness) ; Delicate build—cold and very dry ; Massive build—cold and very moist, or very cold and very moist ; Justness of form—well-balanced humours.

VI. RAPIDITY WITH WHICH MEMBERS RESPOND TO HEAT AND COLD

482. If a member becomes "hot" rapidly and easily, it shows that it is hot in temperament, because change in the direction of its own temperament is more readily undergone than in the opposite direction. Similarly, if the member behaves in the contrary way, it will be of cold temperament.

483. Some assert that it is otherwise, because we know (they say) that a thing only reacts to its contrary and not to its like. But if that were the case, it would follow that a thing would react more strongly to its like. But the reply to this is that two things are only really alike when one does not interact with the other; we then know that their respective qualities are of like "species" and "nature." Of two things A and B, if B is less hot than A, we cannot speak of it as being "like A." As long as one of the two is hotter, they cannot be called "alike." One is cold compared with the other. So an interaction (on the part of the body) is possible. B would be cold compared with A—not hot. B, too, may react with something else which is colder than itself [say C] besides reacting with "cold" [say D]. C or D may enhance the intrinsic quality of B, according as they are stronger than B or not. It is easier for it to change towards that which enhances this quality of B, or neutralizes the opposite quality of B, on condition that the new causative agent harmonizes with A and B, and neutralizes the temperamental nature (*p*).

Therefore it is clear that when the nature is of hot temperament heat will not show any action on it until the influence of the contrary cold has first been removed ; and this is achieved by preventing the calefaction (which tends to be produced by a hot temperament) from becoming greater. The result is that if both events occur simultaneously, and the inhibiting agent is destroyed, they will mutually help one another in producing heat, and the two qualities will thus reach an acme.

When the body is exposed to foreign heat, however, the balance of temperament is likely to be destroyed. The innate

heat of the body is all-important for resisting this. We depend on our innate heat for the neutralization of "hot" poisons, and for their expulsion and for the dissolution of their substance.

484. The innate heat, therefore, is the instrument of (human) "nature" for combating the injurious action of extraneous or foreign heat. By its means, the breath gets rid of it, expels it, disperses it, and oxidizes its material basis (*m*). Further, it combats the injurious action of foreign "cold," expelling it "by contrary." Coldness has not this power. It is only the contrary to coldness—i.e. foreign heat—which can combat or repress it. Coldness cannot combat extraneous "cold." The innate heat does.

485. Innate heat is that which protects the natural humours from being overruled by foreign calorific agents. *If the innate heat is strong*, the natural faculties are able to work through it, upon the humours, and so effect digestion and maturation, and so maintain them within the confines of the healthy state. The humours move according to its ministration. Extraneous or foreign "heat" cannot interfere with this movement, and so they do not undergo putrefactive decomposition. *If the innate heat is feeble*, the natural faculties are harassed in the regulation of the humours. For the instrument—the intermediary between the natural faculties and the humours—is enfeebled. Stagnation sets in and foreign heat now finds the humours no longer opposed to its action. It overcomes them. It utilizes them in its own way, and imparts a foreign movement to them; and the result is what is known as "putrefaction."

486. Hence it is clear that the innate heat is the instrument of all the faculties, whereas coldness can only help them secondarily. That is why one speaks of "innate heat," but not of "innate cold"; and why that which is proportionate to heat is not comparable with cold.

§ 203. This passage is evidently an attempt to explain the nature of bacterial action and infection without the knowledge of the actual bacteria themselves. The description is so ingenious that it requires little change to modernize it.

The following may be amplified accordingly:

1. The meaning of innate heat.
2. The nature of "foreign heat," "foreign cold."
3. The meaning of the term "hot poisons."
4. The meaning of hot and cold, as relative terms.

(1) *Innate heat.* This term, particularly in this passage, is equivalent to "vitality." This word describes a complex concept. Though regarded as vague and quite unsatisfactory to-day, it may be said to be amenable to reduction to a formula—and a formula into which several factors enter. The condemnation of the term is due to the non-recognition of this fact and non-recognition that many well-known and freely-accepted data belong to it.

(2) *The nature of "foreign heat"; "foreign cold."* These refer to material agents, now known as pathogenic micro-organisms. The material substance, which is stated by Avicenna to be oxidised by "innate heat," is the bacterial sub-

stance, which as we know undergoes lysis in the course of the immunising processes of the body. The "heat" refers to what we know as the bacterial toxins which act upon the thermogenic centres, and produce numerous other effects on the tissues. The word "heat" thus comprises two things. The pyrexia produced by bacterial invasion may be theoretically distinguished from the innate heat, but practically speaking the rise of temperature is generally admitted to be part of the so-called defensive mechanism against infections. The destruction of the bacteria, and of their products by anti-substances—these events are comprised in the words "dispersing the foreign heat". After all, both bacteria and products are "dispersed." We are only being told the same fact in different language.

In the case of foreign cold, here the organisms and products differ. But if the temperature becomes subnormal, the immunizing process is not ascribed to the lowered temperature. Recovery from the infection still depends on the "innate heat" or "vitality"—that is, a series of processes of immunization which take place whether the patient develops fever or not.

Avicenna considers that the formation of septic products is more likely if there is not much pyrexia, on the ground that in such a case the bacteria, as we should say, meet with less resistance, and are enabled to produce those decompositions of the body fluids which we know to take place readily as soon as the vitality of a part is lowered.

(3) *The meaning of the term "hot poisons."* Clearly the word poison must be understood as covering both bacterial agents and their products. The toxic products may produce rise of temperature, and are therefore reasonably called "hot"; others do not have this effect.

(4) *The meaning of hot and cold, as relative terms.* In this passage a thing is hot or cold according to its effect on the bodily sensations, or its effect on the heat centres of the body. Taken in its literal or surface meaning, of hot temperature, cold temperature, the passage is of course pedantic and useless. It should be evident that the words "hot" and "cold" cannot possibly have meant literal heat and cold.

VII. SIGNS DERIVED FROM SLEEP AND WAKEFULNESS

The sensitive faculties make use of these things frequently, in a manner corresponding to the primary qualities. Thus we say that in the wakeful state the body is the instrument of the soul.

487. If there is equipoise between sleep and wakefulness, it means that the temperament (especially of the brain) is equable. If sleep dominates, it denotes a cold and moist temperament (of the brain), whereas if wakefulness dominates, it shows a dry and hot temperament (especially in the brain).

A strong inclination to sleep denotes debility—a loss of tone of the muscular power. Histologically, sleep depends on a break in the ideation-zone of the cerebral cortex; if there is a break in the layer below that, the sleep will be that of stupor or coma. The break in this situation is marked in amentia and dementia.—Wakefulness, or insomnia, denotes: poisons circulating in the blood, powerful sensory impulses (pain), or powerful emotions.

VIII. SIGNS DERIVED FROM THE STATE OF THE FUNCTIONS*

488. *Equable temperament:* the activities of the body proceed fully and perfectly and naturally.

Hot temperament: there is over-activity, exaggerated

* Functions may be weakened, exalted, depraved, obstructed in their action or abolished.

activity. Rapid growth of stature ; increased rate of growth of hair ; early eruption of the teeth.

Cold temperament : the activities lessen and become sluggish and delayed, but a hot temperament may cause weak and sluggish activity though only if a deviation from the natural course is associated with weakness.

489. Many natural functions may slow down or lessen owing to heat. Thus in the case of sleep, sometimes there is insomnia or lack of sleep from the effect of the heat of a hot temperament. Similarly some of the natural states may be intensified by cold. Thus, again, in the case of sleep, though this is not strictly the outcome of natural functions, but only an effect conditional upon some causal agent. For the necessity for sleep for life and health is not absolute ; (*a*) it enables the breath to separate off from its impeding factors—the fatigue-substances; (*b*) there is need for a recumbent posture after a meal ; (*c*) one cannot achieve two (contrary) things at the same time. Hence the need for sleep is simply some impotency. It is not included in “natural necessity.” And if its exclusion be “natural” in the sense that it is inevitable, this is only because the word “natural” is here used for “the inevitable.” One word is being made stand for two things. But the most accurate application of the term is to “equable temperament,” for it is this upon which equability of functions and their final completion depends. To use the term in regard to the four qualities—heat, coldness, dryness, moisture—is only hypothetical (*takhmīnī*).

490. Among the “strong” (“*jelal*”) actions which denote a hot temperament are : powerful voice ; harsh or coarse voice ; rapid way of talking ; constantly talking ; anger ; rapid gestures ; blinking of the eyelids. Before deducing a hot temperament from these, one must make sure there is no local cause for them, and that they are not confined to one particular member.

IX. SIGNS DERIVED FROM THE EXPULSIVE FACULTY AND FROM THE QUALITY OF DISCHARGES

491. The temperament is hot : (1) if the waste matters are retained ; (2) if the fæces, urine, sweat, etc., are strong in odour, acrid, of normal colour, and show the normal degree of oxidation and maceration—in the case of matters which normally undergo such changes.

If the signs are contrary, the temperament is cold.

X. SIGNS DERIVED FROM THE STATES OF THE MIND, DURING ACTION AND PASSION

" Every expression is the sign of a state of mind ; that state is as the hand, and the expression is the instrument."—(Mesnavi,^{ss} p. 29).

492. Evidence.		Name of Temperament corresponding.	
		Hot.	Dry.
Emotional aspect	Concupiscent	1 2 3 — (Shameless)* Excitable Lively Vivacious	Infatuation ; love-passion.
	Irascible	1 2 3 Hopefulness Courage ; temerity† Easily provoked to anger	Brooding Anger lasts some time
	Duration	Short Long*	
Mental capacity	Intellectual power	Good	Imaginative
	Power of observation	Good	—
	Capability Talent	Good Conspicuous	Memory good
Moral aspects		Stern Virility of morals and manners Diligence Much flexibility of opinion†	Gentle
Ego faculty		Love of good opinion Not easily perturbed or downcast	Takes things to heart
Movements and gestures		Rapid	
Dreams		Of warming oneself at a fire ; sitting in the hot sun†	

Cold temperaments show the opposites to those given for hot temperaments ; moist, the opposites to those given for dry.

The whole of the above, or at any rate the major part of it, refers to the congenital or innate temperament. Now we refer to acquired temperaments ("intemperaments").

* In the case of the moist temperament, the duration of emotional disturbance is short.

† In the case of a cold temperament, the dreams are of being in the cold, out in the snow, or of being immersed in cold water.

In short, the character of the visual images in the dream is related to the character of the dominant humour, partly because the dream varies with the state of the "breath" at the time.

‡ These represent negative or weak aspects.

493. EVIDENCES OF THE FOUR PRIMARY INTEMPERAMENTS

Evidence.	Hot.	Cold.	Moist.*	Dry.
Morbid states to which there is a tendency.	Inflammatory conditions becoming febrile. Loss of vigour.	Fevers related to the serous humour. Rheumatism. —	— Lassitude.	—
Functional Power	Deficient energy.	Deficient digestive power.	Difficult digestion.	—
Subjective sensations.	Bitter taste in mouth. Excessive thirst. Sense of burning at cardiac orifice.	— Lack of desire for fluids. —	Mucoid salivation. — Sleepiness.	— — <div style="display: inline-block; vertical-align: middle; margin-left: 10px;">{ Insomnia. Wakefulness</div>
Physical signs.	Pulse extremely quick and frequent ; approaching the (weak) type met with in lassitude.	Flaccid joints.	Diarrhoea Swollen eyelids	Rough skin. Spare habit (acquired not inborn).
Foods and medicines.	Calefacients are all harmful. Infrigidants benefit.	Infrigidants are all harmful. Calefacients benefit.	Moist articles of diet are harmful. —	Dry regimen harmful. Humectants benefit.†
Relation to weather (i.e., season).	Worse in summer.	Worse in winter.	—	Bad in autumn

4. THE EVIDENCES OF EQUABLE TEMPERAMENT

(i.e., the evidences of symmetry, beauty of form, and good conformation.)

494. In addition to the signs of normal temperament already given, there are :

1. To the feel, the body imparts sensations mean between hotness, coldness, dryness, moisture, softness, hardness.

The skin feels moist and warm, and has a beautiful smooth and elastic surface. The complexion is clear.

2. In colour, the body shows a balance between whiteness and redness.

3. In build, the body is neither bulky nor spare, though on the whole inclined to be bulky. (Robust Habit of Body?) Tallness and straightness of stature ; quick growth.

4. The veins of the skin are neither prominent nor submerged ; they are separated and spread.

* The signs of moist intemperament include those of the cold.

† Hot water, rarefied oils are beneficial to the dry temperament and are avidly taken up.

5. The hair is neither profuse nor sparse, thick nor thin, curly nor straight, black nor white. During puberty they tend to a tawny shade rather than black, in youth they tend to blackness. [Full hair where hair should be.]

6. Equally inclined for sleep and for wakefulness.

Sleep quiet, uninterrupted, and followed, on waking, by cheerfulness, and a contented mind.

7. Agreeable dreams arousing hopefulness, with fragrant perfumes and alluring voices, visions and agreeable companionship.

8. Mental faculties : vigour of imagination, intellectual power, and memory. Emotions balanced between excess and deficiency—e.g., between courage and timidity, between anger and patience, between sternness and clemency, between vacillation and perseverance.

9. Perfection in all functions (185).

Therefore no conscious feeling of digestion, or discomfort of any kind. Micturition painless, the urine not feeling hot, having an odour neither sweet nor sour, amber-coloured, and forming no deposit. Defecation without soiling the skin, the faeces firm, but not hard.—The appetite according to genuine hunger, and for natural foods ; thirst only for water.—Mouth closed when breathing. Adaptability to climate and to season (Ch. M.).

10. Movements of the limbs deft. (Skilful.)

495. A person with such a temperament will have a happy expression, will be lovable and contented, moderate in desire for food and drink, possessing a good gastric digestion, good hepatic and venous digestion, and good alterative and assimilative power all through the tissues. The waste matters will be moderate in amount and will be discharged through the proper channels.

5. THE INDICATIONS AFFORDED BY CONGENITAL MAL-CONFORMATION OF THE BODY.

(i.e., asymmetry, misproportion, unshapeliness, ugliness, and the like.)

496. In brief, there is non-uniformity of temperament among the members ; or, perchance, the principal members depart from equability and come to be of contrary temperament, one deviating towards one, another to its contrary. If the components of the body are out of proportion, it is unfortunate both for talent and reasoning power. Thus, (1) a tall person with a large abdomen and short face and round head, and short fingers ; (2) a person of small stature, with small head, much flesh in the face and forehead, and even in the neck and feet—the face like the full-moon ; the jaws rounded and massive.

Similarly, (3) if the head and forehead were round, but the face very round (long, marginal reading), and the neck very thick, and if the eyes are sluggish in movement. Such persons would be the very last of people to be classed as in good health.

6. THE SIGNS OF PLETHORA

497. Regarding plethora there are two aspects. There is the plethora in regard to the cavities, tubes, and juice canals ; and there is the plethora in regard to power or strength (vitality).

1. *Plethora of the channels of the body* consists of an undue amount of humours or of breath. These may be healthy in quality, and merely superabundant in quantity, so that the channels are overdistended and overfilled. In such a case movements become dangerous, the vascular channels running a risk of rupture, followed by a flux towards the regions where there is back-pressure, and choking of these parts may occur, with subsequent apoplexy or epilepsy. To relieve such, the local plethora must be rapidly relieved by venesection.

2. *Plethora of strength of faculties.* In this case the error is not in quantity of humours, but in unhealthiness of quality, whereby the faculties are embarrassed, and they become inefficient for the processes of digestion and maturation. A person who is in this state is in danger of putrefactive disorders.

498. Speaking in general *the signs of plethora* of the first type are :

Objective : red face ; full veins ; tightness of skin ; sluggish movements (gestures) ; full pulse. High-coloured urine ; dense urine ; scanty appetite.

Subjective : sense of weight in the limbs ; weak vision ; dreams in which there is a sense of weight—as when one dreams one is unable to move, or is carrying a heavy weight, or cannot give utterance to words. This kind of dream may be compared with that associated with attenuation of humours, or where the humours are moderate in amount for here one dreams one is flying through the air, or moving at a great speed.

The modern term "*hypertension*" is covered by the old term of plethora or repletion. The correspondence is verified by some of its symptoms. Thus, haemorrhagic phenomena occur—in the nose, retina, cerebrum, meninges, labyrinth, the skin ; and as haematuria and haematemesis simulating organic disease. Hypertension causes fatigue of the heart shown by : dyspnoea, palpitation, quick pulse, anginal attacks, nocturnal pseudo-asthma, bruit de galop¹⁴¹ (P. 348).

499. *The signs of plethora in respect of faculties* : Heaviness ; sluggishness ; loss of appetite (these are also present in the preceding type). Disinclination for exertion. Sense of burdensomeness.

If the plethora of the faculty is unaccompanied by plethora of humours, the veins are not as distended, and the skin is not as tense, or the pulse as full and large, or the urine as gross (dense) or as red in colour. There is no lassitude except after undue movement and exercise and activity. The dreams consist of sensations of itching, stinging, burning, and of fetid odours.

Which of the humours it is which is dominant in such cases is discerned by the signs which now follow. But in the case of plethora of faculty, illness ensues before all its signs are manifest.

7. THE EVIDENCES WHICH SHOW WHICH OF THE HUMOURS 500. IS DOMINANT

		HUMOUR DOMINANT.		
EVIDENCE.		SANGUINEOUS.	SEROUS.	CHOLERIC.
ASPECT:		General physique ..	Effeminate ; bones slender, joints well-covered.	Lean; joints large.
Age	Ruddy. +	Unduly pale.	Yellow tinge in skin and conjunctiva. +
Colour	Flesh firm.	Soft and cool.	—
Feel of the body	Rebounds on rubbing; furnaces.	—	—
State of the skin	Full.	Absent on trunk. Constricted.	Hairy. Thick and hard.
Hair	Surface veins	—
Vegetative faculties :—		Mouth ..	Liability to pustules.	Abundant sticky saliva.
		Tongue ..	Red.	—
		Nose	Soft, tends to be slow and infrequent.
		Pulse	White.
		Urine
		Faeces
Sensitive faculties :—		Special senses : taste ..	Unusual sweetness in mouth, senses dull.	—
		Appetite for food ..	—	Bitter taste.
		Appetite for fluid ..	—	Rough and dry.
		Muscular tone ..	Weariness not accounted for by exertion.	Rough and dry.
		Dreams ..	Sees red things; blood coming out of the body; swimming in blood, and the like.	Rough and dry.
Movements (gestures) ..		Yawning, stretching.	—	Rough and dry.
Rational faculties.		Reaction time slow.	Somnolence, laziness, tiredness, lassitude.	Hebetude.
Abnormal phenomena :—		Present.	—	—
		Nausea	Present.
		Vomiting	Yellow and green bile and "acrid flux"; As from needlepricks.
		Gooseflesh	—
		Headache	—
		Others ..	Sense of weight in back of eyes and temples. Blood flows out readily from nose, anus, gums.	Severe diarrhoea.
Preceding factors :—		Regimen ..	Weak digestion and acid eructations.	Note.
		Occupations	Note.
		Locality lived in	Note.
		Habits	Note.
		Season of year	Note.
		Date of last venesection	Note.
		Previous temperament	—

501. Additional remarks :

The age of the patient gives a clue to the kind of humour likely to be dominant.

Excess of sanguineous humour is shown by signs akin to those of plethora, and some of the signs given are accounted for by simple plethora.

When the atrabilious humour is in excess, the blood is dusky and heavier than normal. Atrabilious humour is seldom in excess in pale and slight persons.

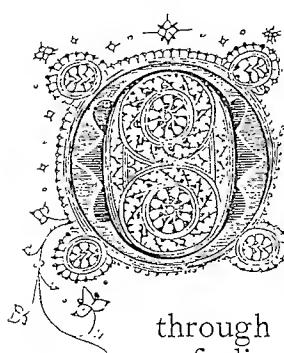
One or two of the data given (under general physique ; on the hair ; the surface veins) are from Rhazes.

Note the patient at rest (in repose) and in activity (gestures, attitude).

Note that the signs of his temperament are accentuated when he is ill. The type of reaction to infection is determined by his temperament.

8. SIGNS OF OBSTRUCTION (TO THE FLOW OF THE HUMOURS)

502.



OBSTRUCTION is known to be present if there are signs indicative of accumulation of matters, and the patient experiences the sensation of fullness throughout the body without there being any of the signs of general plethora.

If the obstructions are in those channels through which much fluid is bound to flow, there is a feeling of weight or heaviness. Thus, in hepatic obstructions, the material from the aliments cannot enter the organ, and therefore accumulates and is retained, so as to produce a much greater "encumbrance" than an inflammatory swelling would. The difference from the latter consists in the great heaviness and the absence of fever.

Obstructions in other channels do not lead to such a sensation of heaviness, but only one of overfullness and of stretching and tenseness.

503. Obstruction in venous channels causes the skin to become tinged with yellow, since the blood does not then gain access to the surface (layers of the skin).

The subject of "obstructions" is capable of great expansion.

(i) The symptoms differ :—

(a) With each of the *humours*. Thus, serous humour obstruction is manifested

as œdema of the glottis, œdema of the lung, nasopharyngeal hypersecretion, œdema of the kidney tissue, of the blood itself; vomiting, diarrhoea, headache (too much cerebro-spinal fluid), convulsions; delirium, coma, Cheyne-Stokes respiration, amaurosis.

(b) With the different *substances*. Thus in nephritis, obstruction of the channels in the skin prevents the wastes leaving the body by that route, with consequent manifestation as arthritis, anginas, otitis, etc.

(c) With the *atom groups*. Thus obstruction to the outlet of nitrogen (azotæmia) manifests as hypertension, vomiting, diarrhoea, sialorrhœa, stomatitis, parotitis, retinitis, anaemia of plasmatic type; arthralgia; fibrillar tremors; coma; loss of appetite for meats.

Viewing diseases in this way, the important thing is to find both site of obstruction, and substance or atom-groups concerned.

(ii) The symptoms may be monosyndromic or polysyndromic. (Vallery-Radot,¹⁴¹ p. 296-299.)

(iii) Obstruction to the flow of "breath."

(iv) The "pores" which may become obstructed vary in size from that of the orifices of the body down to the smallest channels, whether visible to the naked eye or only with the microscope, or whether sub-microscopic or "ultra-microscopic." The pores vary in shape and consistence, resilience, elasticity, distensibility. Fluids may traverse them in both directions, but when there is obstruction, they may be able to pass only in one direction or not at all.

9. THE SIGNS OF GASEOUS DISTENSION

504. Gaseous distension is recognized (1) by means of pain experienced in the sentient members. This is because the gases produce a severance of continuity in the tissue-elements; (2) by the movements which take place in the sentient members; (3) by sound; (4) by touch.

1. The *pain* of stretching is a sign of gaseous distension, especially if the painful tissues are soft to the touch. The evidence will be complete if the pain afterwards ceases, for this could not occur without there being a loss of continuity. In members like bone or glandular tissues, gaseous distension is not manifested by pain, even if such distension arises in bones which have been fractured (unless the skin has been torn by the fractured ends).

2. The *movements* which point to gaseous distension are: fidgeting, tossing about (peristalsis). They are produced by the gaseous materials making their way through the organs out of the body.

3. *Noises* may be produced, e.g., gurglings, rumblings. These may be evoked by manual compression, percussing—as is done for distinguishing between dropsy (ascites) and tympanites.

4. *Touch* enables one to distinguish between distension with gas and other nodular swellings. Gaseous distension stretches the part and yields to pressure. That is not the case with fluid distension (liquid, viscous, mucoid).

505. The difference between inflation and gaseous distension is not in substance but in form. The form or shape,

of the distended area is different when standing or lying down and manipulation will alter its position.

10. THE EVIDENCES OF SOLID SWELLINGS

506. The presence of external tumours is easily demonstrated to the sense of sight. Deeply placed inflammatory swellings are revealed by accompanying fever, as well as by a sense of heaviness, if the affected member be devoid of sensation, or of stabbing pain as well as heaviness if the member be sentient. Interference or hindrance to function and movement of a part affords a further sign of the presence of a "tumour." A certain degree of intumescence of the overlying part is a very important sign of an inflammatory mass, if sensation has access to it.

Cold swellings are not accompanied by pain.

507. It is difficult to describe the signs of tumours in a general manner. Even if one could do so it would be at the expense of wearisome words. That is why it is simpler to defer details to the special chapters. It will suffice for the present to say that wherever heaviness and not pain are perceived, and the signs of dominance of the serous humour are present, this leaves no doubt about the swelling being of pituitous nature.

If there are signs of dominance of the atrabilious humour, and the swelling is hard to the touch, it will be an atrabilious mass, because induration is pre-eminent among the signs of this form of swelling.

508. Inflammatory swellings in muscular organs are extremely painful, and fever is intense ; the nerves are stretched early (causing the pain) and there is delirium. Such swellings interfere with the movements of contraction and expansion.

