13-P2) Avicenna, "Canon"\textsuperscript{1}

The Subject Matter of Medicine

Since medicine considers the human body from the standpoint of how it is made healthy and how it sickens, and since we can have knowledge of neither unless it is known through its causes, we must in medicine know the causes of health and of sickness. Now as health and sickness and their causes are sometimes evident to the senses and sometimes only perceived by means of the evidence afforded by the various symptoms (\textit{accidentia}), we must in medicine gain a knowledge of the symptoms of health and sickness. It is a dictum of the exact sciences that knowledge of a thing is attained only through a knowledge of the causes and the origins of the causes—assuming there to be causes and origins. Consequently our knowledge of health and sickness cannot be complete without an understanding both of symptoms and of the principles of being.

There are four kinds of cause: material, efficient, formal, and final. The material cause is the subject in a state of health or disease—the immediate subject is the members and the spirits (\textit{spiritus})\textsuperscript{2}; the more remote subject is the humors; the most remote is the elements. The latter two are in composition when they are subjects, and are liable to vary. But a certain unity is achieved in the composition and alteration of

\textsuperscript{1} Book I, Fen I. Reprinted by permission of Luzac and Co., Ltd., from O. Cameron Gruner, A Treatise on the Canon of Medicine of Avicenna (London: Luzac and Co., 1930), pp. 25—26,29—31, 57—59, 62—63, 77—80, 83—85, 88—92, 107, 110—111. This translation has been considerably modified in certain places in order to present a more accurate rendition of the Latin version of Venice, 1569—Grant.
\textsuperscript{2} "Spirit" in Galenic medicine usually means one of three fine substance produced in the body and capable of carrying out basic physiological functions. See pp. above/below [??]
any such thing composed, and this unity to which the many things are reduced is called either the complexion or the form: complexion in regard to alteration, form in regard to composition. The efficient causes are such as change or maintain the states of the human body. Namely: the air and affiliated agents; comestibles, potables, and the like; evacuation and retention; locale, cities and habitable places; motion and rest, sleeping and waking; the changes at the different periods of life, and in occupations, in habits and customs; and in those things affecting the human body by contact, whether contrary to nature or not. The formal causes are the complexions, the faculties (virtutes) proceeding from the complexions, and the compositions. The final causes are the actions (operationes). A knowledge of these presupposes a knowledge of