509. Swellings in any of the inward parts of the body cause the abdominal wall to become wasted. If they are inflammatory and undergo suppuration and track outwards, they cause extremely severe pain, with fever ; the tongue becomes very rough, and there is great wakefulness, and the symptoms become more and more severe—notably the sense of heaviness and weight and stiffness in the affected part. Induration and tension become evident. Sudden emaciation of the body, with hollowness of the eyes may develop. But when the process of suppuration has attained maturity, fever is high, pain lessens, the pulse softens, throbbing subsides, and itching replaces the pain. If there was much redness and induration, the redness lessens, and the induration is less noticeable. Pressure on neighbouring organs lessens, and all the causes of pain subside, along with

the great sense of heaviness. When finally the abscess bursts there is a rigor (produced by the acridity of the sanguous matter) ; fever increases again (because of the movement and discharge of the pus), and the pulse becomes "empty," unequal, weak, infrequent, small, broad, and slow. There is loss of appetite ; often the extremities grow warm.

The pus may also be discharged through ordinary routes — the expectoration, the vomit, the urine, or the fæces.

510. The following signs after the bursting of an abscess are good : subsiding fever, easy breathing, return of strength, quick evacuation of pus through its proper channels.

511. Sometimes, however, in deep abscesses, pus passes from one member to another ; and this transference is sometimes beneficial, sometimes detrimental. It is beneficial when it passes from a principal member to a subordinate one ; as for instance, when it passes from the brain to the tissues behind the ears, and from the liver to the groins. It is detrimental if it passes from an ignoble organ to a noble one, or to a weaker or less resistant organ, as for instance when pleurisy involves the heart or lung.

512. The passage of latent or hidden inflammation and abscesses and eruptions to higher or lower regions affords (distinctive) signs. If they pass downwards, this is shown by difficult breathing and other respiratory trouble, and tightness of the chest. There is a burning sensation beginning below and passing to the upper parts. There is heaviness in the region of the clavicle ; and headache. Evidence may also be obtained from the clavicle and forearm.

If it should pass upwards, and the brain become involved in inflammation, it is a bad and very grave sign. But if the inflammation passes into the loose tissues behind the ears, there is hope of recovery.

Epistaxis is a good sign in such a case, as it is in all inflammations of the internal organs.

A more careful account of all kinds of swelling will follow later, at the same time as we deal with the morbid states of the several internal organs.

II. THE EVIDENCES OF LOSS OF CONTINUITY

513. Loss of continuity in a visible member is readily evident to the senses. In the case of interior organs, loss of continuity is shown by

(1) *Pain*—boring, stabbing, tearing.

(2) Especially if there is *no fever*.

(3) Often there is the *flow of some humour*—such as (*a*) haemoptysis ; (*b*) effusion into a roomy cavity of the body ; (*c*) outburst of purulent matter : in the cases where loss of continuity follows the maturation of an abscess, with bursting of the abscess. If the suppurative process has matured, the fever will subside and the pus be discharged, and the sensation of heaviness and pain will subside. Otherwise the pain would increase, and the other symptoms become more severe.

(4) In some cases, loss of continuity is revealed by *complete luxation* of the member, or partial displacement from its proper position (e.g. hernia).

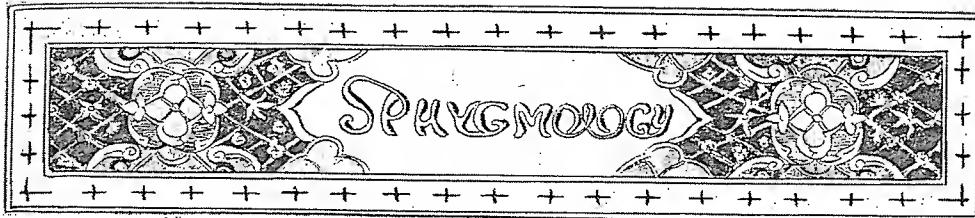
(5) *Diversion of discharges* from normal to other channels, or into some cavity, which has itself been produced by the break of continuity. Ex. : traumatic rupture of the intestines, whereby the faecal contents cease to leave the body; (false aneurysm).

(6) In some cases, the existence of loss of continuity escapes detection by these general signs. *Special signs* peculiar to each member must then be utilized ; such as : loss of sensation; inability to retain the fluids normally entering the part; rigid or fixed position resulting from displacement of the part from its proper position ; lack of rigidity ; inability to retain relation to another member from which it has become displaced.

514. Prognosis. As you are aware, both loss of continuity and the presence of (inflammatory swellings) are more grave when they occur in very sensitive fibromuscular members. In fact, such loss of continuity may prove fatal from syncope or spasm. The syncope is due to the violence of the pain ; the spasms are due to the irritation of the nerves in which the parts are so rich.

Next in severity comes loss of continuity near joints, because restoration can only be slow considering the undue mobility of the parts; and the fact that spaces are opened up in and round the joints, and matters readily flow into these spaces.

We now proceed to expound the subjects of the Pulse and the Urine, as affording general evidence of morbid states.



THE PULSE

"It is necessary to enquire diligently into the properties of the pulse, for diagnosis and for the use of drugs."—Duhalde.²⁰

"Every important variety of pulse revealed by the sphygmograph was recognized, described, and named, before the Christian era. . . . We count the beats and note their force and volume to ascertain the strength of the sufferer and the effect upon him of the disease. . . . Many of the indications obtained from the pulse do not depend on a knowledge of the circulation at all."* Broadbent, "The Pulse," 1890, p. 32.

515. Definition. The pulse is a movement in the heart and arteries (the receptacles of the breath) which takes the form of alternate expansion and contraction, whereby the breath becomes subjected to the influence of the air inspired.

In modern language, "it is the change of shape from the flattened condition impressed on the vessel by the finger which the artery assumes under the distending force of the blood within it, which constitutes for us the pulse." (Broadbent, ib. p. 20.)

The subject of the pulse may be considered (i) generally, (ii) in regard to each of the several diseases. We defer the latter till a later period when we speak of the diseases themselves. At this stage we discuss the subject generally.

516. Description.—Every beat of the pulse comprises two movements and two pauses. Thus,

expansion : pause : contraction : pause.

One movement could not pass at once into another in an opposite direction. There must be a boundary or "limit of an act," as is expounded in the work on natural science.

Many doctors consider that it is impossible to perceive the movement of contraction. Others are able to perceive it—as "strength"—if the pulse is strong; as "degree of expansion" in a large pulse, as "great resistance" in a hard pulse, and, in a slow pulse, by the long period of time occupied by the movement.

Galen also says: "For many years I was doubtful about clearly discerning the movement of contraction by touch, and I shelved the question until such time as I should learn enough to fill the gap in my knowledge. After that, the doors of the pulse

* The following section on Sphygmology is therefore not obsolete, but of real value to the modern practitioner.

were opened to me. Whoever should study these things as I did will perceive that which I perceived [as it were, a brilliant light shining suddenly out from behind total darkness. Whoever allows these words to be true and not fabulous will benefit very greatly ; despair will not touch him or frighten him from the pursuit of his study, even though he makes no progress for many years."] Nevertheless there are conditions in which this movement cannot be perceived.

517. Reason for feeling the pulse at the wrist. (1) It is readily accessible ; there is little flesh over it ; (2) the patient is not distressed by exposing this part.

§ 204. This reason is important in the East where the doctor may not expose a female patient in any way. This interdiction accounts for the extraordinary erudition attained in the art of feeling the pulse, for instance in China. "The old Chinese doctors are remarkably good diagnosticians. Although the study of the patient is restricted to the examination of the two radial pulses, and noting the state of the eyes and tongue, the diagnosis is disconcertingly accurate." (Hartmann.²⁸)

William of Rubruk, a Franciscan friar (1253) recorded : "The Cathayans . . . are first-rate artists in every kind, and their physicians have a thorough knowledge of the virtues of herbs, and an admirable skill in diagnosis by the pulse" (quoted in Encycl. Brit., vi. 189, by Prof. Giles, who also states "the variations of the pulse have been classified and allocated with a minuteness hardly credible" (p. 228).

Eusebius Renaudot¹⁴⁸ (p. 209), in 1733, wrote : "They are so sure of the disease that they tell all the precedent symptoms to a nicety."

(3) The artery runs in a straight course (which is no small help towards accuracy of diagnosis : Galen).

(4) The distance from the heart is not great.

§ 205. The heart and arteries all pulsate with the same rhythm, so that any artery can be used for feeling the pulse. But most arteries are embedded in flesh and cannot be distinctly felt. The order of clearness is : wrist, soles, behind ears, along arms.

Arteries within bones cannot, of course be felt ; nor can arteries be made use of which have other bodies in front of them except in emaciated persons, where for instance the aorta or limb arteries become palpable for the first time.

518. Technique in feeling the pulse. (1) *The position of the hand.* If the palm be turned upwards the pulse will appear wider, less high and less long, especially in thin persons. If the hand be palm down, the pulse seems higher, longer and narrower.

§ 206. (2) If the patient be a male, use the left hand : if a female, the right.⁹⁸ This ancient Chinese idea, that the pulse of one side has a different significance to that of the other, is also met with, in a different form, in recent literature. Thus, Jones (see Bibl.) states that the pulse at the right wrist informs of the state of the constitution, or vitality, and that of the left wrist informs of the local disease, and the real and true condition of the patient. He further states that when both pulses are fully strong and regular, after an illness, the patient is nearly well.—Baraduc,¹¹⁰ on the basis of biometric observations of an elaborate kind, asserts that reactions obtained with the right hand belong to changes in the physical or material vitality of the body, whereas those obtained with the left hand belong to the psychic vitality.—These statements are of interest in relation to the ancient Chinese idea.

(3) The position of the observer's hand.—This must be adapted according to the position of the patient. The middle finger must be placed exactly at the junction of carpus with lower end of radius. The other two fingers are now allowed to rest upon the artery, one on either side (*ib.*). The index finger should be nearest the heart. (Broadbent, p. 39.)

(4) *Emotional state of the patient.* The pulse should be felt at a time when the patient is not in a state of excitement or anger, or affected by exertion, or under the influence of the emotions, or in a state of satiety (which renders the pulse heavy), or of hunger ; nor must it be a time when usual habits are neglected or new ones are being formed.

§ 207. (5) *The state of the observer.* The observer must be in a calm state of mind. He must be very attentive and free from the least distraction of thought. The body must be tranquil, and the posture at ease. The respirations should thus be unimpeded and regular. His own state of health should be good (Duhalde.²⁰).

Comparison with a normal pulse is thus possible.

§ 208. (6) *Other instructions given in the Chinese system of Sphygmology.*

The instructions for feeling the pulse include the following : first apply the fingers gently, touching the skin very lightly at the three places corresponding to the three fingers—named C (for cubitus, or lower end of radius), G for “gate,” and W (for wrist), the successive fingerpulses being in contact with those three places. The character of the pulse is now noted in reference to the vital organs.

The next step is to apply the fingers a little harder, but not hard enough to feel the bone. The attention should now be directed to the state of the pulse at G. The third step consists in applying pressure till the bone can be felt, and then making tests with a view to deciding on the state of each of the five main organs.

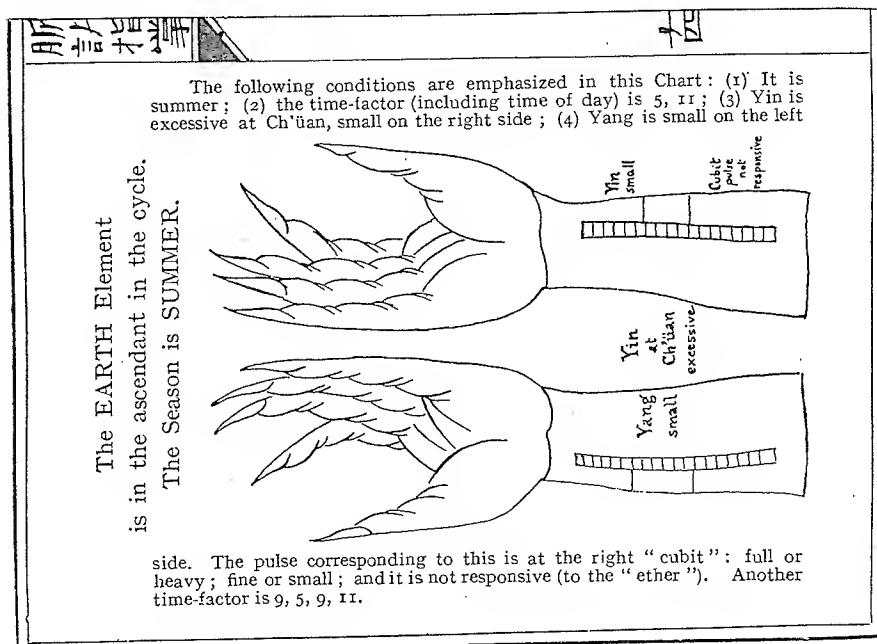
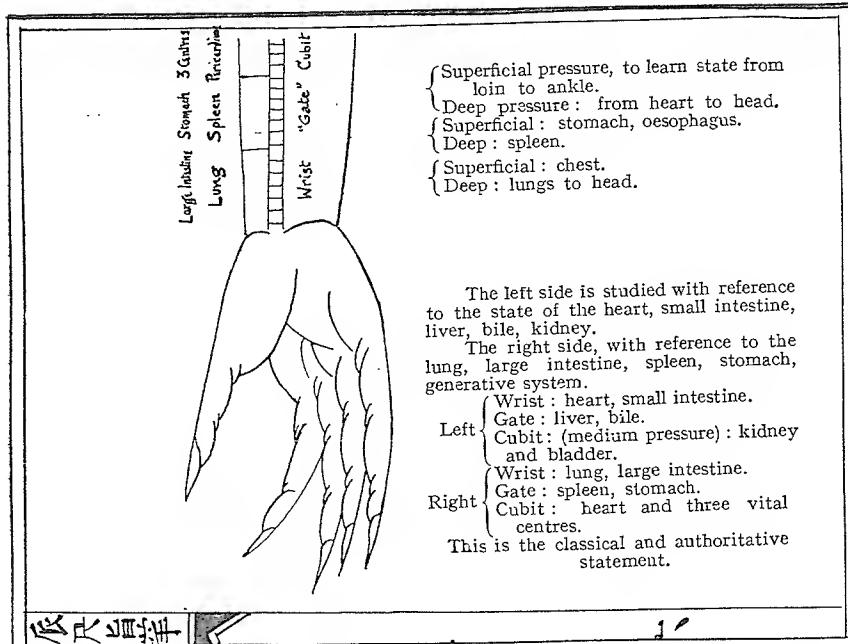
If the wrist be long, the fingers need not be readjusted ; but if short, readjustment of the fingers must be made several times, moving to juxtapositions each time.

The attention must not be allowed to wander from the search in question—the five vital organs and the six viscera. The sensation imparted to each finger is noted for the purpose. Great exactitude must be observed. The observation will evidently occupy a considerable period of time.

“ Fine though these distinctions are, the sedulous physician will perceive and remember them.”

A copy of one of the numerous diagrams in the work quoted is here appended, substituting a translation for the actual accompanying text.*

* For guidance in the translation of this passage and many parts of the work quoted, grateful thanks may be here expressed to Prof. J. P. Bruce and Mr. Li.



FACSIMILE OF TWO PAGES IN THE CHINESE CLASSIC ON THE PULSE. WITH THE (TRANSLATED) TEXT ARRANGED AS IN THE ORIGINAL.

§ 209. Some noteworthy theoretical considerations arising out of the Chinese work may be added as applicable to the Arabian conceptions, without attempting to outline their full system.

We must study the subtler aspects of the nature of the human being by invading the domain of "occult" science (by some considered to be forbidden), if we are to understand the real position not only of the great Chinese work, but also that of the Canon itself. With such a key, many of the passages acquire an entirely new aspect and value. The expansion and retraction of "the breath"—so important in regard to the subject of the nature of the pulse, respiration and other periodic movements—are part and parcel with diurnal and other changes in what is called the "cosmic ether." By working out the formulæ embodying the behaviour of the human vibrations, using biometric methods, Baraduc¹¹⁰ makes concrete that which is usually passed over as unauthenticated and apocryphal.

The interpretation of the pulse depends on the interpretation of the body itself. The latter follows "world-conception" rather than concrete anatomy. The natural phenomena of the patient harmonize with those of nature in general, and the two must be taken conjointly.

According to the classical style—"the two ideas—'urge,' 'change'—how important they are!" They provide the key to physiological processes, and also to the understanding of the pulse. They represent something deeper than our modern idea "forces of Nature"; they are over and above the ordinary course of Nature, as expressed in the Latin "praeternaturalis." These two ideas provide the purpose of study as the physician sits with his hand on the pulse, and his mind stilled for no small period of time.* The relation between the root factors of life and those of the patient is to be elucidated; and they find their expression in terms of functional activity of the several organs of the body. Hence this science of sphygmology pays regard to the seasonal variations, the age, the sex, the personal constitution, the dominant 'element,' its phase (rise or fall), and especially the character of the vital force—active, passive, negative, positive (see Figure). It aims at forming an opinion as to whether the illness is slight or deep-seated, easily curable or incurable, fatal or not, and if fatal in how long a time.

The permutations and combinations—the five *tsang* pulses, the six *fu* pulses, the seven *pyau* pulses, the eight *li* pulses and the nine *tau* pulses—all these afford ample scope towards a system which may encounter ridicule but is too rich in minutiae to be lightly put aside.

For, quoting Broadbent again: "It is impossible to examine with attention a large number of pulses, whether among the healthy or the sick, without being struck by the extraordinary diversity of frequency, size, character, tension, and force met with. This diversity prevails quite independently of disease in both sexes and with all ages, especially in regard to diameter of vessel and tension

* See Frontispiece.

and force of pulse. . . . Taking everything into account, there must, when we compare the small, short compressible pulse of one man with the large, firm and long pulse of another be great differences in the velocity and energy of the movement of blood through the capillaries in different individuals, and clearly there are great differences in the circulation of the same person at different times. . . . The fact that such differences are compatible with health and vigour is conclusive evidence that nutrition and functional efficiency, even of the nerve-centres, are not in such close relation with and intimate dependence upon the blood-supply as we are sometimes apt to suppose."

The endless diversity in the pulse is not an incident, it is fundamental; the ancients sought to reduce it to a science because they (rightly) believed there was a law underlying this diversity. This goes with the fact that the various organs of the body actually vary greatly from the standards adopted by the pathological anatomist. The amount of blood discharged from the heart at each beat is very different in various persons. The state of health is as it were something over and above the ordinary physiological mechanisms so fully expounded in modern textbooks. The attempt to reduce nutrition to mechanical laws is an attempt to bind to mechanics that which is beyond mechanics.

Hence the study of the Chinese system, and of their world-conception affords additional justification not only for contending that corporeal form, corporeal phenomena, and mental phenomena—features, contours, build, mannerisms, talents—all belong together and are mutually illuminative, but also for proceeding to the formulation of these associations and inter-relations.

If in so doing, a Medicine is built up in which disease takes a very minor place, and "soil" (a rather tiresome, though expressive word) a first place, which it is the object of the physician to elucidate and continuously realize, It will at least be a guide to something approaching universality of application, and cease to attempt multi-specific therapy.

§ 210. The idea that different sensations can be imparted to adjoining fingers by one and the same pulse may be discussed briefly here. It must be assumed that there are potential waves of different lengths passing along the artery at the same time. Long waves reach one finger, but not another. The long sweep of an artery can actually be seen in thin subjects. The waves usually thought of are the short ones induced by the force of the impacts of the heart wall on the blood. Long waves consist of changes of tension in a spiral direction, and careful concentrative observation will allow such an accession to be felt.

§ 211. The relation between pulse and special organs is not to be regarded as fanciful, when one obvious instance alone will justify it—the influence upon cardiac activity and force of beat which the state of the stomach exerts.

§ 212. The frequency of missed beats, and the number of misses compared with number of respirations, exemplifies another very widely neglected aspect of the study.

§ 213. The names given to pulses are of interest, but it is difficult to assign Chinese terms to particular Arabic or Latin names. It will suffice to present the following comparisons of pulse-types with natural objects, and human actions.

Natural objects : Blade of small onion, solid within; stone bullet shot out of a crossbow; drop of water; down; drum-head; grate in a passage; hole in a flute; filament of hair; scattered leaves; a pestle; pills; a silk thread; the handle of a staff or spear; untwisted string; worn-out cloth.

TABLE OF TERMINOLOGY

A.—GENERAL TERMS.

(Arranged in pairs of opposites.)

Group No.	Section in trans.	Term used.	Term in Latin Text.	Term in Bulaq Text.	Term in Chinese Text.‡
(1)	521	Long—Short	Longus—Curtus	Tawil ¹ —qaṣīr ²	ch'ang—tuan
	522	Broad—Slender Deep—Elevated	Latus—Strictus Profundus—Elevatus	'arid ³ —dayyiq ⁴ munkhaṭṭaq ⁵ —mushrif ⁶	ch'eng—fu
(2)	523	Large—Small Thick—Slender	Magnus—Parvus Grossus—Subtilis	'azim ⁷ —saghīr ⁸ ghaliz ⁹ —daqiq ¹⁰	ta—hsiao
		Strong—Weak	Fortis—Debilis Vehemens*—Imbecillus	qawi ¹¹ —da'if ¹²	li—jao
(3)	524	Swift—Slow (Rapid—Sluggish)	Validus*—Languidus Velox—Tardus	sari ¹³ —baṭi ¹⁴	hung
(4)	525	Hard—Soft (Compressible— Incompressible)	Durus—Mollis Lenis*	ṣalb ¹⁵ —layyin ¹⁶	k'uai—ch'iḥ
(5)	526	Full—Empty	Plenus—Vacuus	mumtali ¹⁷ —khāli ¹⁸	shih—juan (Kē)
(6)	527	Hot—Cold	Calidus—frigidus	ḥarr ¹⁹ —bārid ²⁰	man—kung (hsü)
(7)	528	Hurried—Infrequent Brisk—Sluggish	Frequens—Rarus	mutawāṭir ²¹ —mutafāwut ²²	chieh(?)—huan(?)
		"Dense"—"Rare"	Continenſ—Resolutus	mutadārik ²³ —mutakhalkhil ²⁴	mi (chin)—san
(8)	529	Equal—Unequal (Regular—Irrregular)	Spissus†—Lassus	mutakāθif ²⁵ —mutarākhi ²⁶ §	jun—k'ou
(9)	530	Orderly—Disorderly	Aequalis—Diversus	mustawi ²⁷ —ikhtilāf ²⁸ (mukhtāf)	ting-tai
(10)	533	Rhythmic— Arhythmic	Ordinatus—Inordinatus Pondus—arrythmus	Muntazim ²⁹ —mukhtalif ³⁰ Wazn—arda'l-wazn ³¹	

* Synonymous words occurring in older Latin editions.

§ These synonyms all appear together in the one (Bulaq) text.

† In the Latin the term "spissus" is often used as the opposite of "rarus." In the Arabic, the latter is mutafāwut, to which mutawāṭir is opposite. In the passages in which spissus is used, the Arabic is often mutawāṭir and not mutakāθif. There is actually a slight difference between frequens and spissus, for the former has the thought of an abrupt rise in the pulse-beat, according to group-number 2, whereas spissus conveys the idea of beats very close together. Rarus may be taken as the counterpart of either thought: if it means a leisurely rise, it is in accordance with group-number 3; if it means "spaced," this is also the idea in mutafāwut. The Arabic distinguishes the two ideas of rarus, by using mutarākhi for sluggishness.

The words rapid, hurried, brisk—slow, sluggish, leisurely, rare, and the words frequens, spissus, velox—rarus, tardus, languidus, are apt to be misleading, and it is difficult to avoid inconsistency, both in the Latin and the English, for in some cases one word conveys a better idea of a shade of meaning, and in others another, whichever Arabic term is employed.

B.—DISTINCTIVE TERMS.

(Arranged alphabetically.)

	Term used.	Section in trans.	Synonym.	Term in Latin Text.	Term in Bulaq Text.	Term in Chinese Text.‡
a	Bounding	540, 571	Undulatory	Undosus, fluctuosus	Al mawja ^{**}	Hung (?)
b	Chord-like	549		Chordosus	Mutawattir ^{**}	Hsien
c	Continuous	538	Unbroken	Continuus	Muttasil ^{**}	
d	Creeping	541, 572	Vermicular	Vermicularis	Al dudi ^{**}	
e	Dicrotic	546, 560		Bispulsans ; dicrotus	Dzuwa qar'aina ^{**}	
f	Failing	547, 568	Fading, falling	Cadens in medio	Al wāqi' fi'l-wasat ^{**}	Wei
g	Flickering	545	Recurrent	Reciprocus ; mesalius ; pulsus inclinatus (Rhazes) pulsus innuens (Haly Abbas)	Musalli ^{**§}	
h	Formicant	542, 572		Formicans	Al namli ^{**}	
i	Harsh	543, 565	Serrate, sawing	Serrinus, serratus	Minshāriy ^{**}	Se
j	Intermittent	538	Interrupted	Intersectus	Munqata ^{**}	
k	Jerking	539	Gazelle	Dorcadissans ; gazellans	Al ghazali ^{**}	Ts'u
l	Mouse-tail	544, 567	Decurate	Cauda soricina ; murus innuens	Zanabul' fār ^{**}	Fu
m	Recurrent	538	—	Reditivus	'ā'id ^{**}	
n	Spasmodic	548, 569	Tense	Spasmus	Mutashannuj ^{**}	Chin
o	Swooning	567, 600	Recurrent mouse-tail	Cauda reditiva Syncopizans	Ghashiyā ^{**}	Fu, jao, tai (?)
p	Thrilling	548, 570	Trembling	Tremulus	Murta'ish ^{**}	Tung (?)
q	Wiry	548	Twisted	Retortus	Multawi ^{**}	Hsi

* Lit. a fast-going she-camel, whose girth slips through the inequality of the motion of the fore and hind feet.

§ Lit. the third horse in a race.

‡ Some of the Chinese equivalents here given are free of ambiguity, whereas others are only approximately correct. This is because the basis of Chinese sphygmology is different, as indicated in §209. Dual terms also exist which may prove to be more exactly representative of the types given in part B of the Table. It is of interest that the "water-hammer pulse," is described in the Chinese work (*tan she*, or *yen tau*), but does not appear to be represented in the *Qanun*.

(1) 短 矮 قصیر	(2) 長 طولیل	(3) 矮 قصیر	(4) 短 矮 قصیر
(5) 短 矮 منخفض	(6) 高 高 منخفض	(7) 高 高 عظيم	(8) 短 矮 ضيق
(9) 短 矮 غليخا	(10) 高 高 غليخا	(11) 強 强 قوى	(12) 強 强 ضيق
(13) 短 矮 سرير	(14) 快 سرير	(15) 車 车 بيلن	(16) 車 车 بيلن
(17) 短 矮 مهني	(18) 短 矮 مهني	(19) 矩 矩 صلب	(20) 矩 矩 بارد
(21) 短 矮 متوازن	(22) 短 矮 متوازن	(23) 矩 矩 متوازن	(24) 矩 矩 متوازن
(25) 短 矮 متباين	(26) 短 矮 متباين	(27) 單 散 متراخرون	(28) 單 散 متراخرون
(29) 短 矮 منتظر	(30) 短 矮 منتظر	(31) 匀 匀 مستوا	(32) 匀 匀 مستوا
(33) 短 矮 متغير	(34) 短 矮 متغير	(35) 代 代 الدور	(36) 洪 浩 الموج
(37) 短 矮 الواقع في الوسط	(38) 微 微 الواقع في الوسط	(39) 伏 伏 الالدو	(40) 洪 浩 والتربيتين
(41) 短 矮 منقطع	(42) 短 矮 منقطع	(43) 促 促 ذنب الفار	(44) 代 代 عائد
(45) 短 矮 الشنج	(46) 短 矮 الشنج	(47) 代 代 مرتعب	(48) 細 细 الماتور

C.—THE ARABIC AND CHINESE TERMS IN THE TWO PRECEDING TABLES.

Actions seen in nature : a bird pecking ; a bubbling spring ; the branches of a willow tree in a gentle zephyr in spring ; drops of water dripping through a crack in the roof ; frisking fish ; feathers agitated by the wind ; a bird flying low ; liquid being constantly gulped down ; rolling of thunder ; scattered leaves ; swimming on the surface of water ; the pace of a toad embarrassed by weeds ; water simmering in a kettle over a fire ; waves running into one another.

Human actions : Throwing earth over an object ; going by stealth ; the strokes of a knife-point ; a knife scraping bamboo ; puffing and blowing in going upstairs ; turning back.

§ 214. *Ayurvedic Sphygmology*.—Sarangadhara gives eight or nine verses showing how to examine the pulse, and gives the characteristics belonging to derangements of Vayu, Pitta and Kapha singly or in combinations. But this interesting subject is necessarily not dealt with here.

519. Ten features in the pulse. We say that there are ten features in the pulse from which we are able to discern the states of the body. Some group them under only nine headings.

(1) Amount of diastole ; estimated in terms of length, breadth, and thickness.

(2) Quality of impact (lit. knocking at) imparted to the finger of the observer at each beat.

(3) Duration of time occupied in each movement.

(4) Consistence of the artery (resistance to the touch).

(5) Emptiness or fullness of the vessel between the beats (modern : compressibility).

(6) The feel—whether hot or cold.

The remaining features concern several beats :

(7) Duration of time occupied by the pauses.

(8) Equality or inequality of force in successive beats.

(9) Regularity or irregularity ; orderliness or disorderliness.

Presence of intermissions.

(10) Metre ; rhythm ; harmony ; measure ; accent.

§ 215. *Additional points* : frequency, or number of beats per minute ; number of beats to each respiratory movement (inspiration plus expiration) ; mode of rise, mode of fall, and kind of pause at C.G. and W. as one tests from skin to bone and back ; the number of beats which occur before there is an intermission (an intermission is almost certain to occur in everyone) ; the comparison of the patient's pulse with one's own, or with that of a person of definitely equable temperament ; the comparison of the pulse with that which should be present at a given season.

DETAILS

520. (1) Amount of Expansion.—The kind of pulse in terms of the three dimensions : length, breadth and thickness. There are nine variations in regard to one dimension alone, and these are called " simple," and there are nine compound varieties.

§ 216. Broadbent remarks (" Pulse,"¹¹⁵ p. 7 footnote) that the classification of pulses according to length, breadth and thickness is superfluous. " Deserting the path of observation, Galen did not see that a cylindrical tube would expand equally in all directions, and that there could not be any difference between its breadth and depth. . . . The permutations and combinations of large, moderate and small pulses, to the number of 27 varieties of pulse—an over-refinement on purely theoretical or transcendental grounds, which led to extreme confusion."

§ 217. A careful consideration of the text of the Canon, in conjunction with the Chinese writings, suggests that something more was in mind. One is dealing with waves, not with cylindrical tubes merely. There is a subtle distinction between breadth and thickness. Every tiny portion of an artery is fluctuating continuously both in health and disease in virtue of its vasomotor endowment; and it is this that is sought. Here, as in so many matters in regard to the living being, the simple mechanistic conception leads to error (and to scepticism about the existence of unthought-of detail). It is possible in the physiological laboratory to reduce the (experimental) animal into something very nearly a mechanism, or actually into a mechanism, and in that way secure results which triumphantly prove the contentions offered; but the living human being with the full possession of all his faculties constitutes a very different "proposition." Moreover, observations on the more subtle vibrations, as by biometric study, go to suggest that there may be reason in the ideas in question (cf. Baraduc¹¹⁰).

521. The *simple pulses* are : the long, the short and the mean ; the broad, the slender and the mean ; the deep, the elevated and the mean.

The long pulse is one which is longer than normal. This is the type appropriate to a person of equable temperament or else approximating to this. The difference between the natural and the equable has been already made plain.

The short pulse is contrary to the preceding.

The mean between these two extremes completes the first group of three. The remaining six can be understood on the same lines.

Short pulse : Impact sudden ; acme momentary ; subsidence of wave abrupt, dicrotic wave present ; artery large ; tension low.

Long pulse : Impact deliberate ; acme persisting ; subsidence of wave gradual ; artery contracted.

Normal pulse : impact sudden, acme moderately high ; subsidence of wave gentle ; tension moderate.

522. As regards the *compound pulses*, some have received distinctive names and some have not. A pulse which is increased both in length and breadth as well as in depth is called "large." When all these dimensions show diminution, it is a "small" pulse. The moderate pulse is the mean between these two.

A small pulse may seem to be a large one in a wasted subject ; hence the pulse may be palpable in arteries in which it is not usually felt. The aorta may be felt. A pulse may seem small because carelessly felt in a person with a thick wrist.

A pulse which is increased both in breadth and depth is called "thick" ; one which is diminished in these two dimensions is called "slender." The medium pulse is the mean between the two.

523. (2) Quality of impact. The varieties are three : strong—this resists the finger during expansion ; weak—the opposite character ; and the intermediate.

Strong or violent pulse.—Impact strong ; acme high ; artery incompressible. Occurs temporarily in emotional states, or after the bath. It is habitual in persons of passionate nature (Aeg.).

Weak or feeble pulse.—Impact faint; acme low; artery between beats is compressible.

524. (3) *Duration of cycle.* There are three variants : rapid or short or swift—where the movement is completed in a short space of time ; slow or sluggish or long—the contrary ; and the intermediate, or moderately quick pulse.

525. (4) *Consistence of artery.* There are three variants: soft or easily compressible ; hard, firm or incompressible ; and one of moderate compressibility.

526. (5) *Fullness or emptiness.* The full (high) pulse seems to be overfull of humour and gives the impression that it needs liberating. The empty (low) pulse is contrary in character. There is an intermediate between the two.

Empty pulse : the artery feels as if it contained bubbles of air, so that the fingers seem to fall on an empty place (Aegineta). (Chinese simile : "the hole in the flute.")

527. (6) *The feel of the pulse.* Hot, cold or intermediate.

528. (7) *Duration of pause.* Hurried ("dense"), where the period between the two successive beats is short ; sluggish ("rare"), where the period is prolonged. And there is a mean. This period of time is recognized from the contraction-period, but if contraction cannot be perceived it is estimated from the period between two expansions. In this case it is reckoned from the times of the two extremes.

529. (8) *Equality or inequality.* This is reckoned according as the successive pulses are similar or dissimilar, there being a difference of size (large or small), strength (strong or weak), swiftness (rapid or slow; prompt or sluggish), hardness or softness, until it happens that the second expansion of the first pulse is overtaken by the first of the next (due to excess of innate heat), or is weaker than the next (excess of weakness).

If desired, one could expand this discourse and consider the equality or inequality in regard to the three variants in the other features of the pulse already named. But it is sufficient to consider them only in regard to strength.

Regular ("equal") pulse in the strict sense is one which is regular in all these respects ; if it is regular only in one feature, it is so specified. Thus we speak of a pulse as regular ("equal") in strength or regular in speed. In the same way a pulse is irregular either in all respects or only in one.

Equal pulse : this is always regular.

Unequal pulse is not altogether irregular. Supposing it to have no equality, and yet to preserve a certain period, such, e.g., as to extent of diastole, if there are two great and one small, then again two great and one small, and so on, such a pulse

is unequal but regular. If it not only had no equality, but also no order in its inequality, such a pulse would be not only unequal, but also irregular.—So, too, with the other kinds.

"Not only may an inequality in the time of motion take place in regard to one pulsation in one part of an artery, but also in regard to the strength of the power; not so, however, in regard to the extent of dilation (for it is impossible that the same pulse in the same place should be great and small at the same time), nor in regard to the other kinds of pulses. But in different places different parts of an artery may exhibit a double inequality in one pulsation. For the motion may continue constant, and be swifter at one finger, and slower at another; or it may intermit, and one finger may perceive it, and another not. And also, in regard to the extent of the diastole, the same inequality becomes apparent in different places."

Irregular pulse.—Sometimes there is altogether an irregularity, observing no periods whatever. Sometimes there is regularity as to periods, but, having no continued order, they may in this respect be called irregular, but in so far as they observe a certain period regularly, they are regular as to their periods. E.g., two great, two small, three great, three small, and so on. (Aegineta, after Galen.)

530. (9) *Orderliness or disorderliness.* There are two forms: the pulse may be irregularly orderly or irregularly disorderly. The orderly pulse maintains orderly succession. This occurs in one of two modes. The orderliness is absolute, where there is every feature maintained; or cyclical, where there are two or more irregularities which keep on repeating in cycles, as if there were two cycles simultaneously, or superposed, so that the original order reappears.

In this way it becomes evident that the tenth feature belongs here, in a certain sense; so that those who restrict the features to nine instead of ten are justified.

531. For one must now see *the musical character of the pulse.* For in the art of music sounds are juxtaposed in orderly relations of loudness and softness which keep on repeating at regular intervals; rates of utterance vary—some sounds coming close to one another, and others being further apart; the attack may be abrupt or gentle, sharp or dull. The notes may be sounded clearly or be indefinite; they may be strong or weak; the volume may be full or "thin." The rhythm of the sequence of the sounds may be regular or irregular.

In feeling the pulse, all these features are also to be met with. The intervals between the beats, or the successions, may be harmonious or inharmonious. So, too, the irregularities may be orderly or disorderly. It is orderly when there is a proper relation of strength and weakness. It is disorderly if there is not.

All this belongs to the question of order and regularity.

532. Galen indeed discussed the metre of the pulse, or its rhythm along the lines of musical nomenclature. Thus we would have double time, three-four time, common time, four-five time, five-six time, and so on. For those who have a sensitive touch and a keen sense of rhythm, with a training in the musical art,

such minutiae of observation could be correlated in the mind. I am surprised to think how many of such relations could be perceived by the sense of touch, and yet I am confident that it can be done if one is habituated to the use of it, and can apportion metre and beats of time. On the other hand, since these variations all belong to inequality and disorderliness it is not necessary to define them particularly.

The analogy between pulse and musical time is found in the Chinese work as well as in Avicenna. The fact that they compare certain beats with those produced on particular musical (stringed) instruments shows that they had something in mind like that suggested above. The *Kin* pulse is so named after a musical instrument of that name; another pulse is compared with the vibration of the thirteen stringed instrument named *Tseng*.

533. (10.) *Metre.* Even if the preceding details cannot be perceived, at least the relation between period of expansion and period of pause can be appreciated, as well as the relation between the total duration of beat and the total duration of pause. Under this heading, then, we place : first total period of pulse : next total period ; period of expansion : period of pause ; period of expansion plus period of pause : period of contraction plus period of pause ; period of expansion : period of contraction. A relation of period of expansion : period of contraction ; or, period of first pause : period of second pause, is not important.

534. Metre (rhythm, "beat," accent) is good (eurhythm) or bad (arhythm) according to the musical analogy. There are three kinds of arhythm : (i) pararhythm, where the beat is altered only slightly, and temporarily. Ex. : where the adult has a metre which is only natural in youth ; where a child shows a rhythm proper to an adult. (ii) Heterorhythm. This is a change greater in degree. Ex. : where a youth has a metre proper to an old man. (iii) Etrhythm. Here the change is to something altogether different, as where the metre does not conform to the human type at all. A great change of metre denotes great change of bodily state.

§ 218 Relation between beats to musical time may be equally exemplified from Arabic poetry, for the richness of the poetic metres gives a simple and ample parallel. Cadences, pauses (corresponding to intermissions of beat) of various lengths produced by the words and phrases and intonations belonging to emotional expression being natural sequences with evident relations to physiological variations. A short passage of poetry may sometimes be sufficient basis for a correct impression of the whole, but it is better to hear the whole. So, in feeling the pulse, much may be learnt from the observation of the beats for a minute or two, and yet it is better to study a long series of beats in order to be sure there is no inter-

mission at all. This thought is applied in Chinese sphygmology. (See § 229).

§ 219. *Rhythmical successions of words—musical rhythm—effects on emotional state and on physiological processes.*—The effect of words uttered in rhythm resembles that of musical successions of sounds. The different forms of rhythm which are adopted in different kinds of poetry have each their own effect on the emotional state, and tend to produce in the brain all the concomitants of the emotional state which they themselves belong to. Therefore the reciter is able to produce specific effects on the minds of his hearers. For this reason, the idea of rhythm and cadence can be pursued both in Arabian poetry and in Arabian music; and it can be pursued with respect to both aspects of æsthetics in any country or language, though some languages are more potent in their influence, according as they are intrinsically more, or less, musical.

We may note that as the rhythm, whether of words or musical notes, evokes an influence on the pulse-rate in the course of their effect on the ear itself—both internal ear and the ear of the mind—so the emotional effect will be produced even though the hearers are not purposely or specially receptive. This emotional effect may be inevitable, or it may be deliberate. To quote from numerous passages in the “Nights,”—“touched with it a masterly touch, at once exciting to sadness and changing sorrow to gladness . . . went on to sing . . . to many and various modes, till our senses were bewitched, and the very room danced with excess of delight and surprise” (163); “meseemed the doors and the walls and all that was in the house answered and sang with him” (688); “played a measure which made all hearts yearn” (37) (Burton, ii. 291; iv. 322; i. 337).

When the effect is deliberately sought, it is stronger the more thoroughly worked out the principle is—which explains why some composers meet with more response than others, and why some compositions are considered more perfect or attractive than others. Yet a great composer may still be in ignorance of why that particular music should meet the need; he may be guided by the effect which the thought of the particular music has on his own organization; or he may even work according to stereotyped lines elaborated by theoretical developments and studies, without having even “intuitive” feelings of his own. (Cf. Frederick Corder, ¹⁵⁸, p. 7). Music, the composer, the listener—all three show the same possible aspects: the purely artistic, the emotional, the scientific or intellectual; and, more rarely, the inspirational and the celestial. The number of listeners whom he will attract depends on the type of music which the composer employs. In this way, for some the pleasure is in the stirring-up of desire to accompany the music with the bodily movements of various dances; for others the pleasure is through the feelings; for others it is through the intellect (e.g. the fugue); for others it is through some glimpse of the Abstract Truth which such music renders possible, even though they understand not what it is doing. But the last-named does not need

music in the ordinary sense of the word (i.e., instrumental); it is that of which it has been said: "The music of God is everywhere for those whose hearts are open to hear it."

We may also note that it is not only the pulse-rate and the manner of the pulse beat which is influenced by the musical rhythm; the effect pervades the body*, because all the vibrations which belong to the secretions and excretions, and to the nervous system throughout are affected, and tend to harmonize, each in their own way—the successive waves becoming set so that all reach the same phase at some same moment which recurs every so often. The movements belonging, for instance, to the emergence of secretory granules from a salivary or peptic cell, or an adrenal cell, alter in rhythm during the time the music lasts—and possibly for some time after. That these movements are essential in the vital phenomena is easily verified by studying such cells, e.g., in invertebrates, with the ultramicroscope, or even by studying saliva itself.

§ 220. Additional remarks on Rhythm.

Let *a* and *c* represent the heart-sounds, and *b*, *d* the pauses. The ratio *b/d* is remarkably constant, whatever the number of beats per minute. Exercise, excitement, fever, etc., increase the rate, yet do not alter this ratio.

The normal rhythm is *ab/c/d*; that is, "triple time."

Double-time is *ab/cd*; where the sound is "tick-tack," *b* is the same length as *d* (for instance, owing to shortening of *d*). Such is what occurs in palpitation or tachycardia.

If, however, *b* becomes long, it shows that the peripheral resistance is greater. If *a* is stronger, *b* is longer. If the time is still triple, it necessarily implies that the pulse-rate is slower. But if this rhythm now becomes double-time, it shows that the resistance is too great for the heart, and that the heart is dilating or dilated. This happens for instance in chronic renal disease, or acute renal dropsy associated with myocardial change.

Four-time.—1. *ab/c/d/d/*. The contraction is quick, the resistance is low. This occurs in fever or in excitement. This rhythm tends to return to triple by shortening of *c* to : *abc/d/d/*. The pulse is short.

Such a pulse may follow on a double-time pulse; for instance in chronic renal disease. The prognosis is then grave.

A similar effect is produced if the cardiac contraction is not completed either because the muscle is too weak or the resistance too high. To find such a pulse forewarns the physician of cardiac asthenia forty-eight hours beforehand.

2. *aa/b/c/d*. This is met with where the systemic and the pulmonary pressure are not equal. The former may be too high from renal disease; the latter may be too high from pulmonary or bronchial disease. Where the heart is hypertrophied, such a rhythm denotes failing heart.

The second "a" is not usually loud, but it may be as loud as the first "a." In such a case one could feel both ventricles beating separately over the apical region. *ab/c/c/d* may appear simply by holding the breath. It may also appear in mitral stenosis, in bronchitis with emphysema, in pericarditis, in pleural effusion and in cases of cerebral tumour.

Five-time: *a/b/c/c/d*; *a/b/c/c/d*; *a/b/c¹/c/d*; or *a/b/c/c¹/d*. These are all variants of "bruit de galop." The problem to solve in each patient is: which is the source of the second *c*? Is it the pulmonary valve? The causes are the same as of the preceding. *Pulsus bigeminus*: *db/c¹d//ab/cd//db/c¹d*, etc., in the case of the heart, but *ab/cd//ab/cd//ab/cd//etc.*, in the pulse at the same time. This type is found in mitral stenosis under treatment. Another form: *ab/cd//ab/cd//ab/cd//etc.*, in the case of the heart and *ab/cd/d/d//ab/cd/d/d/* in the case of the pulse. This type is found in more advanced cases, and in cases of epileptiform attacks. It simulates alternate action by the two ventricles. *Pulsus trigeminus*; *ab/cd//ab/cc/d//ab/d/d//*

* Bearing on this is a recent paper by Swale Vincent and J. H. Thompson: "the effects of music upon the human blood pressure." (Lancet, March 9, 1929, 534.)

Some heart-beats are too weak to reach the wrist; or, in some cases too little blood enters the heart. The pulse may therefore be irregular though the heart is regular; or the pulse may be more irregular than the heart.

2. THE REGULAR AND THE IRREGULAR PULSE

535. Some say that irregularity (dissimilarity) of the pulse applies to a succession of beats or to any individual beat. But when the irregularity is in the individual beat the various components are diverse,—whether in the various places where one applies one's fingers, or only at one particular point of application.

536. When the irregularity is in regard to several pulsations there may be a regular succession of events. This begins with one pulsation and there is a change to a greater or lesser, following on regularly step by step until a maximum or minimum is reached, after which there is a break, and the original cycle is resumed. Or, the beats continue at the same level for a time, and there is then an intermission and the original cycle is resumed.

The whole cycle may show only one irregularity or it may show two or more. In this case, it is as if there were two cycles, distinct from one another, and yet keeping to one order, so that the whole seems to be just one single cycle.

The irregularity may consist in the occurrence of a pause when one expects a beat, or in the occurrence of a beat in the middle of a pause.

537. When the irregularity refers to several components of one single pulsation, this may be in regard to relative position or to movement. And as there are six components there will be corresponding irregularities : (a) expansion swift or sluggish ; (b) premature or delayed expansion ; (c) strength or weakness ; (d) largeness or smallness. All of this may be orderly and regular or may vary by exaggeration or by deficiency—in two components or in three or in four.

This may all be worked out for oneself.

538. Irregularity of the pulse in one section* is shown as an intermitting or as a recurrent or as a continuous pulse.

The *intermitting* pulse† : one component is separated from the next only by a short interval and a pause is interposed in another, so that the two extremes of the pulsation vary in swiftness, sluggishness, and the like.

* Juz' : a section of the Quran.

† Intermittent pulse : a smaller beat occurs after one or more great pulsations : sometimes even the smaller beat is wanting. Intercurrent pulse: this is the

The *recurrent* pulse† : here a large pulse becomes small in one component and then becomes slowly large again. In this case there may be two kinds of pulse passing into one another, so that, for instance, one pulse, by its irregularity, comes to appear like two, or two pulses come to appear like one. Opinions about this differ.

"When the radial artery is completely closed by one or more fingers till the direct pulse is arrested, a feeble and retarded beat can be felt in the distal part of the vessel. This is because the blood-pressure is low, and the arteries are relaxed, and the force of the heart strong." ¹¹⁶ (p. 52.)

The *continuous* pulse is one in which the expansion is continual and unbroken. There is a steady increase from slowness to swiftness, and from swiftness to slowness ; from equality to inequality ; from largeness to smaller, and so on. There is no break in the change, for it is continuing the whole time. Sometimes there is more irregularity in regard to some of the components and sometimes there is less.

§ 221. Brief summary :—

Variations in *rate of expansion* : Sudden ; deliberate ; second expansion quick ; or slow ; first sudden and then tardy, or vice versa.

Rate of fall or contraction of the vessel : abrupt, or gradual and gentle.

Variations of *degree of expansion* : large, small, moderate ; forceful or feeble ; alike in every beat or unlike.

Variations of *duration of expansion* : first short, then long, or vice versa ; momentary ; persisting ; or mean.

Variations of *duration of pause* : first short, then long, or vice versa. Pause when there should be a beat ; beat when there should be a pause.

Variations of *size of successive beats* or between the beats : first diminished and then increased ; first increased, then diminished. The size of the artery between the beats informs of the constant pressure in the artery. To ascertain it, roll the artery transversely between the beats ; it should not be palpable between the beats unless the skin is soft and flexible and thin. Inability to feel the pulse between the beats means low tension ; if easy to feel, the tension is high.

Variations in *successive beats* : the fourth beat may be irregular in one or other respect, or the fifth or the sixth or the seventh. Every beat may be different (irregular disorderliness).

3. THE VARIETIES OF IRREGULAR PULSE WHICH HAVE RECEIVED DISTINCTIVE NAMES

539. *Gazelle Pulse* : [Syn. : goatleap pulse ; modern "jerking" ; "pulsus bisferiens"]. The expansion is interrupted and occupies a longer time than usual and remains at a certain height and is succeeded by a swift increase to the full height.

Just before the wave begins to subside a second heat is felt (Broadbent)—"a swifter spring than before" (Aegenita)—The two phases of the one beat are unequal.

opposite. When we are expecting an interval of rest, a supernumerary pulsation occurs. (Aeg.)

These two pulses denote impairment of the cardiac power, the degree being greater in the intermittent than in the recurrent.

Cause : febrile heat. If the commencement of the diastole is feeble, and there is increase in velocity towards the end and beginning of the systole, this shows that putrefaction is prevailing, nature hastening on the discharge of the fuliginous superfluities. But if, on the other hand, the commencement of the systole is feeble, and the speed is towards the diastole, this means that heat is prevailing.

In fever cases, such a pulse is accompanied by density, and sometimes by largeness, if the artery is not too rigid. (Aeg.)
(This pulse is characteristic of pericarditis.)

540. Undulatory [“bounding” (modern) ; “like rolling waves”]. The irregularity is in respect of largeness and smallness of artery, of degree of rise, and of breadth, and in the position of the beginning of the beat (whether too soon or too late), and also in softness. It is not very small ; it has a certain breadth, recalling the movement of waves, which follow upon one another in orderly fashion and yet vary in the extent of upward rise and downward fall, and in swiftness and slowness.

Aegineta says : “The whole artery is not expanded at once, but first under the first finger, then under the second and so on ; like a series of waves. The wave may be carried on straight or obliquely ; it may be high but short, low but long, broad or narrow, unequal in speed and force.”

Rhazes says : “It is one which in breadth takes up much space of the finger ; with this it is soft and full, but there is not much rise or fall ; one rise seems to join to another until it resembles waves, one following the other.”

541. Vermicular [modern “creeping”]. This resembles the preceding, but is small, soft, feeble, and very hurried. The closeness of the beats causes it to be mistaken for a swift or rapid pulse.

The feel is that of a worm wriggling. It is a weak form of the undulatory pulse. The size of the artery is not of the same inequality at all times. There are waves of pulsation, the whole artery not being distended at the same time (Broadbent). See 572.

542. Formicant Pulse. This is the smallest, most feeble and hurried of all the pulses. [It is not a quick pulse, though apparently swift. (Aeg.)] It differs from the vermicular pulse in the great ease with which upward rise, anteposition of beat or postposition is perceived. Irregularity of breadth is not discernible. [It is a weak form of vermicular pulse ; and allied in character to the “hectic” pulse.]

543. Serrate Pulse. This [modern “harsh”] pulse resembles the undulatory in the inequality of the various components of the beat—upward rise, breadth, anteposition and postposition. It differs, however, in appearing harder, and in its components being of unequal hardness. This pulse is quick, hurried, hard. The irregularity is in respect of size of expansion, of hardness and of softness (see 565).

544. Mousetail. There is progressive inequality of the components—from decrease to increase, from increase to de-

crease. This may apply to several beats or only to one beat or only to a part of a beat. The inequality is in respect of volume, or of slowness (changing to swiftness), or of weakness (changing to strength).

The artery, says Aegineta, feels swollen to the index finger, and very slender to the last finger. He speaks of a "failing or swooning myurus, where the smallness of the last beat is maintained; and of a recurrent myurus, where the pulse resumes its original amplitude."

545. *Recurrent* [modern "flickering" pulse]. This passes from minuteness to a certain volume, and then fails progressively until it reaches its former minuteness. It is like two myuri placed together end to end.

"Your first finger feels it small, your middle finger feels it large and swelled, and your little finger feels it small; the expansion is only slight."—(Aegineta.)

Cause: weakness of arterial wall, and wasting of the tissues round the artery. Significance: extreme debility; wasting from unresolved inflammation or any other cause.

546. *Dicrotic.* Doctors are divided in opinion about this pulse. Some regard it as a single beat in which antecession and post-position are unequal; others regard it as a double pulse, one beat following the next too quickly to give time for the second to produce full expansion. However, the presence of two beats does not make two distinct pulses. A pulse which makes a partial expansion and then resumes it, would not be dual. It would only be dual if the artery were to fill first, and then pause and then contract and again refill; but otherwise it would virtually be a jerking pulse.

§ 222. As regards the dicrotic pulse, some have regarded it as a wave reflected from the periphery, but it is really the elastic recoil of the aorta that accounts for it. It is most distinct if the peripheral resistance is low. The semilunar valves form the fulcrum of the rebound (Broadbent, p. 26).

The first beat of the pulse is large, the artery rising strongly to the finger; then it stops and recedes; the second beat is small. The artery is as if repelled at the first beat and then trembles a little, and then quickly resumes its beat but less strongly, and at too short an interval.

547. *Fading or falling pulse.* Here there is a pause in the middle of the pulsation, as there is in the gazelle pulse. But in the gazelle pulse the second beat begins before the first is finished; in the falling pulse the first beat is completed before the second begins.

548. *The spasmodic, thrilling and twisted pulse.* The latter is compared with a twisted thread; there is here an irregularity between the precession and the later parts of the pulsation, both in position and in breadth.

The spasmodic (or "tense") pulse suggests that the artery is being stretched and dragged and pulled by its extremities like a cord (Aeg.).

The "thrilling" (modern term), or tremulous pulse is hard, quick and frequent. It suggests the quivering of arrows thrown with great force (Aeg.).

549. *The chord-like pulse* feels like a twisted cord (or sinew), and is similar to the thrilling pulse. But in the chord-like pulse the expansion is less conspicuous ; the departure from regularity of position of rise is less evident ; but tension is evident ; the twisting is sometimes only in regard to one portion of the pulsation. The two kinds of pulse are really equally common, and equally liable to occur in "dry" diseases.

All the above are simple pulses.

550. The varieties of compound pulse (that is, where there is more than one form of inequality or irregularity at once) are almost innumerable. In any case they have received no special names.

ADDITIONAL NOTES

§ 223. 1. The pulse is *visible* under the following circumstances : when the radial artery follows an abnormal course, immediately under the skin ; when the patient is spare, and the skin is thin ; when the tension is very high, and the blood-vessels are enlarged and tortuous ; and (entirely pathologically) in aortic regurgitation—where the artery is empty and collapsed between the beats, and the blood rushes in with extreme suddenness and violence, especially if the hand is raised. Such a pulse may be *audible* as well, and at the same time there is conspicuous throbbing of the carotids and temples and facial artery. The tension is here very low indeed.

Visibility is not mentioned in the Qanun ; and whether the "empty" pulse is comparable at all with the "Corrigan" or not, is not clear. It seems hardly likely that so striking a pulse should not have been observed, even though they could not know its explanation.

§ 224. 2. *Hectic pulse*. This occurs in marasmus and phthisis. The components do not vary greatly. The pulse suggests "being entangled, and never getting free," because the state of disease is actually diffused throughout the body. This pulse therefore agrees with the Chinese type named "like a toad embarrassed by weeds." This may be simply a form of the "thrilling" pulse.

§ 225. 3. *Pulse-rate*. (Broadbent,¹¹⁵, etc.)

Increased pulse-rate.—Lowered resistance quickens the pulse rate. *Diurnal variations* : the pulse-rate is greater in the evening, and slower in the early morning. The fact of the latter explains the following : morning headache ; tendency to depression of spirits ; to awake tired ; the tendency to asthmatic attacks and epileptic fits (the blood-pressure is now minimal). *Posture* : the erect posture adds eight beats to the minute. *Emotions* : the rate is increased by fear (the force is feeble), and anger (force violent) ; the explanation is that the tension is increased by the emotions. *Exercise* : at first the rate is increased as well as the force and the pulse becomes "vehement." The explanation is threefold—(a) nervous factors ; (b) muscular action drives more blood to the heart and fills up the right side ; the heart has to beat quickly and strongly to get it through the lungs ; (c) accumulation of blood in the lungs produces breathlessness and panting. *Food* : the rate is increased after food, and the vessels are relaxed. *Drugs, etc.* : stimulants increase the rate and cause greater relaxation of the vessels ; alcohol and ether belong to this category. They lower the peripheral resistance by acting on the central nervous system, and also stimulate the heart directly ; nitrites increase pulse rate, and at the same time cause great relaxation of the artery. Pungent essential oils and ammonia increase the rate and through the peripheral nerves relax the vessels. Belladonna and atropin also increase the rate. *External warmth* : slight increase of rate and slight relaxation of the vessels. *Respiratory movements*—cause irregularities.

§ 226. *Increased pulse-rate in relation to morbid states* :—

These diseases in which the rate is increased, show the same rate, even in repose, but exertion makes the rate increase inordinately, out of all proportion. Emotional disturbance has the same effect.

In pyrexia : the rate rises according to the degree of fever, but chiefly according to the effects on the system and according to the patient's reaction to the disease. The peripheral resistance falls. The force may be increased (sthenic fever : pulse frequent, sudden, vehement, large, short, dicrotous) or diminished (pulse weaker, less sudden, less large, dicrotous). Towards the end of the illness, the weaker the patient, the greater the rate ; even a few beats more per minute are serious. In septic fevers (septicæmia : modern term) a quick rate forewarns of shock, and a fatal issue (in puerperal cases). A "racing" pulse is a danger sign.

Among special fevers : scarlet fever is characterized by a very quick pulse-rate (120-200).

§ 227. Specially quick pulse-rates.—In young people : overstrain from athletics ; the "irritable heart" (the blood-pressure is high). In older people : sudden single acts of excessive exertion (sudden dilatation of the heart). Special cases : paroxysmal tachycardia : due to flatulence, emotions, gout ; gastric trouble. The pulse is frequent, short, variable in fulness and strength, not vehement, occasionally irregular. The heart-sounds are confused and short, and cannot be analysed. May arise suddenly from a fright or sudden noise, or violent emotion.

(In this condition the motion of the blood is not accelerated. It is a vibratory alternation of pressure with little onward movement. The left ventricle is not dilated. It may be that the ventricle is not expanding properly. Cf. auricular fibrillation ; auricular flutter. This form of pulse must be among those described by the Chinese, but certain identity has not been reached).

The quick pulse of "Graves' disease" might be included here.

Middle-aged and elderly women : here the occurrence of throbbing aorta may be referred to, though it is not a true "quick pulse" ; it arises from lack of tone in the aortic wall.

§ 228. Decreased pulse-rate. Increased resistance slows down the pulse. Habitually low pulse-rate (bradycardia) forewarns of the risk of cramp when swimming. In this category belong—the slower rate of jaundice ; of fatty degeneration of the heart (not often met with here) ; the special pulses : pulsus bigeminus and pulsus trigeminus : heart-block.

§ 229. 4. Intermissions. Irregularity.

On the one hand there is a variation of force between successive beats ; on the other hand there is a drop of a beat, or an interposition of a beat.

Intermissions may be habitual or constant, the person being unconscious of it except during exercise or excitement. It is accentuated when the body is fatigued or the disposition is nervous. The patient is conscious of it during pyrexia.

Occasional intermissions are produced in shock ; in hypochondriasis after the use of tobacco ; in fatty degeneration of the heart. In these cases the heart itself is beating, though hurriedly and imperfectly.

Irregularity is habitual in mitral regurgitation, where it is produced by the variations of pressure dependent on breathing. Inspiration forces blood into the left ventricle, expiration sucks it out of the left auricle. A similar occurrence is found when the heart is dilated, and under nervous conditions.

Irregularity is occasional as a result of flatulence of the colon, or stomach, which disturbs the action of the diaphragm ; as a result of tobacco.

Irregularity is usually more serious than intermission.

Rules in regard to intermission found in Chinese textbooks :—Omission of one beat after forty shows a lack in one of the five "noble" organs : "death will follow in four years, in spring." If there are no intermissions within fifty beats, the health is perfect. But if there is an intermission then, it has a similar significance to the preceding and shows "death will follow five years later." (See § 218.)

Other rules cannot be presented without also discussing the theory of the relation between pulse-type and physiological value of the several organs. Thus an intermission of one in 12, or 19, or 26 (and so on), beats differs in significance according as the pulse-type is "heart," "lung," "liver," "kidney," and so on.—After all, such a classification is justified, and it should be easily understood that intermissions under such circumstances might have distinct significances.

§ 230. 5. Relation of pulse-rate to respiration-rate. In the Chinese works this form of observation replaces our own habit of estimating the number of beats per minute, and also the number of respirations per minute. In health there should be four beats to one respiration ; five beats in the same period is allowable as consistent with health. But over five is pathological, and eight beats is a bad prognostic sign. A reduction to three or two is pathological and a reduction to two is a bad sign. When death is imminent there may be only one beat to two respirations. Full details are stated to be given in "the book of eighty-one difficulties."

4. THE PULSE DESIGNATED AS "NATURAL."

551. Each of the above-named varieties (of pulse) necessitates a distinction into "increased" and "diminished." And that which is "natural" among them is the "equable" pulse, except in the case of the strong sort. For (here) the "natural" pulse is excessive as to strength. But in other cases, the increase is in natural proportion to the increase in force, so that, for example, as it becomes greater, it is "natural" for it also to be forcible.

As for the sorts (of pulse) in which there is no possibility of increase and diminution, in such cases the "natural" pulse is the one which is even (equable), regular (orderly), and of good rhythm (weight).*

PARAPHRASE.

Amongst all the varieties of pulse which have now been described, there are two classes. (i) Those which show degrees of qualities : namely, increase above, and diminution below, a "mean." (See 521-528). (ii) Those which do not. Thus, a dicrotic pulse cannot be more, or less, or intermediately dicrotic ; an irregular pulse cannot show a "mean" irregularity.

The "natural" pulse in the first group is one which shows a mean quality in respect of every feature except that of strength (523) for the natural pulse is strong (forcible).

The "natural" pulse in the second group is one which is uniform, regular (orderly), and eurhythmic.

This rendering brings out the real meaning of the word "natural"—*tabi'yya*. It is not synonymous with "normal," but refers strictly to "the nature"—i.e., the state of the vegetative soul, when in health.

In short, a pulse which is "*mu'tadil*" is not therefore necessarily "normal" ; still less is it necessarily "natural."

A pulse may be (a) natural and normal, (b) not natural, yet not abnormal, (c) not natural, and also abnormal.

5. THE FACTORS CONCERNED IN THE PRODUCTION OF THE PULSE

552. The factors concerned in the production of the pulse are (i) essential and integral in the constitution of the pulse. These are called "contentive" factors ; (ii) non-essential : comprising two groups, (a) inseparable—that is, if they were altered, the type of the pulse would be altered ; (b) separable ;

* It may be noted that the close resemblance between the Latin version and the corresponding passage in Galen makes it seem as if Avicenna had simply introduced a translation into Arabic from Galen. But in the Greek the natural pulse is simply a mean between extremes, and is so called presumably because usual in health; whereas with Avicenna this is not so ; he speaks of a distinct kind of pulse, and is truly consistent to his usage of the term "nature"—the outcome of the great thesis "the body is a unity"—throughout his physiology, pathology, and sphygmology.

that is, a change may be produced in them without affecting the type of the pulse.

There are three contentive factors :

1. The (vital) power of the heart, producing the expansion.
2. The elasticity of the artery.
3. The resistance, or urge.

The last-named is, in Avicenna, taken to be a question of the degree of innate heat, and its relation to heat-loss ; not a question of peripheral resistance as a factor in producing blood-pressure.

The influence of the three factors varies with the non-essential factors which may be associated with them at the given time.

553. List of non-essential factors :

1. Natural (i.e. pertaining to the nature)—Age (manhood, youth) ; temperature of air (hot seasons ; hot localities) ; temperament (hot temperament).
2. Non-natural : exposure to very hot atmosphere ; use of hot baths ; vigorous exercise or gymnastics ; influence of food and wine ; influence of calefacient medicines.
3. Preternatural : emotional states ; secretiveness (hiding anger, concealing the fact of having taken a heating medicine in spite of the physician's enquiry) ; cunning persons who easily conceal matters relative ; habits of the patient ; "hot" intemperaments ; decompositions occurring in the fluids (in the stomach or tissues).

6. THE EFFECT OF THE CONTENTIVE FACTORS UPON THE PULSE

554. Large Pulse. If the arterial wall is at the same time yielding, and the vital power is strong, and the resistance excessive, the pulse will be large. The resistance is the chief factor in the production of a large pulse, for should the power fail, the pulse will naturally weaken ; and if the arterial wall were also hard, and the resistance lowered, the pulse would be even smaller.

An unyielding artery will also make the pulse small. But the difference between a small pulse due to inelastic artery and one due to weakness is that in the former the pulse is hard and not weak or short or low as in the latter.

Low resistance also makes a small pulse, but it is not weak. Weakness is the chief cause of all three forms of small pulse. Granted the power is constant, lack of hardness of the artery

has more effect than lack of resistance, for there is nothing to prevent the artery from expanding.

The temperament has not much influence unless the resistance be lowered.

If the resistance be great and the power strong, and the artery inelastic, the pulse becomes swift. The swiftness makes up for lack of size of pulse. But if the power be not adequate, and the pulse is therefore unable to become large, and therefore not swift, it necessarily becomes brisk, and this briskness makes up for the lack of volume and swiftness. Several beats of this kind would become equivalent to the effect of one adequately large beat, or of two swift beats.

555. It is like a man wishing to carry a very heavy weight ; if he is able to do so, he will carry it in one journey, though with difficulty ; or he may divide it into two, thus making each journey more easily ; or, if he cannot manage even that, he will divide the load into many portions, and carry each one as leisurely or as quickly as he wishes. He need not rest himself between the journeys, though he may choose to linger. But if he were very weak, he would stop and rest awhile between the loads, and as he becomes tired with the journeys would perform them more slowly.

556. If the vital power be strong, and the artery responsive, and the resistance moderate, the effect of the power would be to make the pulse more swift and of greater volume. But if the resistance were greater, there would be briskness as well as large volume and swiftness.

557. The factors which go to make a large pulse also go to make a long pulse, if rise and fall are hindered in any way. For instance, a hard artery cannot widen, and tough flesh and skin, especially if the tissues be wasted, prevents the artery from rising to the finger.

Variants of Large Pulse, and their causes (Aeg.) :—

Large and also soft : hot baths.

Large and also hard : hot intemperament, especially if there is dryness of the system.

Large and mean between hard and soft : massage ; exercise.

Large and vehement : wine ; anger.

Large and unequal : concealing anger ; deceiving the doctor in regard to definite questions, as to possibility of heating factors.

Large and also a hasty contraction : putrefactive changes in humours.

Large and also quick and dense : increase of heat in the heart from various causes.

Large only in appearance : emaciated state of the tissues at the wrist.

558. The Causes of Pulses bearing Distinctive Names
Broad Pulse. Emaciation may make a pulse appear broad.

Emptiness of vessel also makes a pulse appear broad, because the two walls come into apposition. A very soft artery gives the same effect.

Causes of broad pulse: redundancy of humidity from natural causes or from external causes, such as a soft artery (Aeg.).

559. Hurried pulse. The causes of a hurried pulse are: weakness; great resistance; heat.

560. Sluggish pulse. The causes of a sluggish pulse are: power relatively greater than resistance; great coldness due to resistance; great loss of vital power; approach of death.

561. Feeble pulse. The causes of feeble pulse are: loss of natural power by lack of food; emaciation; excessive discharges; insomnia; too much exercise; solicitude; morbid change in the humours; movement of the humours, especially into a very sensitive member, or into a member which is in relation with the heart; any source of intemperament; pain (producing syncope); sadness, grief and other mental states or cares; any factor whereby the vitality is markedly depressed. (Note also: age, season, locality; temperament.)

Cause of change from feeble pulse to strong pulse: (a) when the vitality becomes strong again, after being enfeebled from lack of food, wakefulness, immoderate evacuations, grief, cares, syncope, or any cause of intemperament. (b) When humours are matured; when noxious substances are excreted, when there is passion, when an intemperament is rectified; also after use of certain foods, of wines; after exercise. (Aeg.)

562. Hard pulse. The causes of hard ("tense") pulse are: dryness of the arteries and great stretching of the arteries; intense cold. The pulse may become very hard at the crisis of an illness owing to the intensity of the conflict between the person and his disease, for all the members are implicated. (This pulse is usually also small, quick, and sometimes frequent.)

Hard pulse must be distinguished from a strong pulse. The latter is usually also large, swells up and strikes the finger forcibly. A hard pulse cannot be large, for the artery is unyielding; a hard pulse is also small, quick, and sometimes dense. (Aeg.)

Causes of hard pulse: hardness of artery; this is due to immoderate cold, dryness, or tension of inflammation, or spasm. (Aeg.)

Cause of strong pulse: the force of natural vitality, associated with hardness of the artery (Aeg.).

563. Soft pulse. The causes of soft pulse are: "natural" agents with an emollient action, such as aliments (more abundant diet; liquid food). Morbid states which tend to emollient effect: e.g. dropsy, sleepy-sickness, coma, disorders arising from or in a serous humour. Mental states, such as hilarity. Agents which are neither "natural" nor morbid: e.g. bathing (to excess).

Other causes (Aeg.) : humid state of artery due to (a) preternatural causes : coma, lethargy, dropsy, affections related to the serous humour. (b) Non-preternatural causes : more liquid food, much sleep, a more abundant diet, immoderate baths ; hilarity.

564. Irregular pulse. If the vital power be maintained, the cause will be heaviness [in substance] of the food, or of some humour. If the vital power be weak, it shows a contest between causative agent [of the illness] and the tissues. Other causes : (a) overfullness of the vessels. This would be remedied by venesection. (b) Viscidity of the blood. In this case the breath becomes choked in the vessels. This form of pulse is especially liable to occur when the breath is also imprisoned in the cardiac region—e.g. by an over-full stomach, which produces this effect very rapidly ; or by anxiety ; or by pain.

If the stomach contain depraved humour, the irregularity increases until cardiac tremor comes on, and a thrilling pulse (tachycardia !) results.

If the irregularity is orderly, it betokens lesser constitutional injuries ; if disorderly, it shows that there are more serious constitutional defects to deal with.

565. Harsh pulse. This pulse shows a varying consistence of the artery which is produced by changes in the composition of the (circulating) humours, whereby decomposition products, "crudities," or products of maturation diffuse through the vessel wall and affect its mode of expansion. Inflammatory deposits in fibro-muscular organs (e.g. diaphragm, pleura : Rhazes) also render the pulse harsh.

If the harshness be slight, it shows that the inflammation is mild ; if more marked, it means that the case is severe and dangerous, with a danger of empyema or tuberculous change (Aeg.). See 543.

566. Dicrotic pulse. Vital power is strong ; the artery is hard ; the resistance is considerable. The artery does not at once yield to the force. It suggests a person wishing to sever something at one blow, but failing to do so until helped out, for instance by a sudden dire need to achieve it. (Significance : approaching crisis).

567. Mousetail. Such a pulse is produced when the vital power is weak, as a person who ceases manual labour, or is resuming it after a rest. If it is constant, it shows that the loss of power is greater. However, as long as the pulsation is mousetail in type (and the similar forms) it shows that there is some vitality left. But it is apt to pass on to the terminal mousetail, then to continuous mousetail, and finally end in the grave "recurrent mousetail" ("swooning" pulse).

Recurrent mousetail means : (a) failing vital powers, with a greater or less degree of prostration ; (b) weak power, which is still struggling on in face of the odds (Aeg.).

568. *Fading or falling pulse.* The vital power is enfeebled or waning, and inadequate. It is also produced by a sudden change in the " nature " and in the mind.

569. *The spasmodic or tense pulse.* This is produced when there are non-natural movements in the vital power or when the artery is itself unhealthy.

Significance : inflammatory changes at the nerve-origins (meningitis, acute epilepsy). It can be felt after death has taken place, while the body is still warm (Aeg.).

570. *Thrilling pulse.* Here the vital power is strong ; the artery is hard ; the resistance is great. Without these conditions it cannot arise.

It denotes inflammation in fibro-muscular tissues which are well supplied with nerves. A strong expansion is required, with adequate vital power. The hardness of the artery prevents adequate expansion.

571. *Undulatory pulse.* This usually means chiefly a lack of vital power, expansion being hardly achieved, if at all, and then only little by little. If the artery is soft, this would itself suffice to produce the effect of waves, even though the power were not much reduced. A soft and moist artery does not respond to an impact, and does not allow every part to be expanded ; whereas a dry and hard artery does—dryness being responsive to impact and tremor. An artery which is both hard and dry will transmit expansion at once ; the soft and moist artery will only do so at the beginning of the pulsation, expansion and alteration of form of the vessel subsiding suddenly so that the other fingers do not perceive any movement.

The beats are indistinct ; the dicrotic waves blend. At the same time the first cardiac sound disappears.

Significance : crisis approaching by sweat (Rhazes, Haly Abbas), or by bowels ; humid affections like sudden dropsy, lethargy, peripneumonia (Aeg.) ; typhoid fever ; and malaria ; extreme cardiac asthenia (Broadbent).

572. *Vermicular and formicant pulse* are produced by great weakness, and so the pulse is sluggish, the intervals between the beats are short, and the components are unequal. This is because the artery is unable to expand at once, but only little by little. (See 541.)

Significance : sudden loss of vital power due to excessive haemorrhage, diarrhoea, cholera, etc. Failing life (Galen).

In the formicant pulse the powers of life are at a still lower ebb than in the case of the vermicular pulse (Aeg.).

Chinese simile : to a silk thread (§ 214).

573. *Pulse of faulty rhythm.* If this occurs during a time of repose, it is due to an increased resistance. If it occurs during exercise, there is an increased weakness (of vital power) or deficient degree of resistance. The pulse of exercise produced by swiftness of expansion is something different to this.

The duration of the pause is lessened in old age. Equality between expansion and pause denotes a normal temperament of the body. It occurs in early life. If the pause is greater in duration than the expansion, the temperament is hot (e.g., adult). If the pause is less than the expansion, it shows that the temperament is cold (e.g., the aged).

Change of rhythm changes the rate and frequency of the pulse. (Aegineta.)

The causes of full, empty, hot and cold, deep (high) and low pulses are evident.

Full pulse is produced by plethora from food or wine; or any mere abundance of fluid-intake; empty pulse is produced by lack of nourishment, or undue discharges. The pulse feels warm (*a*) if there is great heat in the heart—the rest of the body being cold; (*b*) if the artery is in a sort of spasmotic state; (*c*) in catalepsy, and in persons who are becoming comatose. (Aegineta, quoting Archigenes.)

§ 231. *The influence of low resistance upon the pulse.* There is a sudden impact; the acme is brief; the subsidence rapid and the dicrotic wave is present. As it subsides quickly under the fingers it is called hurried. If at the same time the heart beat is forcible, the pulse is "full and bounding"—large, sudden impact, vehement; artery easily flattened. If the heart is beating feebly, the artery is narrow; the pulse is small, easily compressed; the impact is not sharp, and therefore the fingers must be applied very lightly in order to be able to feel the pulse. An extreme degree of this kind of pulse constitutes the "running" pulse. Sphygmographic variants are: hyperdicrotic, and "anacrotic" (which is a form cf "gazelle").

Clinical causes of low resistance: (*a*) congenital. (*b*) transient: after a hot bath, in fatigue, in exhaustion; after a meal, especially a hot meal; lack of nitrogenous aliments; alcohol. (*c*) Emotional: anxiety, depression. (*d*) Morbid states: obesity, fever; flatulence; constipation; sleeplessness; headache; nervous conditions; chlorosis; fatty degeneration of heart.

Other facts.—A low resistance occurring in a person with a high tension is a bad sign; a person suffering from habitual constipation, and having a low blood-pressure, should not be given purgation, much less mercurial purgation.

§ 232. *The influence of high resistance (high tension) on the pulse.* This depends on the force of the heart. The pulse is full between the beats; the artery feels like a tendon or the *vas deferens*; or is even visible under the skin. The artery is large or small. It may be thrown into a curve; there may be nodosities along the artery. The wave is gradual; lasts too long; subsides too slowly; seems weak, but is more plain when one presses harder. There is no dicrotism.

A variant, called "virtual tension," is where the artery is large and full between the beats; moderate pressure does not make the pulse seem stronger; it is compressible; the impact is sudden, the acme is short, and the subsidence is sudden. Such a pulse shows that the heart is unable to cope with the resistance.

Clinical causes: excitement; exertion; external cold (which drives the blood from the surface); migraine; early meningitis; early acute nephritis (the water cannot get out through the kidney); plethora; presence of certain waste products in the blood which cause the small vessels to contract.

§ 233. TYPES OF PULSE AND VARIOUS CONDITIONS (MODERN).

Sleeplessness.—Two types of pulse. (*a*) Impact gradual; acme long; may subside suddenly; artery large or small; full between beats, and usually not easily compressible. It may be weak and yielding. The condition in this respect depends on the state of the heart. (*b*) Impact sudden; acme short; artery full between the beats; low tension. A sleepless person with such a pulse will be able to sleep readily in the daytime; he may be able to sleep sitting up though unable to do so lying down. The pulse is unstable.

Emotional excitement.—Impact strong; rate increased.

Fevers:—

Catarrhal. The pulse varies according to the degree of obstruction to the pulmonary circulation (bronchitis, e.g.).

Pneumonia. Pulse frequent, large, vehement, dicrotic, not short, not compressible. The pulse can be felt with the third finger after pressing hard with the index finger, because the pulsation goes round the radial arch. When the lungs become engorged more and more, the artery is small, the beat is weak, but the heart itself is very forcible, working hard to get the blood round the lungs. Violent heart action and weak pulse! (Venesection indicated !)

Diphtheria. At first the pulse is weak and small especially if the heart is affected. The heart rhythm is *ab/c/d/d* or *ab/c/d/d/d/d*.

Erysipelas. Large, soft, very dicrotic; tends to become undulating.

Septicaemia. Artery small; pulse rate 140-200; beat sharp; compressible; "tick-tack" heart. The pulse varies much in different cases.

Pyaemia. Pulse frequent, and sharp, apart from the degree of pyrexia. The pulse is that of shock.

Acute rheumatism. The character of the pulse varies with the degree of inflammation in the joints, etc.

Inflammation of serous membranes. First, small, long, frequent, hard, full between beats; not easily compressible. Later—shock: very small, weak, compressible; "wiry" or "thready" pulse due to the filling up of the abdominal vessels. These characters are more noticeable with peritonitis than with pleurisy.

Cerebral conditions:—

Tumour. Rate slow; artery full between beats. Later on the impact is very weak, and the acme short; the artery small; the artery empty between beats (denoting feeble heart and relaxed arteries).

Coma. The pulse varies with the state of the heart.

Convulsions. Impact strong; rate increased; tension lowered; the blood-pressure is sometimes increased, sometimes low.

Epilepsy. Low tension is a bad sign; if a high pressure is present and continues, the case is tractable. The tension is always high in senile cases.

Meningitis. Early cases show the "hesitating" pulse; the force is not quite constant; the time is not quite regular. The impact is deliberate, the acme long; the artery is contracted. The rate is slow. Later on, the rate becomes quick; there is no tension (owing to compression of the brain).

7. THE EFFECT OF AGE AND SEX ON THE PULSE

574. Male Sex. The pulse is larger and much stronger, because the vital power and the resistance are both marked. The pulse is slower and more sluggish than in women because the degree of resistance is so great.

If the vital power is maintained, and the pulse is brisk, it must needs be swift. Swiftness comes before briskness. Hence the pulse of males is slow, and is necessarily also sluggish.

575. Late childhood (7-14). The pulse is softer because the temperament is moist at this period. It is weaker and more brisk because the innate heat is abundant. The vital power is not great, for growth has not yet become complete. Considering the small size of the body at this age, the pulse is large. This is because the artery is very soft and the resistance strong, and the vital power is not small—considering the small bulk of the body (at this age). Compared with the pulse of adult life the pulse at this age is not large but quick and more brisk (due to the resistance). This is because at this period of life there is a greater

aggregation of "fumosities,"* consequent on eating so often and so liberally—wherefore more frequent evacuation becomes called for and "ventilation" of the innate heat is desirable.

576. *Early adult life (21-35).* The pulse is large, not very swift—indeed inclined to be slower and less brisk ; the tendency is to become sluggish. At the beginning of this period of life the volume of the pulse is greater ; and at the middle of the period it is stronger. The innate heat, as we have stated, is about the same in adolescents and in young adults ; there is therefore about the same resistance in each. The vital power is greater at this period, and the greater volume of pulse therefore compensates for the lack of swiftness and frequency. Vital power is the main reason for the pulse being large at this time of life. The resistance is next in importance, and the state of the arterial wall is the contributory factor.

577. *Elderly persons.* The pulse is here smaller because of the weakness of the vital power ; the swiftness is lessened both because of this and because of the lessened resistance. Such a pulse is therefore more sluggish.

578. *Old age.* In advanced years of life, the pulse becomes small, sluggish, slow. If it be also soft this is because of extraneous, and not natural, humours.

§ 234. From the Chinese.—In the male sex, the pulse at *W* should be more brisk than at *C* ; in the female sex it should be more brisk at *C* than at *W*. From deviations of normal character of the pulse in women one may become aware of menstrual errors ; of the presence or not of pregnancy, and the size of the pregnancy. The *C* pulse is noted for these purposes, and the right arm is used.—The exact details required for diagnosis require the application of the special nomenclature of pulses which is richer in variety and subtlety than that of the list of § 213.

Age. Bloom of life : pulse firm and full ; persons of nurture may show a slow thin, even soft, pulse, uniform at *C*, *W*, and *G* ; if not uniform, such a pulse is a sign of shortness of life.

Old age : the pulse is slow and weak. Some old men have "the pulse of long life"—strong, firm, fairly swift, not skipping. (The presence of a skipping or hesitating character would show that the strength of the person is outward, and that life would not reach an extreme length.)

8. THE PULSE IN THE VARIOUS TEMPERAMENTS

579. *Hot temperament.* The resistance is great. If the vital power and artery correspond, the pulse will be large. But if one of them do not correspond, the pulse will vary in the manner already described.

If the heat is not due to an intemperament, but is natural, the vital power will be very strong, and the heat increases. But one must not suppose that the increase of innate heat, to however

* *Dukhāni*; lit. smoke or mist.

great an extent, will lessen the vital power. For, on the contrary, the power of the breath becomes greater, and the mental qualities show more boldness.

If the heat arises from intemperament, the greater the degree of heat, the greater the weakening of vital power.

Cold temperament. The pulse is reduced in breadth, and so becomes small, slow and infrequent (sluggish). If the artery is soft, the pulse increases in width, and also becomes slow and infrequent. But if the artery be hard, the breadth will lessen. The weakness produced by a cold intemperament is greater than that produced by a hot intemperament because the heat of the latter, for instance, is then more correspondent (i.e. in slowness or activity) than is the innate heat.

Moist temperament. The pulse is here soft and wide.

Dry temperament. The pulse becomes hard and wiry. If the vital power be strong and the resistance great, the pulse will become dicrotic, or spasmodic, or thrilling.

These remarks will suffice in regard to the relation between the several temperaments and the simple types of pulse. The effect on composite pulses can be worked out from the principles already explained.

580. It may happen that a person may have a dual temperament, one side being cold and the other hot. The pulse will then be different on the two sides, according to the heat and cold respectively. In the one case it will be like the pulse in hot temperament; in the other like that in cold temperament. From this we learn that the expansion and contraction of the pulse is not merely an effect of the ebb and flow of cardiac action, but there is also an expansion and contraction of the arterial wall itself.

9. THE EFFECT OF THE SEASONS ON THE PULSE

581. Spring. The pulse is equable in all respects except in strength, which is above the mean.

Summer. The pulse is quick and brisk, because of the resistance. It is small and weak because the vital power is dispersed by the dispersal of the breath (which in its turn is due to dominance of undue external atmospheric heat).

Winter. The pulse is more sluggish, slow, weak, and therefore small. This is because the vital power is lessened. In some people the heat is retained interiorly and aggregated together, thus making the vital power stronger. This is especially so if the temperament is hot, for then the external cold is

overruled and prevented from passing inwardly, as would otherwise occur.

Autumn. The pulse is unequal and tends to a certain weakness. The inequality is due to the frequent changes of temperament which occur during this season owing to the fluctuations of temperature. The temperament is now hot, now cold accordingly. The weakness is due to two causes : (a) a contrary temperament always renders the injurious effect of a noxious greater than a similar but equable temperament would, even though that be a morbid one ; (b) autumn is a season antagonistic to life because at this period the innate heat is lessened and dryness dominates.

At periods between the seasons, the pulse corresponds to the adjoining season.

The pulse at each season also has its own appropriate *rhythm*.

§ 235. The following details from the Chinese work are tabulated for convenient survey :—

Month and Season.		Dominant element (Chinese name).	Type of Pulse.
First	Spring	mu	Tremulous : long.
Second	Spring	mu	" " "
Third	Fifth	t'u	Moderately slow : strong : hard.
Fourth	Summer	huo	Superficial : strong : " scattered."
Fifth	Summer	huo	" " "
Sixth	Fifth	t'u	Mod. " slow : strong : hard.
Seventh	Autumn	chin	Superficial ; short ; brisk.
Eighth	Autumn	chin	" " "
Ninth	Fifth	t'u	Mod. " slow : strong : " hard.
Tenth	Winter	shiu	Deep : soft : slippery.
Eleventh	Winter	shiu	" " "
Twelfth	Fifth	t'u	Mod. slow : strong : hard.

If the pulse proper to one season is met with during a different season, this is usually to be regarded as morbid, and may betoken a long or a short or a fatal illness according to the particular inversion. The autumn type in spring ; the winter type in summer ; the summer type in autumn, are grave signs.

It is to be noted that the third, sixth, ninth, and twelfth months form a fifth season, and are not counted under the corresponding season. These months therefore correspond to those named in Avicenna " periods between the seasons." The pulse changes are definitely specified in the above table, though only spoken of generally in the Canon.

IO. THE EFFECTS OF LOCALITY ON THE PULSE

582. Some regions are temperate and vernal ; some are hot and aestival ; some are cold and winterly ; some are dry and autumnal. The character of the pulse will follow the statements made in regard to seasonal influences upon the pulse.

II. THE EFFECTS OF FOOD AND DRINK

583. Aliments (lit. substances entering the body from without) alter the condition of the pulse according to their quality and quantity. (*a*) By *quality*, one refers to the calefacient or infrigidant nature of the substance in question, which has a corresponding effect upon the pulse. (*b*) As regards *quantity*—if the amount of aliment is moderate, the pulse shows an increase of volume, swiftness and frequency, owing to the increase of vital power and innate heat resulting; this change in the pulse lasts a considerable time.

If the amount be unduly great, the pulse will become irregular and disorderly, because the burden of the food overrules the vital power; any overloading renders the pulse irregular. Archigenes thought that the swiftness of the pulse exceeded the frequency, as long as the excess of food existed. When the excess came to be less, the pulse would show an orderly irregularity.

If the amount be unduly small, the pulse becomes irregular both in volume and swiftness. In this case the duration of the change would be short because so small an amount of food would be rapidly digested.

If the vital power is weakened, whether the amount of food taken be small or large, the pulse corresponds in smallness and slowness until the digestion of the meal is completed.

If the natural (vegetative, digestive, maturative) faculty be strong, the pulse will be equable.

584. *Effect of wine on the pulse.* Wine has a notable effect on the pulse, in that if taken plentifully, being attenuated in nature, it gives rise to an irregular pulse, but not to so great an extent as other similarly nutrient aliments. This is because its substance is too rare, attenuated, and light. Being in actuality cold, wine, like other cold things, lessens the pulse-rate and makes it slow and infrequent in proportion to the rapidity with which it enters the body. Once it has become warmed by the body the initial effect passes off.

The heating effect of wine. The heating effect which wine produces is not very different from that of the innate heat, for wine is rapidly distributed through the body, especially if taken warm, and it undergoes rapid dissipation or resolution. If taken cold, it exerts an injurious effect on the pulse of a kind not shared by other cold articles of food, for the latter become warm only gradually and do not reach the blood as quickly as does

wine, and they are therefore warm when they do so. But wine is absorbed so quickly that it has to be warmed by the blood itself, and this constitutes a noxa for such persons as are sensitive to cold. This injurious effect is not as great in degree if the wine is taken warm, because the natural faculty then counteracts it by breaking it up, distributing it through the body and finally dispersing it.

The cooling effect of wine. Wine has a cooling effect when it causes the natural power to fail, so that the pulse loses its strength before the wine has become broken up, distributed and dispersed.

Such is the manner in which the use of wine in quantity produces a heating or a cooling effect.

585. When we study the question of how the use of wine can make the pulse strong, other factors must be considered. Its own intrinsic character invigorates healthy persons ; it enhances the vital power by securing a rapid accession to the " substance " of the breath.

Although the heating and cooling effects above explained are injurious to most persons, there are some whose temperament is suited by it. Cold things, for instance, are tonic for persons of hot intemperament. For, as Galen truly said, the juice of pomegranate is strengthening for persons of hot intemperament ; honey-wine is tonic for those of cold temperament.

Wine may therefore be considered to be hot in nature, in that it is tonic for persons of hot temperament ; cold in nature in that it is tonic for those of cold temperament. Still, this question is aside from our purpose. We are concerned with the fact that it speedily accedes to the breath, as an intrinsic property ; and that from that point of view it is always invigorating.

The pulse becomes stronger if either the invigorating effect is exerted or the warming effect. It becomes weaker if neither occurs. By warming the body the resistance [i.e. the blood-pressure] is increased ; by cooling the body the resistance is diminished. But the usual action is that the pulse becomes stronger. Moreover, resistance [blood-pressure] is never increased without rendering the pulse more swift.

586. Water. Water has a similar invigorating effect to wine, because it is the means by which the aliment is enabled to permeate all through the body. But as it induces cold rather than warmth, it does not increase the resistance as much as does wine.

12. THE EFFECT OF SLEEP AND THE ACT OF WAKING ON THE PULSE

587. The characters of the pulse *during sleep* vary according to the stage of sleep and the state of digestion.

At the beginning of sleep, the pulse is small and weak, because the innate heat is then in process of retracting and withdrawing inwardly,* instead of expanding and travelling to the surface.

588. Difference between the "heat" in the first stage of sleep and that produced by exercise.—During the time of sleep, the innate heat is withdrawn inwards by the vegetative faculty in order to procure the digestion of the aliment and the maturation of effete substances. The heat is therefore, as it were, mastered and forced into service. The pulse is therefore more slow and sluggish in spite of the fact that the contraction and imprisonment of the heat in this region means a local increase of heat. For, in amount, this local heat is not so much as exists during the waking state, with its associated movements and exercise.

Thus, exercise is apt to create undue heat and "inflammation" up to an intemperamental degree, whereas there is only a moderate aggregation of heat when the innate heat is imprisoned, and so "inflammation" is less feasible. You know that this is so, because of the fact that exercise makes breathing laboured (forced), and hurried, incomparably more than when the innate heat is constricted and imprisoned by some other agent similar to sleep. For instance, to be submerged in tepid water brings about such an imprisonment of innate heat, and produces rapid respiration, yet not nearly to the extent produced by toil and exercise. Careful consideration shows that nothing increases the heat as much as these do. But it is not the mere exercise which accounts for this, as if resting would bring about a cessation of heat production. It is rather that the heat produced by exercise simply moves on the breath to the exterior parts, as long as generation of the breath takes place.

589. During the stage of sleep following the completion of digestion, the pulse becomes stronger. This is because vital power is added to by the digested aliment. The heat which had passed to the inward parts now returns towards the surface in order to regulate the nutrients passing thither, and also returns towards its source. This fact, and the fact that the temperament

* i.e., into the abdominal viscera, in whose veins the blood has now collected.

is made hotter by the products of nutrition explains why the pulse becomes of increased volume, and the arterial wall is softer because of the addition of the appropriate nutrients. There is no increase in swiftness and briskness along with the increase of volume, because mere increase of volume does not alter blood-pressure (lit. increase the resistance) either directly or indirectly ; that is, by restoring the factors which directly raise the blood-pressure (lit. increase the resistance).

* * *

The thought underlying this passage may be expressed as follows :—The person is supposed to have gone to sleep shortly after completing his meal. The body-heat is now concentrated round the digestive organs in order to render digestion possible. The surface of the body becomes cold. Later, when the first digestion is accomplished, the products are distributed to the various parts of the body. The heat now leaves the interior parts (i.e. the splanchnic system), and may be pictured as passing to the surface again, whence it had come (*mabda'*), so as to be ready to receive these digestive-products. Once more does it preside (lit. regulate, *tadbir*), or brood over them so as to render possible the further (third and fourth) digestion which they are about to undergo in this new situation.

The pulse is strengthened by two factors : (a) the access of body-heat which has now left the abdomen; (b) the food-products. The latter affect the pulse in two ways : (i) indirectly, by making the temperament more hot ; (ii) directly, by making the arterial wall soft.

The person, it will be borne in mind, is supposed to be still sleeping. If he continues to sleep, the pulse will change in the manner next to be described ; if he awakes, the conditions also change, and the pulse alters as described below.

* * *

590. If sleep continues after the completion of digestion, the pulse again becomes weak owing to the aggregation of innate heat and the choking of the vital power by the undue preponderance of those effete substances which now await evacuation by channels only possible during the waking state—namely exercise, and the insensible perspiration.

591. If the body were fasting when sleep began, and there is nothing awaiting digestion, the temperament would tend towards coldness, and consequently the pulse would not only remain small, slow and sluggish but would become more so.

592. The *act of waking* has certain effects on the pulse.

When a sleeping person awakes, the pulse steadily gains volume and swiftness until it reaches the natural state for that person. But if the wakening is sudden, the change in the pulse will be sudden ; it will become rapidly weak, because the act of waking overrules the vital power. The previous large volume will reappear later, and the pulse will become quick, brisk and irregular (up to "thrilling"). The quasi-violent movement introduces great heat. The sudden stirring up of the vital power to meet the sudden change accounts for the irregularity and trembling of the pulse. However, the pulse does not remain long in this condition ; it rapidly becomes regular again. Seemingly potent though the agent is, its duration is so short that all trace of its effect is soon lost.

13. THE PULSE DURING (RIGOROUS) ATHLETIC EXERCISE

Note : the word "Exercise" includes (a) athletic sports of all kinds : running, endurance tests, sprinting, gymnastics of all kinds, military exercises, laborious manual or physical work ; (b) work in the fields ; (c) necessary exercise and walking exercise taken for health's sake and recreation ; (d) mental.

593. At the outset, as long as the exertion is moderate, the pulse is large and strong. This is because the innate heat increases, and is strong. The pulse is also swift and brisk. This is because the resistance becomes greatly increased by the exertion.

(The pulse is frequent, strong, and the artery is moderately contracted :¹¹⁵⁾

594. As exertion continues and increases, even if it be intense for only a short time, the pulse weakens, and, with the dispersal of the innate heat, becomes small. The pulse remains swift and brisk for two reasons : (1) the degree of resistance (i.e. blood-pressure) is further increased ; (2) the vital power progressively fails until it is insufficient. After this, the swiftness steadily and progressively lessens ; and the briskness increases correspondingly to the lessening of vital power.

(Violent, but not excessive exercise, renders the pulse frequent, strong, sudden, vehement, large, short, dicrotous :¹¹⁵⁾

Still further prolongation of the exertion weakens the pulse until it becomes formicant and very brisk.

(Exhaustion produces a frequent, sudden, short, not vehement, very dicrotous pulse. It is large unless the heart is very weak. Fatigue makes the pulse slightly slow ; the force is diminished, the arteries are relaxed.¹¹⁵⁾

595. Finally, if the exercise has been carried on to an extremely excessive extent, it leads to a state akin to death, acting

like all resolvents—that is, it renders the pulse vermicular, very brisk, slow, weak and small.

14. THE EFFECT OF BATHING ON THE PULSE

596. (1) *Hot bath.* If one bathes in hot water, the first effect is to make the pulse strong and raise the pressure. When the bath has brought about a dispersal of the vital power, the pulse becomes weak. Galen says it is small, slow in beat and sluggish. But while agreeing that it is weak and small ; we say that the hot water acts first by increasing the interior heat of the body, like any extraneous heat, i.e. only temporarily. After a while the water resumes its cooling effect*—its natural quality. This cooling effect may persist. As long as its action as extraneous heat holds the field, the pulse becomes swift and brisk. But when its own natural character is resumed, the pulse will be slow and sluggish. If the incidental quality (of being hot) lead to so much loss of strength that syncope is imminent, the pulse becomes slow and sluggish.

(2) *Cold baths.* If the cold reaches to the interior parts, the pulse becomes weak, small, sluggish, slow. If it does not do so, but has the effect of aggregating the innate heat in the interior, the volume of the pulse will increase as the power increases, and the swiftness and briskness decrease.

(3) *Bathing in natural thermal waters.* If these have desiccant properties, the pulse becomes harder and its volume diminishes. If they impart warmth, the swiftness increases. If they dispel the vital power the pulse will come to be as described above.

15. THE PULSE IN PREGNANCY

597. The resistance is specially great in pregnancy, because the foetus shares in the mother's respiration. Both mother and embryo have their own resistance (blood-pressure), and there is as it were a double respiration. Nevertheless there is no doubt about the fact that the vital power is neither increased nor lessened, except to a degree consistent with a slight lassitude proceeding from the mere weight of the foetus. Hence the increase of resistance overrules the moderate amount of vital power, and the pulse is made of greater volume and becomes swift and brisk.

§ 236. The Chinese say : a pulse at *C* which is constantly superficial (or "swimming") or deep in an otherwise healthy woman, with amenorrhoea, betokens pregnancy ; so also a high strong *C* pulse ; a "slippery" pulse at *C* is a certain

* On the nervous system.

sign. An overflowing and high or deep and full pulse at the left *C* goes with a male pregnancy; a superficial and high pulse at the right *C* betokens a female pregnancy.

A number of other rules are given, the changes in the character of the pulse during the successive months of pregnancy being specified. Thus, first month : *W* pulse small, *C* pulse brisk. Third month : pressure with the finger makes the pulse seem to disperse. Sixth month : pressure does not alter the typical character. Seventh-eighth month : full, hard, strong pulse betokens a good labour. A deep and slender pulse forewarns of difficult labour.

Death of the foetus makes the pulse long and tremulous.

If the *C* pulse is continually small, weak, and sharp, and the nature is cold, with a tendency to shiverings, pregnancy will never be possible.

16. THE PULSE IN PAIN

598. Pain changes the character of the pulse according to (1) its intensity ; (2) its duration ; (3) its situation—whether the member affected is a vital one or not.

At first, pain stirs up the vital power, making it resist and counteract the pain ; at the same time the cause of the pain increases the heat of the body. The pulse is therefore of large volume, swift and very brisk, the effort entailed in immobilizing the body [the reflex effect of the pain] accounting for the volume and swiftness. When the pain becomes less unbearable in one or other of the ways we have already explained, the pulse steadily declines in fullness until it has lost its size and swiftness ; but these features are replaced by very marked briskness and smallness of beat, and hence the pulse becomes formicant and vermicular.

If pain becomes more and more severe, it makes the pulse sluggish and finally extinct.

17. THE PULSE IN (INFLAMMATORY) SWELLINGS

599. The formation of certain swellings is associated with fever, either because of their size, or because they affect some vital organ. The pulse varies with the changes induced in the body as a whole by the fever, as we shall explain in its proper place.

Afebrile swellings alter the pulse of the member itself, from their very nature. The pulse in the rest of the body may be altered secondarily—not because they are swellings, but because they produce pain (and restrict movement. Aeg.).

In sthenic fever, the pulse is frequent, sudden, vehement, large, short, dicrotous. In asthenic fever it is frequent, sudden, not vehement, large (unless the heart is weak), short, and very dicrotous. In peritonitis, the arteries are extremely contracted. (Broadbent.)

600. When an inflammatory mass causes a change of the pulse, it does so either according to (1) kind of swelling, (2) its

phase, (3) its bulk, (4) the organ in which it occurs, (5) associated effects.

1. *Relation to variety of mass.* (a) If "hot," the pulse becomes harsh, and coarsely, and then finely thrilling; swift, brisk. (b) If, however, there is an antagonistic humectant agent at work, the pulse ceases to be harsh and becomes undulatory. It is also always tremulous—coarse or fine tremor—and swift and brisk. Not only are there agents which will alter a hard pulse, but there are also agents which make a harsh pulse more decided. (c) If the mass be soft, the pulse is undulatory. (d) If very cold, the pulse becomes slow and sluggish. (e) If hard, the harsh pulse becomes still more harsh.

When abscess formation comes on, the pulse ceases to be harsh and becomes undulatory. This is because suppuration goes with moisture and softness. The pulse also becomes irregular owing to the weight of the mass, and the rate of briskness lessens owing to the fact that heat-formation ceases with maturation of the pus.

2. *Relation between phase of inflammatory process and character of pulse.* The larger the "hot" inflammatory mass becomes, the more harsh does the pulse become. The hardness and tension in the mass increases steadily, and as the pain increases, tremor appears in the pulse. At the acme, all the features of the pulse become more marked, except those depending on force; the force of the pulse lessens and the briskness and swiftness increase. If the acme is prolonged, the swiftness lessens and the pulse becomes formicant. After the swelling subsides, whether by natural processes or by surgical interference, the pulse becomes strong in proportion as the tension in the swelling lessens; and the pulse ceases to be thrilling because the pain ceases with the fall of tension in the tissues.

3. *Relation between bulk of inflammatory mass and the pulse.* A large mass denotes marked inflammation; the pulse becomes larger in all respects, and each beat is prolonged. When the mass is only small, the pulse is smaller and more sluggish.

4. *Effect of the position in the body.* When the inflammatory process is situate in an organ or tissue rich in sensory nerves, the pulse becomes hard, and approaches the "harsh" type. If the organ is rich in blood-vessels, there is an increase in size of the pulse, and in force; and it is very irregular. If arteries predominate—as in the spleen and lung—the volume is not maintained unless the force is maintained as well.

When it is situate in moist soft members (like the brain and lung) the pulse becomes undulating.

5. *Effect of secondary results of inflammation.* An inflammatory mass in the lung has a choking effect, and hence the pulse becomes thrilling ; in the liver, atrophy is produced and the pulse becomes like that found in wasting diseases ; in the kidney, strangury is produced, and there is suppression of urine, which alters the pulse accordingly. In members which are rich in sensory nerves (stomach, diaphragm), the pulse becomes spasmodic and swooning.

18. EFFECT OF VARIOUS EMOTIONAL STATES* ON THE PULSE

601. *Anger.* Anger stirs up the vital power and causes the breath (*ruh*) to expand all at once. Hence the pulse is large, rises high, is swift and brisk. It is not necessarily irregular because the passion does not change—unless there is fear present as well, in which case anger would prevail at one time, and fear at another. Irregularity may also occur if shame is associated, for the intellect warns the person to be silent and not yield to the same evil as did the person who has excited one to anger.

Excitement apart from anger.—The pulse is frequent, strong, and the artery is moderately contracted.—Note also the modern observation that “excitement always increases the blood-concentration, sometimes by as much as 10 per cent.” (Barbour and Hamilton, *Journ. Am. Med. Assoc.*, 1927, p. 91).

Delight. Here the movement is gradual and outwards. The pulse does not become as speedy and brisk as in the case of anger, but its volume is adequate for the resistance, and therefore the pulse is slow and infrequent.

Joy. The pulse is similar to the preceding, because usually large in volume, and soft ; it becomes slow and infrequent.

Grief. Here the heat is extinguished, or choked, nearly to obliteration, and the vital power is weakened. Hence the pulse is small, weak, sluggish and slow.

Fear. If of sudden origin, the pulse becomes quick, irregular, disorderly. If the state is prolonged, or more or less habitual, having begun insidiously, the pulse varies with the varying shades of anxiety.

Love.—“Now the lover’s pulse is variable and irregular, especially when he sees the object of his affections, or hears her name, or gets tidings of her. In this way one can discover, in the case of the one who conceals his love and the name of his beloved, who is the object of his passion. . . .”—(Dhakhira-i-Khwarazm-shahi, Book vi. Guftar i, Juz’ 2, ch. 3 ; E. G. Browne’s translation,⁷ p. 89.)

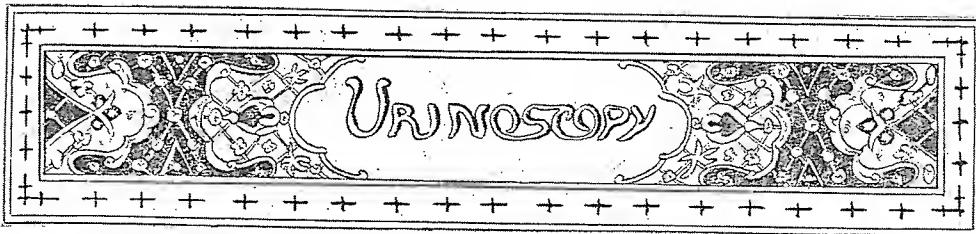
* *Nafsāniat.* See § 160 iii, iv, and 174 sqq.

19. BRIEF SUMMARY OF THE CHANGES PRODUCED BY AGENTS
ANTAGONISTIC TO THE NATURE OF THE PULSE

602. When the pulse is changed by such agents, it is either (1) because of an intemperament ; and you know the effect of each of these upon the pulse ; or (2) by confining the vital power, whereby the pulse becomes irregular. If the restriction be unduly great, the pulse becomes also disorderly and arhythmic. The degree of confinement varies with the amount of morbid material, whether there be an inflammatory mass or not. Or, (3) by dispersal of the vital power, whereby the pulse becomes weak. Here belong such agents as : severe pain, affections of the mind which produce a profound loss of vital power, severe or protracted diarrhoea.

§ 237. Pulse in convalescence from acute disease : the rate is normal or slightly slow ; the force of the heart is diminished and the arteries are relaxed. The force of the heart and the arterial tone increase as convalescence advances. (Broadbent, p. 51.)

The "renal pulse" : the frequency is normal or slightly diminished. The force of the heart beat is increased. The arterioles are contracted (*ib.*).



THE URINE

I. GENERAL REMARKS

PRECAUTIONS NECESSARY IN COLLECTING THE URINE, BEFORE FORMING AN OPINION AS TO ITS CHARACTER

603. 1. It must be collected in the early morning* ; it must not have been kept over from the night before.†
2. The person must not have taken either food or drink before passing it.
3. The previous food must have been free from colouring agents like crocus and cassia fistula (these render the urine lemon yellow or ruddy), and from potherbs (which make the urine a greenish tint), and from salted fish (which renders the urine dark), and from intoxicating wines (which tend to render the colour of the urine similar to themselves).
4. The patient should not have been given an agent which expels some humour (a cholagogue or phlegmagogue) by the urine.
5. Physiological state. The patient should not have undertaken severe exercise or toil, or be in a praeternal mental state ; for in each case the colour of the urine may alter. E.g., fasting, wakefulness,† toil, anger, dread—for all these cause the urine to become more lemon-yellow or redder in tint. Coitus also alters the urine, rendering it oily. Vomiting and defecation alter both colour and texture of the urine. The same happens if the urine is kept standing a while. This is why some advise urine not to be left standing more than six hours before examination, for otherwise the significance is altered ; the colour changes ; the sediment goes partly into solution ; and the density increases. Personally I think that such changes begin within an hour.
6. The whole of the urine should be collected into one

* Because digestion, whose efficacy the urinoscopy determines, will then have had time to be completed in a normal person.

† The patient must have slept through the night.

single vessel lest anything should be spilt out of it ; one should allow it to settle before scrutinizing it.

7. The urinal must be clean. For instance, alkanna will impart its colour to the urine ; this is a dye used by some people for tinting their skin and finger-nails.

8. The vessel used for the specimen must be clean, and the previous sample must have been rinsed out of it.

9. The material of which the vessel is made should be clear white glass or crystal.

10. The urine must not be exposed to the sun or wind or freezing cold, until the sediment has separated out and the various characters have properly developed. The settling is not immediate even if the digestive processes are normal.

11. The sample must be inspected in a light place where the rays do not fall directly upon it, as otherwise the brilliant light would interfere with the colours and give rise to erroneous deductions.

12. The nearer one holds the sample to the eye, the denser does it appear. The further away it is, the clearer does it seem. In this way one can distinguish urine from other fluids brought to the doctor in a falsified state.

604. There is little advantage to be derived from the study of the urine in childhood, and still less in infancy, because their nourishment consists solely of milk, and the very little colouring matter there is in the urine is lost to view ; their "nature" is also very feeble in view of the fact that they pass so much time in sleep, which abolishes the evidences of digestion.

605. The first and foremost object of observing the urine is to form an opinion about the state of the liver, the urinary passages and the blood-vessels. The various disorders of these organs are revealed by it. But the most precise information to be obtained is that concerning the functional capacity of the liver.

INSPECTION OF URINE. (TAFSIRA.)

The name "tafsira" is given to "inspection" because it "explains" (tufassir) and makes manifest to the physician ; it is an indication or guide (dalil) to the patient's condition.*

606. The following are the points to observe in a sample of urine :

1. quantity (665)
2. odour (645)

* Dict. of the Technical Terms used in the Sciences of the Mussulmans ¹¹⁸, and Browne ⁷, p. 142.

- 3. colour (609)
- 4. foam (649)
- 5. texture (627)
- 6. clearness (632)
- 7. sediment (652)

Some persons add other two : the feel and the taste, but we reject them as objectionable.

By *colour* we understand the various shades of colour perceived by the sense of sight—whiteness, darkness, intermediate shades.

By *texture* we refer to the coarseness or fineness.

By *clearness* or *turbidity* we refer to the ease or otherwise with which light traverses it (translucence).

607. There is a difference between texture and translucence, for a urine may be coarse and yet as clear as egg-white or liquid fish-glue ; and a rarefied urine may be turbid (e.g. turbid water is more rarefied than white of egg).

608. Turbidity depends on the presence of certain variously coloured particles—opaque or dark, or tinted with other colours which are imperceptible to the sense of sight and yet are impervious. Sediment differs from turbidity in that the particles are readily visible to the eye, whereas particles cannot really be distinguished in the case of turbidity. Sediment appears immediately after the passage of the urine ; turbidity does not clear up on standing. Turbidity differs from coloration in that the latter pervades the whole substance of the urine, whereas turbidity is less intimately admixed.

2. THE SIGNIFICANCE OF THE COLOUR OF THE URINE

609. THE DEGREES OF YELLOWNESS. Among the shades of yellow colour are : (1) straw-yellow ; (2) lemon-yellow ;* (3) orange-yellow ; (4) flame-yellow, or saffron-yellow ; that is, a very deep yellow ; (5) clear reddish-yellow. All except the first two denote a hot intemperament, in degrees varying with the amount of exercise, pain, fasting, and abstinence from water. The fourth variety denotes predominance of the biliary humour.

[Variants of (1). If the urine is plentiful also, it shows that a crude humour is being excreted by the urine. If there is also a sediment which is white, smooth,

* Lemon-yellow (*utruj*).—Orange-yellow (*naranja*).—Reddish-yellow (*shuqrat*).—The latter is the yellowish colour of a chestnut horse.—Another yellow, with a reddish shade, is called jujube colour (*unnabi*) ; this is not in the text, though enumerated with dyers' colours (cf. Night 933).

equable and plentiful, it shows that the digestion is good. If thicker, and a sediment is present, it shows that the digestion is not altogether bad. If gritty, scaly, furfuraceous, with black, livid, green or fetid sediment, this shows entire lack of digestive function (Aegineta).]

610. II. THE DEGREES OF REDNESS. (1) rose-red or roseate ; (2) very dark red ; (3) purple red, which has a brilliance about it like a certain rose ; (4) smoky red or dull red. All these denote dominance of the sanguineous humour, for dullness of colour points that way. A flame-yellow shows the presence of more "heat" than dull red because it shows there is biliary humour in it, and this is hotter than sanguineous humour.

The urine tends to saffron-yellow and flame-yellow in acute maladies described as "burning"; but if the urine is at all inclined to be clear, it shows a certain degree of "digestion," namely that this process has actually begun, but its products have not yet appeared in the substance of the urine.

611. Deepening of colour from lemon-yellowness towards a flame-yellow shade shows that the innate heat is steadily increasing. The colour then ceases to be yellow, and attains a pure clear red. If the urine now begins to clarify it shows that the (pathological) heat is beginning to subside.

In acute diseases of a haemorrhagic character, the urine may be tinged with blood without any evident rupture of blood-vessels having occurred. This would indicate an excessive plethora. A gradual loss of blood by the urine, associated with a bad odour, is a sign to be dreaded because it informs us that there is haemorrhage proceeding from congested parts. The prognosis is still worse if the urine becomes thinner and more offensive in odour.

612. Admixture of the urine with blood may be a good sign—namely in acute composite fevers—for it shows that crisis is about to take place, and recovery will follow. The only exception is if the urine becomes suddenly transparent (its colour becoming normal, i.e.) before the crisis is due. Such a phenomenon would be a forerunner of a relapse. But thin urine appearing before the crisis may be equally unfavourable unless the change has been gradual and progressive.

613. In jaundice, if the urine becomes of a deeper red until it is nearly black, and its stain on linen can no longer be removed, it is a good sign;—the better the deeper the red. But if the urine becomes white or slightly reddish, and the jaundice is not subsiding, the advent of dropsy is to be feared.

Fasting is among the conditions which render the urine high-coloured and of marked acridity.

614. III. THE DEGREES OF GREEN COLOUR. (1) A colour approaching that of pistachios* ; (2) the colour of verdigris ; (3) rainbow green ; (4) emerald green ; (5) leek-green. The first denotes a cold intemperament, as do all things the shade of whose green is not (2) or (5). These (2, 5) denote extreme combustion, but (5) is not as unhealthy as (2). If it should be met with after physical labour it denotes "spasm." A green-coloured urine in adolescence points to the same condition.

Rainbow green usually denotes an extremely cold intemperament. In this respect it comes next to (1). Some say that it shows that poison was present in the fluid taken as drink, and that if there be a sediment present there is a hope of recovery; if no sediment, death is likely to take place. Verdigris green colour of urine forewarns of death (destruction of innate heat).

615. IV. THE DEGREES OF BLACKNESS. (1) Dark urine approaching blackness, through a saffron colour. This occurs in jaundice, for instance. It denotes (a) denseness and oxidation of the biliary humour ; (b) atrabilious humour derived from biliary humour ; (c) jaundice. (2) Deep-brown-black. This shows the presence of sanguineous atrabilious humour. (3) Greenish-black. This shows the dominance of pure atrabilious humour.

(Speaking generally) dark or black urine denotes (a) extreme oxidation ; (b) great cold ; (c) extinction of the innate heat (i.e. death) ; (d) crisis ; (e) evacuation whereby the effete substances from the atrabilious humour are expelled.

616. ('The details about each of these are :) (a) dark urine *due to extreme oxidation* is recognized by its causing scalding, and being previously yellow or red. The sediment is discrete (not coherent), not homogeneous, discontinuous, not very dark, but tending to a saffron, lemon-yellow, or dark brown. If the colour of the sediment tends to be lemon-yellow, it strongly suggests jaundice.

(b) When darkness of the urine is *due to great cold*, the urine would previously be tending to a green tint or a livid tint. The sediment is here slightly coherent, and looks dry, and is more purely black in colour. If a dark urine is also very offensive, it shows that the temperament is hot. If it be odourless, or has only a slight odour, it shows that the temperament is cold. This is because no odour emanates from urine unless the innate heat overrules the cold.

* Cf. the passage in Night 933 : "I can dye various kinds of green, such as grass green, olive green, pistachio green, parrot green." (Burton, v. 483.)

(c) When darkness of urine is *due to extinction of the innate heat* this is recognized by the dispersion of vitality.

(d) When the darkness *arises from a critical change* in a fever ("critical polyuria") one of the following conditions may be supposed : the termination of a quartan fever ; the resolution of a splenic disease ; the termination of a fever associated with the atrabilious humour ; the termination of a fever prevailing by night and by day ; subsidence of pains in the back and womb ; retained menses ; retained blood in a case of piles—both the latter two occurring especially when nature is assisted by art. It occurs *in women* in whom the menses are retained, because the effete matters of the blood cannot be disposed of by nature. This is shown in the urine by its being watery previously. When the effete matters are finally discharged from the body, the urine at the same time becomes very abundant.

617. Prognosis. If at the critical periods the urine do not become dark, it is an ominous sign, especially in acute diseases, the more so if at the same time (a) the quantity of urine be small (for scanty urine is evidence that the humour has already become destroyed by oxidation) ; (b) the sediment be coarse-textured ; the coarser, the more depraved ; the finer, the less.

Dark urine is a good sign in acute diseases.

If the urine is limpid [as well as dark] and a deposit is suspended in it at different layers, this denotes cephalalgia, wakefulness, deafness, mental confusion. If the urine is secreted only by drops, and a sediment forms slowly, and the odour is pungent, and there is fever—all this would be strong evidence of the above. But when there is wakefulness, deafness, delirium, and headache—such urine would show that epistaxis is pending.

Dark or dull red urine which is passed after drinking wine of that colour or after taking certain medicines need cause no alarm. The wine has simply passed unchanged through the body.

Dark urine may be evidence of renal calculus. As Rufus says, "black urine is good in infirmities of the kidneys and in stone in the bladder, and also in maniacal cases, for they are diseases proceeding from gross humours. But it is a grave sign in acute diseases". On the other hand, he says that black urine is a bad sign in diseases of the kidneys and bladder if at the same time it is extremely scalding. Therefore one must take all such signs into consideration.

When dark urine occurs in aged persons, it is not a good sign because in such persons, as you know, it can only denote

great destruction of tissue. In puerperal women, the appearance of dark urine is premonitory in convulsions.

In brief, the appearance of dark urine is serious at the onset of fevers as well as at their close, if there is neither crisis nor any abatement of symptoms at the same time.

618. WHITE URINE. The word "whiteness" is applied in two ways: mere translucence, as the laity calls anything which is translucent "white." Thus, clear glass, clear crystal, are "white." Translucence implies absence of all colour. Such urine is "thin" and translucent. Secondly, there is true whiteness, like that of milk or parchment. Such urine is not translucent.

Whiteness in the first sense shows that the intemperament is altogether a cold one, and that digestion is good. If the urine be at the same time coarse, it shows that the serous humour is abundant. A urine which is white in the second sense is necessarily coarse.

619.

Variety of Whiteness.	Significance.
(a) Mucilaginous.	Excess of serous humour, and crude humour.
(b) Waxlike.	Liquefaction of adipose tissue.
(c) Greasy, soapy.	Liquefaction of serous humour; or it may denote diabetes, active or latent.
(d) Musty whiteness :	Ulcers discharging into the urinary passages.
(i) Tinted with blood and pus.	Great excess of crude non-matured matter; vesical calculus.
(ii) Not tinted with blood.	Crisis in an inflammation arising in serous humour.
(e) Semen-like :	Diseases associated with vitreous serous humour.
(i) Critical in form.	Seminal emission.
	Forewarns of apoplexy and palsy.
(ii) Not critical in form and no inflammation.	The fever will soon become quartan.
(iii) Continuous throughout a fever.	Bad.
(f) Lead-white; no sediment.	Ominous.
(g) Milk-white; in acute diseases.	This shows that bilious humour has descended to some member about to develop an inflammation (e.g., the abdomen, or, which is worse, the head).
(h) Previously coloured; in acute fevers.	The patient will become delirious.
	Absence of digestion (esp. in the venous system: Ch.M.?) ; and in diabetes.
(i) Sudden change from red to white in the course of a fever.	Fatal issue; or wasting.
(j) Whiteness persisting in a person apparently healthy.	
(k) Whiteness like buttermilk, in acute fevers.	

620. When the intemperament is hot because of the dominance of the bilious humour, the urine may appear white

[contrary to expectation]. When the intemperament is cold because of dominance of the serous humour, the urine may appear red [contrary to expectation]. If the bilious humour passes down the urinary passages without being admixed with the urine, the latter remains white. Hence it is necessary to study white urine with care. For, if its colour were brilliant, and if the deposit is plentiful and coarse, and the urine itself is rather thick, it shows that the whiteness arises from a cold intemperament, with predominance of the serous humour. Again, if the urine be not clear and bright, and there is not much deposit, and if the whiteness tends to a brownish tint, it shows that there is bilious humour concealed therein. Whiteness in the course of an acute disease, the signs of recovery being present, with no fear of maniacal delirium, and the like, indicates that the bilious humour has passed out by some other channel, such as the intestine, causing constipation.

Brilliant.—Arabic : *mushriq* ; Latin : *clarus*.—This term describes the colour-effect produced in urine by the presence of bile-pigment (as shown by its use in the next paragraph, where it is evidently equivalent to our “dichroic”). Other equivalents are : bright, shining, resplendent, lustrous, luminous. In this passage Avicenna seeks to warn the reader that a urine is not necessarily free of “bilious humour” because it happens to be very pale (white).

Brilliance, however, may be taken as evidence of health, for when metabolism proceeds quite normally, the urine assumes a peculiar clear shining colour when viewed in the light. In this case, we may think of the various stages of catabolism proceeding without the formation of irregular intermediate substances, or by-products. The moments of nascence (§91) are “sharp” throughout.

621. If urine is red in the course of “cold” maladies, it means one of four things—(1) that there is severe pain which disperses the bilious humour (ex. : colic without the signs of inflammation) ; (2) there is so much serous humour in the bileducts as to give rise to obstruction there, and the bilious humour is in consequence diverted from the intestine into the urinary passages. (3) Hepatic insufficiency, especially in regard to separating off water from the blood, as occurs in “cold” dropsy. The urine comes to look like the washings of raw meat. (4) Some form of putrefactive process in the veins subsequent to obstruction in the ducts ; here the serous humour in the vessels undergoes a change of colour. The urine is rendered watery, and the sediment is of a kind already described—faint in colour, and not resplendent. The presence of bilious humour renders a colour resplendent (i.e. dichroic).

622. Urine is often white at the onset of a disease, and becomes dark and offensive in odour later. So it is in jaundice.

623. Urine becomes white after a meal, and remains so until digestion is nearly completed. It then begins to assume colour.

624. During the waking state, the urine is white—partly because of dispersal of the innate heat—but it is not resplendent. It tends to be dusky if there is an associated defective digestion.

625. *Prognosis.* A red colour is better than a watery-white one, in the case of acute diseases. But a white colour is better if intrinsic—not due to wateriness.

Redness due to blood is not as dangerous as redness due to biliary humour. Redness from biliary humour is not as serious if the biliary humour is quiescent; it is very ominous if it begins to move about.

Red urine is very bad in the case of renal disease because it is a sign that there is a “hot” inflammatory process there. If it occurs in diseases associated with (intense) headache, it portends delirium.

When a urine begins to turn red in an acute disease, and stays so, without forming a sediment, it is an ominous sign because it points to an inflammatory swelling in the kidneys. If such urine becomes turbid, and stays so, it points to an inflammatory mass in the liver, with lack of innate heat.

Unusual coloration of the urine, produced by eating saffron or cassia fistula must be borne in mind; tricksters may alter their urine thus (Alsaharavius).

So much for the simple colours of the urine.

626. THE COMPOUND COLOURS OF THE URINE.

(1) *Like raw meat washings* (i.e. blood-stained water). This means hepatic insufficiency due to plethora of blood or to any form of intemperament, resulting in deficient digestive power and dispersal of the vitality. Were the vital power adequate, it would show that there is plenty of blood, even to great excess; and in such a case, the secretory power would be hardly adequate for dealing with it.

(2) *Oleaginous. Oily.* The fat of the body is being destroyed. The appearance is like a lemon-yellow tinged with the greenness of the mistletoe growing on larches. It is called oleaginous because it is viscid and translucent, and also has the lustre of fat, and shows a certain brilliance or resplendence in spite of a certain opacity. It is not a good sign in many states, not to say it is bad. For it shows there is neither maturation, nor a change for

the better. In rare cases it indicates the critical evacuation of unctuous matter, but for it to mean this alleviation must follow.

If such urine be also fetid and scanty in amount, it is a very ominous sign. It is also serious if it be admixed with material like meat washings, as might happen in the course of dropsy, phthisis, and intestinal obstruction.

If oleaginous urine replaces a black urine, it is a good sign. But if such a urine appear on the fourth day of an acute disease it forewarns of the patient's death on the seventh day. (Very dark oily urine forewarns of collapse and death. Theophilus.)

In brief, there are three kinds of oleaginous urine. (1) All fat, throughout. (2) Fat only in the lower part. (3) Fat in the upper layers. The first is oleaginous only in colour ; it occurs in phthisis, hectic fever, and wasting diseases, especially at their outset. The second is oleaginous only in "substance." The third is oily in both respects—e.g. in diseases of the kidney, at the acme and termination of phthisis.

(3) *Purple (-black).* This is a very bad sign. It means oxidation of both bilious and atrabilious humour.

(4) *Ruddy colour admixed with a tinge of blackness.* This occurs in composite fevers and in fevers arising from gross superfluities. If it clarifies, and the darkness settles down from the surface, it denotes an inflammatory mass in the lung.

3. THE SIGNS AFFORDED BY THE DENSITY, QUALITY, CLEARNESS OR TURBIDITY OF THE URINE

627. Urine may be transparent or opaque, or intermediate in density.

§ 237a. The "density" here spoken of is not the equivalent of "specific gravity," though many of the statements in the text would apply equally even in the modern sense.

The difference in specific gravity shown by the morning and evening urine (1005, 1015 respectively, for health) was not discernible with unaided senses, but the general rule still holds that a persistently dense urine (sp. gr. over 1022) indicates a need for depurative foods (greens, acid fruits).

TRANSPARENT (LIMPID) URINE

628. Whatever be the state, a urine of limpid consistence denotes : (a) deficient digestion (lack of maturation) ; (b) venous congestion ; (c) renal insufficiency (for the kidneys only separate out fine matter, or if they attract other matter, they fail to discharge it until it has been rarefied or rendered capable of excretion) ; (d) excessive fluid-intake ; (e) a very cold or a dry intemperament.

When it occurs in the course of an acute illness, it denotes deficient digestive power, and inability to complete digestion (absence of maturation : cf. above). It may indicate that the weakness of the other faculties is so marked that they cannot influence water at all, and hence it passes through the body unchanged.

629. Prognosis. It is worse for urine to be very transparent at puberty than in adolescence, because during the former period of life urine is naturally more opaque than in adolescence. Being more moist in their temperament, their bodies attract moisture more readily, and, in addition, moisture is essential for their growth. Hence, if acute fevers arise during the age of puberty, the urine is decidedly abnormal if it is transparent ; and, should it continue of that character, it would be a very ominous sign. Should it continue and favourable symptoms should not appear, and should the vitality not be maintained, it would be a sign that an abscess is forming below the liver.

630. If urine continue to be transparent for a long time without any variation in a person otherwise healthy, should he experience pain one will know that an inflammatory mass is forming in the situation of the pain. The pain is usually lumbar when the urine is of this character, and that is the usual site for an abscess.

If there is no localized pain in such a case, but a general pain and heaviness, this points to the widespread formation of small pustules.

If the urine is transparent at the crisis of an illness, contrary to rule, it forewarns of a relapse.

OPAQUE (THICK) URINE

631. If the urine is very opaque, it shows that maturation has failed to take place ; or, more rarely, it denotes the maturation of "gross" humours, such as occur at the height (*status*) of humoral fevers, or after the opening of abscesses. In acute fevers, the appearance of opaque urine is usually a bad sign, though not as bad as a persistently transparent urine. The fact that urine is opaque shows that there is a certain degree of digestion proceeding, because digestion adds to the opacity of urine to a certain extent, and shows that there is some power of expulsion (of effete matter). But it is a bad sign in so far as it denotes the breakdown of, and abundance of, humours, and that the evacuation of the separated materials is hindered.

To ascertain which of the two is dominant, notice whether improvement or increased weakness follows.

Prognosis. When opaque urine is passed in the course of fevers, it is a less serious sign if it be poured out quickly and plentifully. When excreted slowly it denotes a redundancy of the (serous, Ch.M.⁷) humours and an enfeebled vitality. A sign which is still less serious is that a urine of medium density should go with a simultaneous improvement in the general condition.

A very dense urine sometimes denotes that digestion is unduly excessive (Ch. M.⁷).

When the urine is transparent in an acute illness, and then becomes thick, and there is no improvement in the condition of the patient, it denotes colliquation [of tissues].

Persistent opacity of urine in a presumably healthy person forewarns of fever should headache and mental confusion arise. Opaque urine also occurs after excessive evacuations, after the opening of an abscess, or owing to ulcers in the urinary passages.

Transparent and opaque urine cannot both denote lack of digestion (maturation) unless there is an intermediate degree of density associated with the maturation. Dense substances are rendered thin or limpid by the process of digestion, and the urine changes from transparency to opacity.

CLEARNESS AND TURBIDITY

632. Thick urine, as has been already stated, is sometimes clear and translucent, sometimes turbid and opaque ; and yet there is a marked difference between thick and limpid translucent urine. When the former is shaken, it does not easily break up into little portions—it only forms large portions ; and the particles move slowly ; and if it makes a foam, its foam is composed of numerous bubbles which do not coalesce for a long time. Such a urine is the outcome of an adequate digestion of the serous humour, or of the vitelline bilious humour (if there be any tint suggestive of yellowness in it) ; or of the resolution of vitreous serous humour (if there be not any tint of yellowness in it). The last-named variety is often found in the urine of epileptics.

But a well-coloured transparent urine owes its colour not to digestion but to admixture with bilious humour. For otherwise digestion would be supposed to affect only the " substance " until a mixture of colours had been brought about, whereas the process of digestion effects a change of " substance " first, and of colour secondarily. Digestion concerns " substance," not " colour." Hence if a transparent urine is yellow, and there is

no abatement of the acute illness, that is a bad sign, for it shows the digestive faculties are dormant.

The appearance of alternating redness and yellowness in a limpid urine points to inflammatory changes dependent on toil. If it be limpid and shows scale-like objects in it, and if the bladder is healthy, that is a sign of oxidation of the serous humour.

In brief, a thick urine in acute febrile states may denote predominance of various humours, and at the same time point to colliquative processes (in the body). Should such processes persist during the whole phase of a disease, the urine would become more opaque (denser, thicker).

Lastly, *turbid urine* denotes earthiness as well as the presence of gas and wateriness. For when these qualities are combined, turbidity is the result. When they are separated again, the urine becomes clear.

633. *The following three states should be noted*

1. The urine is clear at the time of passing, and then becomes opaque. This shows that maturation is difficult ; that the matter (of the food) has not yet succumbed to the vegetative powers ("nature"). It may denote colliquation in the tissues.

2. The urine is opaque when passed, but then becomes clear. The coarse matters settle and separate out. This shows that the vegetative powers ("nature") have already overcome the material (of the food) and matured it. The clearer it grows, the greater the amount of sediment, and the more rapidly the sediment falls, the more complete is the digestion.

3. A state between the above two. In this case the vegetative powers improve, as long as the vitality is maintained. It shows that maturation is not progressing to completion. But if the vitality is not maintained, it would mean that the maturative processes are not likely to reach completion. Should this condition persist a long time without the feared symptoms (of loss of vitality) appearing, then it is likely that headache will develop, for it shows that there is much gas formation.

In modern language we should say :—

Urine which is clear when passed, but is turbid on standing ; if acid, the deposit is (a) urates, which are not soluble in the cold ; or (b) bacterial decomposition, stellar and triple phosphates separating out.—We should heat the specimen also ; a cloud in an acid urine would be albumen.

Urine which is turbid when passed or becomes turbid on standing ; if alkaline, the deposit is earthy phosphates (magnesium and calcium). It is met with after a rich protein meal or vegetable meal. Such a urine may become cloudy on heating, from the deposition of (calcium) phosphates, which are soluble again if acetic acid be added.

It is a better sign for a clear urine to become turbid than for it to remain turbid for several hours after being passed.

Urine may become turbid because of loss of vitality, apart from expulsion of "the nature."

If urine is watery when voided, and remains so, it shows that digestion has entirely ceased.

634. Good signs

(a) Opaque urine easily voided, whose sediment falls easily : when occurring in palsy, etc.

(b) Urine opaque when voided but then becoming transparent and plentiful.

(c) Limpid plentiful urine following upon thick turbid urine or thick and scanty urine.

(d) Opaque turbid urine passed at a slow rate, and then becoming suddenly abundant and easy to void. (This means that recovery is about to take place, whether it be an acute fever or any other plethoric disorder, or a plethora about to manifest as actual disease). But this kind of urine is rarely met with.

635. If the urine is of natural colour, and its opacity be great, it is evident that much (effete) matter is passing through, and that there is no hindrance to their outflow. But it is usually a bad sign because it shows that the humours are superabundant, and the vitality deficient. Such a urine is scanty and difficult to void.

Opaque urine is a good sign if it occurs at the crisis in "splenic" diseases and "mixed" fevers, in which the emunctory powers cannot come into play, or equipoise be restored.

Lastly, turbid urine denotes that the humours are overabundant and that the vegetative powers are inadequate for their digestion.

636. *Diagnostic points.* Opaque urine, with a sandy sediment, denotes calculus. Opaque urine, with pus, a bad odour, and scaly particles separating out, denotes rupture of an abscess. A thick urine, with the clinical evidences of an inflammatory mass or of an ulcer in the bladder, kidney, liver or chest, shows that there is an abscess about to burst.

If the urine prior to that were like the washings of raw meat, it would show that there is unhealthy blood flowing from the liver ; and if the faeces were also similar, it would show there is an inflammatory mass in the interior of the liver. If prior to this there was shortness of breath, with a dry cough, and a stabbing pain in the chest, then one knows that an abscess has

ruptured which arose in the chest or (round the) aorta. If the pus is "mature," it is satisfactory.

637. Discharge of urine resembling pus may benefit a person who takes no exercise and lives in an unhygienic manner. It clears the whole body, and removes the laxity resulting from the lack of exercise. It may be that there are obstructions in the liver and adnexa, and when the obstructions are removed, the urine which is voided is dense owing to the matter which passes out with it. Such "matter" is not "pus." It is only pus if it appears in the urine after the bursting of an abscess; the urine is then not only thick but dark. If at this time there be pain in the left side, then one knows that the abscess was in the spleen. If the pain is in the upper part of the abdomen, one knows the abscess was in the stomach. The usual site for the abscess is in the liver and in the urinary organs.

638. Turbid urine often denotes loss of vitality; coldness dominates in the temperament as much as if the whole body were exposed to external cold.

639. Turbid urine of the appearance of poor wine, or of chick-pea-water, may occur during pregnancy, and may be met with in persons with long-standing internal "hot" inflammatory masses.

640. Urine which has the extremely turbid appearance of asses' urine or the urine of other cattle, arises from the very marked agitation which is going on in the humours, especially the serous humour, a certain amount of heat coming into play so as to set up that agitation. Hence this kind of urine is a fore-runner of headache or [coryzal] catarrh in the head. If it persists, it forewarns of lethargia.

641. If the urine resembles the colour of some member for some time, it forewarns that disease is about to arise there.

642. Some say that if the lower layers of the urine show a powdery or nebulous appearance, it means that the illness will be of long duration; and that if it persists throughout the whole illness, it presages death, or the formation of "crude" serous humour, which is distinguished from pus by its fetor.

643. If the urine separates into several layers, the more there are the stronger is the natural faculty, and the more open are the pores.

644. *Threads floating* in the urine denote that it was passed immediately after completing coitus.

4. THE SIGNS DERIVED FROM THE ODOUR OF THE URINE

645. Some people assert that no sick person ever passes a urine which has a healthy odour. But we say that if the urine is quite odourless, it denotes (*a*) a cold intemperament ; (*b*) excessive " crudity " ; (*c*) extinction of the innate heat, in the case of acute diseases.

646. *Fetid odour.* A fetid odour, with signs of maturation in the urine indicates ulcers in the urinary passages, or " scabies." These are identified from their own signs. If with the fetid odour, there are no signs of maturation, the cause of the odour may be merely putrefaction.

Such a urine, in acute fevers, without disease in the urinary organs, is a bad sign. If it is present in acute fevers, and there is a tendency to acridity, it denotes putrefaction in humours which are of a cold nature, when there is a predominance of the extraneous heat.

If such a urine appears in acute diseases, it forewarns of death by extinction of the innate heat and predominance of the extraneous cold.

647. *Sweetish odour.* This denotes predominance of the sanguineous humour. If also very fetid, a predominance of the biliary humour.

648. *Putrid odour.* If this tends to sourness it shows predominance of the atrabilious humour.

An extremely fetid odour of the urine which continues in spite of seeming health denotes (*a*) that a fever arising from putrefaction is coming on ; (*b*) expulsion of retained putrescent matters. The latter will show whether the case may be expected to recover. If a fetid urine appears in an acute illness, and then suddenly ceases to be fetid, without subsidence of the symptoms, it shows a destruction of vitality.

A moderately fetid urine denotes defective digestion : Haly Abbas.

Offensive odour may be ammoniacal, as in alkaline fermentation. Sweet odour may be " fruity " or like new-mown hay in diabetes. Specific odours result from the use of certain drugs. (Modern.)

5. THE INDICATIONS AFFORDED BY THE FOAM ON URINE

649. Foam arises from the moisture and the gases forced into the urine as it is passed into the urinal. The vapour which leaves the body with the urine doubtless adds to the consistence of the urine, especially if gases predominate in it, as occurs in cases of obstructions. The urine then shows many bubbles.

650. One notices the following points in regard to the foam :

- (1) Colour : it is dark or reddish in jaundice.
- (2) Size of bubbles : large ones indicate viscosity.
- (3) Number of bubbles : if numerous it denotes viscosity and much gas.
- (4) Rate of bursting of the bubbles : if slow, it indicates viscosity, and coarse glutinous humour.

651. *Prognosis.* Hence if small bubbles persist in a specimen, in cases of kidney disease, it shows that the illness will be of long duration.

In brief, viscous humours in the course of kidney diseases are of bad omen ; they show that the humours are depraved, and cold in temperament.

The significance of small bubbles has already been stated.

6. THE INDICATIONS DERIVED FROM THE DIVERS KINDS OF SEDIMENT

652. *Definition.* In the first place one must specify the meaning of the term "sediment." It is not "that which sinks to the bottom of the vessel." It is "that whole substance (denser in essence than wateriness) which separates out from the wateriness—regardless of whether it settles down or not, floats or not, sinks or not."

Therefore we may say that there are various characters pertaining to the sediment—its "structure," its quantity and quality, the arrangement of its components, its position, duration, and mode of permixture.

I. STRUCTURE

[Structure ; consistence ; texture ; essential substance ; matter ; jawhar.]

A. NATURAL SEDIMENTS

653. A sediment is natural, laudable, evidence of normal digestion and maturation, when it is white, sinks to the bottom of the vessel, when its particles are in continuity [i.e. not discrete], uniform, and all alike. In contour it is rounded. It is light, homogeneous, delicate, like the deposit which forms in rosewater.

Its relation to the maturation of the various matters of the whole body is comparable to that to the maturation of pus. But whereas it is white, light, and of homogeneous nature and delicate in the former, in the case of pus it is coarse.

654. A sediment betokens good digestion even though devoid of colour and homogeneity.* But ancient physicians considered that homogeneity was a more important test than colour. A homogeneous deposit—even though not altogether white, or even if reddish in tint—is a better sign than a deposit which is white but not homogeneous, and composed of coarse particles. The sediment may or may not assume the same colour as the urine. If it does not, it is better that it should be white, next best red, then lemon-yellow or saffron-yellow, and the least good is that it should be like arsenicum in colour, or of a colour like that of lentils.

However, I counsel you not to regard what others say. I say that—whiteness does not necessarily have a relation to the state of digestion ; homogeneity is always related to the (efficiency of) maturation. A thorough mingling of gaseous constituents will produce a white effect.

If a sediment presents an unhealthy appearance, it is more favourable that it should be discrete than continuous.

655. Good sediments resemble pus and crude serous humour when they are tenuous. But pus is different in possessing fetor, crude serous humour is different in (rendering the deposit) compact and not homogeneous. A good sediment differs from both because it is finely textured and light.

656. One would not expect to find such a deposit in a person who is healthy ; it occurs in the sick person because matters are kept back in his blood-vessels, and they undergo (putrefactive) breakdown if they cannot be subjected to maturation. In health, the blood need not necessarily contain a humour which ought to be removed, but if there were such a humour present, it would be better if it were disposed of by way of the faeces (the indigestible excess in the aliments) than if it emerge by way of the urine as a sediment—whether such humour have undergone maturation or not.

In thin persons, the sediment of the urine is scanty and it sinks down differently according to the state of health, especially if the persons are accustomed to exercise or to practise laborious arts.

The sediment is abundant only in obese persons and in those of bad habits.

657. Hence one does not expect to find as much sediment in sick persons who are lean as in those who are stout. For

* The general significance of a sediment is that there is an excess of soluble or insoluble toxic substances in the blood.

disease in the former often resolves without any sediment forming at all. At most there may be a tiny particle floating or swimming in it. In other cases the sediment falls immediately after micturition unless there is good maturation—in which case very little deposit is to be expected.

B. ABNORMAL SEDIMENTS

658. Varieties. (1) Flaky or squamous ; (2) fleshy ; (3) fatty ; (4) mucoid or slimy ; (5) purulent (ichorous) ; (6) hair-like ; (7) resembling pieces of yeast infused in water ; (8) sandy or gritty ; (9) cinerital ; (10) hirudiniform.

i. *Flaky or squamous.* This is composed of large red or large white particles. They are usually supposed to come from the urinary organs. If white, they come from the bladder (ulceration, desquamation, erosions) ; if red or fleshy, they come from the kidney. If brown or dark coloured, or like the scales of fishes, they are a very bad sign, worse than all which we have named. They suggest the shedding of mucous linings. Particles from the bladder or kidneys may not be of moment ; in fact, if vesical they are a sign of recovery. Some say that cantharides causes white flakes to appear, which are like the membrane within eggs ; these dissolve when the specimen is shaken and impart a reddish tint to the urine. This would be evidence of healing and recovery.

Another form resembles the scrapings from intestines ; the particles being less broad and of dense consistence. If reddish coloured it is called orobeal [or tare-like or grumous] sediment ; otherwise it is called furfuraceous. The former recalls the appearance of decorticated orobs [*ervum ervilia*], and are reddish ; this indicates the presence of oxidized particles* which are derived from (a) the liver, (b) the kidney, or (c) blood. When they come from the kidney, the particles are more continuous and fleshy, whereas in the other cases they are more friable. When the colour is decidedly yellowish (one knows that) they are of renal origin ; if dusky red (that) they are of hepatic origin. But sometimes particles of hepatic origin may resemble those of renal origin.

Another form, more strictly scaly, consists of small bodies like the husks or hulls of grain. Such a sediment denotes (i) bladder trouble, or (ii) grave colliquative disorder of the system as a whole. We diagnose (i) bladder trouble if (1) there is itching

* The mineral constituents which are attached to the organic substances in the urine are (1) perfectly oxidized, (2) partly oxidized and partly unoxidized, (3) entirely unoxidized.

at the root of the penis, and (2) the urine is fetid, especially if (3) pus is passed first. Such a state is more probable if (4) there are other evidences of maturation in the urine, (5) if the veins over the bladder are healthy, and there is no macula there. We diagnose (ii) liquefaction of humour if there is fever, weakness, difficulty of micturition, and the sediment is brownish in colour.

Another form, in which the deposit is like coarse particles of barley flour may mean one of four things : (1) oxidation of the sanguineous humour—if there is a tendency to redness ; (ii) colliquative changes in the membranes and their components—if it be white ; (iii) local bladder disease—in a few cases. The difference between this and the others is readily made out from what has already been said ; (iv) oxidation of the blood, especially in the spleen.—Here the colour tends to be black.

Squamous deposits other than those of vesical or renal and ureteral origin, occurring in acute diseases, have a grave significance.

2. *Fleshy sediments.* These, as you already know, are usually of renal origin. They are not so if the flesh is healthy and there is no breakdown in the body. If the evidences of complete digestion are present in the urine, it shows that the blood-vessels are healthy. For the urine can show evidence of maturation even if the kidneys are diseased, seeing that this process begins “above” the kidneys.

3. *Fatty sediment.* This, like the preceding, denotes colliquative processes in the body. It is more serious if it resembles “gold water” in appearance. There are two chief types—either it is abundant and discrete (this being derived from the renal fat) ; or scanty and admixed (this being derived from the fat of a more distant place). There is no fever, in the former case.

A white particle like a pomegranate seed may be seen in the urine. This will be derived from the renal fat. It denotes that a sanious ulcer has formed, especially in the urethra, especially if the sediment sinks promptly. (“In ardent fevers, it forewarns of death.” Hippocrates.)

4. *Mucoid sediment.* This denotes an unnatural humour, which is too plentiful within the body and passes out either by the urinary tract, or a critical hip-gout, or joint pains. The distinction between them is made by the symptoms—whether they abate or not.

A dense humour may become rarefied and tenuous, and a laudable sediment results. Therefore in the course of acute disease, one must not depend on a laudable sediment appearing

before the time when maturation (of the disease) is due, or before its signs have appeared. It may denote that there is a very cold intemperament of the kidneys.—(A very mucoid and abundant sediment appearing at the end of an attack of gout or arthritis, is a good sign).

5. *Ichorous sediment.* This differs from a crude sediment in being fetid. It is preceded by the evidences of abscess. Its particles easily aggregate and separate again. It may be very thoroughly mingled with the water ; it may separate out quickly from the water. A crude sediment, however, is both turbid and thick. It does not readily aggregate, nor separate easily. The urine is not fetid. The signs of abscess do not precede.

6. *Hair-like sediment.* This is produced by the coagulation of any internal humour, which has been exposed to the innate heat on its way from the kidney to the bladder. It is sometimes white, sometimes red. It clots in the kidney. The clots may be as long as the palm of the hand.

7. A sediment having the *appearance of yeast soaked in water*, is evidence of gastric and intestinal weakness and of depraved digestion (often due to milk and cheese having been taken).

8. *Sandy or gritty sediment ("Gravel").* This is always a sign of calculus whether in process of formation or actually formed, or in process of solution. If red coloured, it shows it comes from the kidneys ; if white, it shows the origin is in the bladder.

A gritty sediment, where there are large particles like those of ground grain, is a bad sign in fevers (Hippocrates).

9. *Cineritious sediment.* This is a sign that serous humour or pus has altered in colour through long stagnation and breaking up of its particles. It may be that it is due to having undergone oxidation.

10. *Hirudiniform.* The sediment is of the (appearance and) colour of leeches. If well mingled with the urine, this denotes hepatic insufficiency. If less closely intermingled with the urine, it denotes a trauma in the urinary passages which breaks their continuity. If discrete, it shows that the lesion is in the bladder or in the penis. This subject is carefully dealt with in the third volume, under the heading of "haematuria."

The appearance of bodies like red leeches in the urine, associated with evidences of disease in the spleen, denotes a destructive disease in that organ. (It would seem that strings of blood clot are here referred to, in which case nowadays we should think of a villous tumour in the bladder. Tr.)

Note, that in diseases of the bladder, there is generally not much bleeding because the blood-vessels are few in number, are slender, and are deeply situated in its wall.

II. QUANTITY OF SEDIMENT

659. According as the sediment is abundant or scanty so the degree of the efficient cause is great or small. This has been explained under the previous heading. (It is more abundant in gross-living persons than in those who are temperate. It is less abundant in active persons than in those leading a sedentary life ; hence it is liable to be more abundant in females than males, children than adults.)

III. QUALITY OF SEDIMENT. COLOUR. ODOUR

660. *Black sediment* : this is a bad sign, as in the degree already shown in **617** ; but it is not so bad if the supernatant fluid is not black. (Haly Abbas says it is a fatal sign if it comes on after being intensely red.)

Red sediment. This shows dominance of sanguineous humour (sanguineous plethora) ; it occurs in fasting ; and when digestion is imperfect. If it continues to be present for a long time it denotes inflammation of the liver.

Yellow : this denotes great heat, because it is produced by biliary humour. It may also show an insidious disease.

Green colour : this has the same significance as black sediment.

White colour : this is sometimes good, sometimes bad. That is, when it is mucoid, ichorous, or foamy ; because this shows that the urine is not a completed secretion.

Odour. The indications from the odour have already been given in describing the other characters.

IV. CONSTITUTION, COHERENCE AND CONSISTENCE OF PARTICLES

661. Softness and homogeneity of the sediment which is otherwise laudable is more healthy than when met with in a urine otherwise not laudable. Discreteness of particles points to flatulence and impaired digestion.

V. POSITION

662. A laudable sediment may swim like a cloud or nubecula ; may float on the surface ; or be suspended in the middle layers (which shows that maturation has proceeded further than

in the first variety.). If it is rugose or fimbriate and tends to sink, it is better ; if it sinks to the bottom it is a sign of still more advanced maturation.

When the sediment is not laudable—it is more satisfactory when it is light and rises to the upper layers ; or, if in the course of an acute fever, it is black ; when the humour is serous or atrabilious, it is more satisfactory when it is like a cloud than for it to sink to the bottom ; the fact of its being like a cloud shows it is tenuous, unless by chance gas is making it rise.

If the sediment sinks below the surface, but not right to the bottom it is more satisfactory. It is heat which makes it rise or float ; or it is gas which carries it upwards.

If a sediment made of coarse discrete particles should float, it shows it is light. A fine sediment, especially if heavy, will sink lower.

If the sediment remains suspended as a nubecula right through an illness from its beginning, it shows that crisis will come with suppuration.

A nubecula or suspended sediment may never appear in an illness if the person be slender, as we have stated.

A sediment which is between a cloud and an enaeorema—made of particles suspended or floating in the middle layers like a spider's web (or opaque like a thin pancake—Rome edition) is an ominous sign. (Such particles may appear like the specks of oil which one sees in cooled broth ; or like hairs.) But even a nubecula may be an anxiety, though it be the beginning of a change for the better. It sinks to the middle layers and ultimately to the bottom. In that case it is not a bad sign. But if a "bad" sediment appears after this, it is certainly ominous.

VI. TIME OCCUPIED IN SEDIMENTATION

663. If the sediment settles rapidly, it is a good sign, showing that maturation is correct. If it settles slowly, it is not good, for it shows deficient or absent maturation, according to its amount.

VII. FORM

664. The significance of this has been described in making mention of passing blood and fat with the urine.

7. SIGNS RELATIVE TO THE DAILY QUANTITY OF URINE

665. Generally speaking, oliguria means weakness of vitality. If the amount is less than the fluid consumed, it points

to great loss by diarrhoea or to a tendency to dropsy. Polyuria sometimes means colliquation, and the discharge of fluid effete matters from the body by the urine.

To assess these correctly, one must note the state of the vitality, as follows : if the urine be of bad colour, it is a bad sign; but the more plentiful it is, the more likely is recovery to take place. If the quantity excreted fails, the illness will increase, just as applies in regard to dark or coarse urine.

666. *Variation of quantity.* It is a bad sign if the urine is at one time abundant, at another scanty, at another suppressed. It shows that there is a hard conflict between the vitality and the disease. A plentiful urine in an acute illness, occurring without any abatement of symptoms, and associated with copious sweats, shows hectic fever and may be followed by convulsions.

The quantity of night urine (9 p.m. to 7 a.m.) should equal that passed in two hours during the day. If greater, it denotes arterial disease (Comrie, B.M.J., 1922, p. 1071). Vallery-Radot states that the day-urine is normally thrice the night urine.¹⁴¹

667. A scanty urine, passed involuntarily, drop-by-drop in acute diseases, indicates cerebral disease, affecting nerves and muscles.

If a fever subside and there are other signs of recovery, one may predict epistaxis. Otherwise delirium will ensue and death is likely.

When a person is in apparent health, if the amount of the urine is diminished and it is tenuous in character, and if that condition persists, and if there is a sense of heaviness and pain in the loins, this shows that there is a hard inflammatory swelling in the kidney.

668. When the urine is *increased* in a case of colic, this is a good sign, especially if it be white and easily voided.

8. DESCRIPTION OF NORMAL HEALTHY URINE

669. The following are the *characters of healthy urine* : A medium consistence ; a delicate tint, tending to straw-yellow ; if there be any sediment it is white, light, homogeneous, and has a rounded contour ; the odour should be moderate, neither offensive, nor altogether absent.

Some say that if a urine of this kind appear suddenly at the end of the acme of an illness, health will be restored the following day.

9. VARIATIONS ACCORDING TO AGE

670. *Infancy.* The urine tends to the characters of milk, considering the food and their moist temperament. Hence it is nearly colourless.

Childhood. The urine is thicker and coarser than in adolescents, and more turbid. This has already been mentioned.

Adolescence. The urine tends to igneity, and homogeneity.

Later life. The urine tends to be white and tenuous, but it may be coarse (" thick ") because of the effete matters which are now being evacuated to a greater extent by way of the urine.

Decrepit age. The urine is whiter and still more tenuous. A similar coarseness to that of the preceding may occur, but this is rare. If the urine becomes very thick, it intimates liability to develop calculus.

10. VARIATIONS ACCORDING TO SEX

671. *Women.* The urine is always thicker, whiter and less pellucid than in males. The reason is fourfold : In women there is feebleness of digestion ; abundance of effete matters ; width of emunctory channels ; material discharged by way of the uterus, which draws similar material down the urinary passages also.

Men. When the urine is shaken, it becomes turbid and the turbidity ascends to the surface, though occasionally it remains throughout the whole bulk of the urine. When the urine in women is shaken, it does not become turbid because the particles are barely discrete, and there is usually a circular foam on top. Even if such urine becomes turbid, it does so only to a light extent.

If male and female urine be mingled, a filamentous network forms at once. (Filaments also appear in male urine if passed immediately after intercourse.)

672. *Pregnancy.* The urine is clear and there is a surface cloud. The colour may approach that of chick-pea water, or be yellow with a bluish or iridescent tint in it. In either case there is a sort of " tinted cotton " in the midst of it. Occasionally there are granules present, which rise and fall. If the iridescence (" rainbow tint ") be quite distinct, it is a sign that conception is beginning. When it gives place to redness, it shows that impregnation is completed, especially if the urine becomes turbid on being shaken.

Puerperium. The urine is often dark, as if there were a sootiness or shoemaker's black in it.

III. THE URINE OF ANIMALS AND ITS DIFFERENCE FROM HUMAN URINE

673. It is often desirable for a doctor to know something about the urine of animals, so that when he is tricked by a patient, he can quickly and truly discern it, difficult though it be to do so.

Asses. Some say that the urine is like clarified butter as to turbidity and coarseness.

Beasts of burden. The urine is similar to the preceding, but clearer. The upper middle part of the urine is clear, while the lower middle part is turbid.

Sheep. The urine is (nearly) colourless, with a yellowish tendency approximating that of man. But it has either no "body" and the sediment is fatty, or it is like oil-lees.

The better the quality of the food, the clearer is the urine.

She-goats. The urine is like human and sheep urine, but it has no "body," or sediment; and is clearer than sheep urine.

12. FLUIDS RESEMBLING URINE, AND HOW TO DISTINGUISH THEM

674. Acetous syrup and all fluids compounded of water and honey, water and figs; fluids coloured with saffron and the like—in all these the nearer one holds them to the eye the clearer do they seem, and the further they are held from the eye, the more opaque do they become. Urine is the opposite.

The foam on hydromel is yellow.

The sediment from fig-water or from herbal decoctions lodges on the sides of the glass and not in the middle. It has no definite contour, and does not move its position.

So much suffices for the description of the states of the urine. The individual varieties are discussed in the volume which deals with the special diseases. (Book IV.)

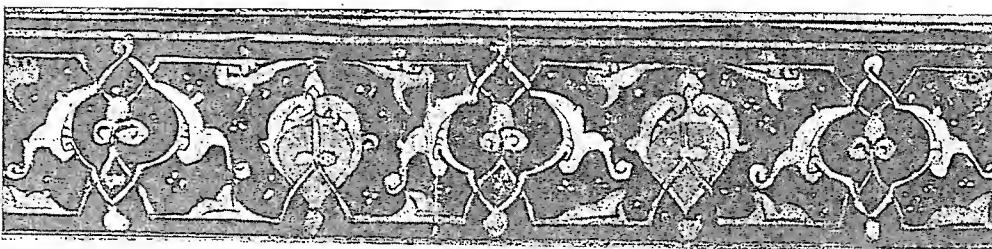
§ 238. TABULAR SUMMARY OF THE PRECEDING SECTION.

	Aspect, etc.	Colour.	Deposit.
1. First stage of Digestion. Good.	Urine plentiful, rather opaque. Mod. fetor.	White.	Homogeneous.
Moderately good.			Round contour, red.
Absent.	Watery, limpid.	Pale; or yellowish (bil. hum.).	Gritty, scaly, black, green, or livid.
Excessive.	Very thick.		
2. Maturation stage : Normal	Opaque first, then clear.	White.	White, homogeneous, delicate, sinks to bottom.
Difficult.	Clear first, then opaque.	Tends to be dusky.	Discrete particles, sinks slowly.
Quite absent.	Opaque.		
3. Completed.	Clear; denser.	Colour appears.	Rapid, proportional to completeness of digestion.
<hr/>			
<i>Digestion of Humours.</i>			
1. Immaturity in general.	Turbid.		Mucoid.
2. Serous humour.	Opaque or dense Foam persists.		
3. Vitreous serous humour.	Plentiful.	White.	Powdery, compact, not homogeneous.
4. Vitelline bilious humour.	Dense.	Foam persists yellow.	
<hr/>			
<i>Oxidation of Humours.</i>			
1. Sanguineous.		Tends to red.	Coarse particles like barley flour.
2. Serous.	Limpid.	Mucoid.	Scale-like bodies float in it; cineritious.
<hr/>			
Gross humours maturing.	Thick, opaque.		
Cold humours putrefying.	Offensive odour.		
<hr/>			
<i>Fasting State.</i>	Very acrid.	High.	Red.
<hr/>			
<i>Intemperaments.</i>			
1. Hot.	Dark. Offensive.	White, if heat due to dominance of bilious humour.	
2. Cold.	White, turbid, limpid.	Red if serous humour is obstructing bile ducts.	
3. Dry.	No odour. Limpid.	Other colours.	

<i>Vitality :</i>	Turbid.
Deficient, because of cold temperament.	Oliguria. Colour deepens to red-yellow.
Weak.	Odoriferous. Colour deepens to flame yellow.
<i>Innate heat</i> too great.	The urine clarifies.
<i>Innate heat</i> increasing.	Urine dark or black; in acute diseases it becomes colourless.
<i>Innate heat</i> subsiding.	
<i>Innate heat</i> extinguished.	
<i>Functional activity of Organs.</i>	
Liver-inflammation.	Turbid, red urine; sediment orobal or tare-like, or dusky red, or hirudiniform.
Splenic disease.	Sediment hirudiniform.
Renal inflammation.	Red urine; no deposit if grave; otherwise orobal, or fleshy, and yellowish.
Venous congestion.	Limpid urine.
Stone in bladder.	Dark.
<i>Special diseases :</i>	
Obesity.	Urine abundant.
Puerperal convulsions.	Urine dark.
Fevers just before crisis.	Urine may become thin and transparent.
Fevers at other times, etc.	Opaque urine: depends on which humour is responsible and on outcome of illness.
At the crisis.	Polyuria; dark, or black.

Corresponding table from a modern textbook. (J. K. Watson, p. 156.)

Disease.	Quantity.	Colour.	Odour.	Deposit.	Additional Modern Facts.
Acute Gout	Diminished	High		Urates abundant	
Acute Nephritis	Diminished or absent	Blood-stained		Blood casts urates occ.	Urea diminished Albumin
Chronic Cystitis	No change	Turbid	Offensive	Mucoid pus	Alkaline
Chronic Nephritis	Increased	Pale		Scanty	Albumin varies Tube-casts
Diabetes mell.	Increased	Pale	Sweet		Urea incr. Glucose Diacetic acid
Fevers, general and special	Diminished	High Turbid		Urates	Urea incr. Albumin, blood, tube-casts
Gastric Catarrh	Normal	High		Urates Oxalates or Phosphates	
Heart and Lung Disease	Diminished	Dark		Urates	Albumin
Jaundice	Normal	Frothy Greenish-brown		Varies	Bile present



§ 239. *Considerations arising out of this section.*—For the detection of changes in the composition of the urine, the ancients were restricted to the evidence afforded by its colour, odour, and what may be called its "texture" (though this term applies usually to solid substances). The evidence was apt to be fallacious because wide differences of composition may produce similar appearances, etc., and differences of appearance do not always denote noteworthy changes of composition.

On the other hand, the limitations in the utility of these simple observations were balanced by the relatively vague conception of the bodily functions. The whole outlook on disease was lacking in detail without being basically incorrect. Thus, many diseased states were ascribed to defective digestive processes, a fact often overlooked to-day in the counter-attraction afforded by the study of diseased conditions which are not so ascribable. To say that the whole body is concerned in digestion is, broadly speaking, correct, especially if we realize that the term digestion covers what we call metabolism. In the Canon, digestion is viewed in two aspects : (1) that which begins in the alimentary canal and ends in the liver : (2) that which is called "maturation," which concerns the digestive products in their course through the body and ending in the tissues. If such maturation is not completed, surplus substances appear, and may undergo sedimentation. The phenomena of disease are attributable to this defective maturation. Consequently, the business of diagnosis and prognosis comes to be a matter of assessing the efficiency or otherwise of maturation.

The study of the urine is therefore directed to this assessment, its different physical properties being noted, both in health and under various unhealthy conditions. Translucence, opacity, separation out into visibility of various substances, the appearance of gaseous matter (in foam), and changes in odour—all these are interpreted in the light of the two-fold division of digestion above referred to: that culminating in the liver, and that culminating in the tissues.

This basis of study is reasonable, and it is not right that they should have been superseded as is the case in modern times. We are armed with a knowledge of innumerable chemical details about the substances met with in metabolism and nutrition in general. We have within our reach the very answers, in vastly improved detail and accuracy, to the selfsame questions which were paramount to Avicenna. But this technical laboratory knowledge tends to be sterile. Urinalysis informs us of the presence of ab-

normal substances, and of the amount both of these and of normal urinary constituents. By their means we reach conclusions about the functional capacity of various organs, and decide whether organic renal disease is present or not. But this is insufficient. In the first place, these organs belong really only to one system—the nutritive; and in the second place, the illness has proceeded to another phase before the information from the analysis is available.

Moreover, the clinician has already taken up his tale before the laboratory work can possibly reach completion, so that those whom he instructs naturally receive the impression that such work is parenthetical, if not purely ritualistic. The clinical aspect of the case is discussed on its own merits, as might be done with a museum specimen which is possibly unusual, or with some topic for a connoisseur. The pathological aspect of the case, again, has a different, and separate interest.

It is not enough to combine these different aspects. Functional activities, morbid states, and clinical manifestations must *centralise in the patient*, and they do so, not because he happens to exhibit them all, but because they are one unity—himself. The organs whose capacity has been assessed are the gateways of entrance and departure; the crafts of the body—its real life—proceed in the tissues, which are the analogues of streets, houses, shops, plazas and bazaars. There are also the gateways of the senses, and these are direct routes into the audience-chamber of the presiding sultan himself. But he is not a separate being. He is *in* every member of the community—organs, tissues, sense-organs. Equity reigns throughout, and must be considered as much as the invaders of his domain.

So if we visualize in a practical form everything that is relevant, we must not forget the dynamic aspect of the matter. Changes are going on hour by hour, and the laboratory cannot keep pace with them. Consequently, we shall in the end make use of the self-same data which Avicenna relied on entirely, and we learn from him to scrutinize the urine—not merely to find such things as albumen, blood or pus and casts—but deliberately to know : (1) Is there any insufficiency in the digestive processes in the pre-hepatic stages? (2) If not, is there any hepatic insufficiency, and in what direction? (3) If so, or if there is trouble in the tissues at large, arising out of an abnormal condition of one or more of the "humours"—which is at fault? In what way is it at fault? Is it entirely morbid or not? What degree as well as kind of defect is there—in modern chemical terms? (4) What is the degree of vitality of the patient (Avicenna included "innate heat" in this)? is the vitality increasing, or failing, or inactive?—recovery from illness, or its duration, or succumbing to illness is often primarily a matter of vitality. (5) Other questions.

Such fundamental questions the modern practitioner (even in cities) can still answer from the simple data used of old, and combine them with the intimate study of the pulse, to realize the nature of the processes in the organs and tissues of the sick from day to day, and feel himself actually armed with that *real* insight into the state of the

particular patient which relatives and friends sometimes incorrectly assume him to have.

Changes in the urine were further studied in those days to decide on the presence or absence of inflammatory states in general, on febrile conditions in general, and to draw a relationship between these changes and certain symptoms, such as headache, pains in various parts of the body, palsies. In such cases, the character of the urine reveals the nature of the pathological changes in the humours, out of which the disease has arisen.



THE ALVINE DISCHARGE

675. The following are the characters to note : the quantity ; the consistence ; the colour ; the form or shape ; and the time occupied in the passage of food through the bowel.

1. QUANTITY. If greater than the amount of food taken, the reason lies in abundance of humours ; if smaller in amount, the reason lies in deficient amount of humours, or in a retention of the food in the caecum or colon (in which case, it is the first step to obstruction). The reason may also be that the expulsive power is insufficient.

2. CONSISTENCE. Moist excrement denotes defective digestion or obstruction of some form ; weakness of the mesentery, so that it does not absorb sufficient water from the food; fluxion from the head ; some constituent of the diet which causes the dejection to be moist. If the faecal matter is both moist and viscid, this shows that there is colliquation in the tissues. Fetur is then present. It usually denotes an excess of depraved and viscous humours ; and the fetor is then very great. It may denote the presence of viscous and "hot" constituents in the food, with defective digestive power.

Frothy faecal matter indicates an admixture with flatulent vapours, or exposure to great (innate) heat.

Dry stool results from (*a*) severe toil ; (*b*) dispersal of innate heat ; (*c*) polyuria ; (*d*) igneous heat ; (*e*) dry aliments ; (*f*) a long delay in the intestines—as will be explained in the appropriate chapter. When the faecal matter is both moist and hard, the dryness is due to (*i*) undue delay in the intestines due to moisture which cannot escape ; (*ii*) lack of bile, which serves to help on the excrement.

If there has been no delay, and there is no evidence of moisture in the intestines, it shows that there is a continual dispersion of sanious and pungent effete matter from the liver into the intestine, until the latter has taken it all up.

3. COLOUR. The normal colour is ruddy, owing to the presence of a slight fieriness. If this colour is more marked, it shows that the bile is plentiful. If less marked it indicates defective maturation of the food.

White stool points to obstruction in the biliary passages, and goes with jaundice. If there is also offensive sanious material present it shows that an inflammatory mass has ruptured.

A healthy person who does not take exercise often passes a morbid sanious matter which acts as a purgative and produces a satisfactory evacuation. For by this means laxity of the tissues is avoided (tarahhul, the swelling of the flesh, in horses), which lack of exercise is liable to produce, as we have already explained when speaking of the urine.

Unduly red colour of stool at the acme of a disease often denotes maturation ; it often points to a depraved constitution.

The significations of *dark-coloured or black* stool are similar to those of dark or black urine. It means (*a*) marked oxidation ; (*b*) maturation of a disease due to atrabilious humour ; (*c*) an aliment which colours it ; (*d*) a medicament which procures the discharge of the atrabilious humour. The first is unfavourable ; the second is merely a staining from admixture with black bile ; this cannot be clearly discerned from colour alone, but only by its acridity, bitterness and the churning out of earthy matter from it. Moreover, among its peculiar properties is this,—that it glitters (is self-luminous). The fact of black bile leaving the body, whether it be by the stool or by the vomit, is a bad sign.

Finally, the discharge of pure atrabilious humour per anum is usually a sign of impending death. But the exit of black chyme is beneficial because it shows that the tissues are active in oxidation, and their moisture is used up.

Blackness of stool also denotes admixture with blood, in cases of disease of the liver, intestinal ulcer, or rupture of vessels (Aegineta).

Green stool. This denotes extinction of the innate heat. The colour is due to the verdigris-green type of bile.

Dark-coloured or "livid" stool. This also denotes extinction of the innate heat ; coldness ; considerable mortification in the interior organs. It is a bad sign.

Parti-coloured stool. This is a bad sign. Reference to this is made in Book IV.

Fatty stool. This is met with when the fat of the body is being dissolved out.

Glutinous stool. In this case other tissues as well as the fatty tissue are being liquefied. It is a very grave sign.

Purulent stool. The pus comes from the liver, or stomach, or bowel.

Intensely yellow stool; when occurring at the beginning of a disease it is due to bilious humour. If at the acme, it is useful in that it purges the body (of undesirable substances).

Unusual colours in the stool, and the various colours which have a bad significance are spoken of in the special volume.

4. FORM OR SHAPE. If the faeces are bulky like those of a cow it is because of flatulence, or gaseousness.

5. TIME OCCUPIED IN PASSAGE THROUGH THE BOWEL. When the faeces are passed out too rapidly it is a bad sign; it shows that there is an excess of bile in the gall-bladder, and also a weakness of the retentive power.

A delay in the passages of faecal matter through the body denotes a feeble digestion, coldness of the intestines, abundant moisture; taking too much sleep; flatulence.

THE CHARACTERS OF NORMAL STOOL

676. The stool should be (1) coherent; (2) homogeneous throughout, the water and the solids being intimately admixed; (3) soft and honeylike in consistence; (4) easily evacuated; (5) of a colour tending to yellow (if the colour should resemble that of the food it would mean indigestion); (6) of not very offensive odour, yet not odourless; (7) of a quality which is neither sharp nor biting; (8) it should emerge inaudibly, neither with gurgling, nor flatus, nor creaking, nor foamy; (9) passed at the time customary to the healthy person; (10) in bulk nearly equal to that of the food consumed.

Note that neither homogeneity nor softness is necessarily a laudable character in faeces. These characters may be the result of violent maturation throughout the body, or of oxidation or colliquation. In such cases, these features would be unfavourable signs.

Note, too, that a consistence which is tending to tenuity is not favourable unless there is no rumbling or discharge of flatus at stool; it should not then emerge bit by bit. But one must also be sure it is not being discharged in that form owing to the admixture of some irritant which prevents cohesion.

677. Many authors proceed from the discussion of urine and faeces to other excretions, including the sweat. I consider it more appropriate to deal with these under their appropriate headings in the volume on special diseases.

THE EXPECTORATION

(From Aegineta; Haly Abbas)

§ 240. The expectoration denotes some affection in the organs of respiration.

	Quality.	Cause.	Disease.
<i>Consistence.</i>	Thin and scanty. Moderate; homogenous, white, unctuous.	Attenuated humour. Attenuated humour.	Not fully developed. Acme of a disease; maturation of morbid substances is complete.
	Thick. Indefinite.	Density of humour.	Is declining. Failure of maturation.
<i>Colour.</i>	Black or dark. Yellow, golden, frothy, thin. Intense yellow, golden, frothy.	Intense heat. Deficient maturation.	Outlook grave. Outlook not entirely bad.
	Green. Verdigris green. White. Red.	Presence of green bile. Serous humour. Sanguineous humour.	Bad significance. Fatal sign.
<i>Odour.</i>	Fetid.	Putrefaction.	Lung; air-passages.
<i>Mode of expectoration.</i>	Easy. Difficult.		Good sign. Bad sign.

Any colour other than that of blood is a sign of a bad intemperament produced by pathological heat. Admixture with colours is intermittent.

The sputum may be described as an excrementitious humour which is forced out through the capillaries of the lung. It is contributed to by proteins which are imperfectly elaborated (e.g. hemialbumose) because of defective digestion. The mucoid material within it forms a film over the respiratory mucous membrane, so that gaseous interchanges are interfered with. This is sometimes shown outwardly as cyanosis, especially when the amount of expectoration becomes very considerable —many ounces a day in some cases.

THE SWEAT

"Easterns judge much by the state of the perspiration, especially in horse-training. The sweat must not taste over-salt, and when held between thumb and forefinger and the two are drawn apart, must not adhere in filaments." (Burton, v. 488.)

MENSTRUAL FLUID

This may be mentioned as being one of the excretions. Its characters are usually only noted in relation to lochial discharge.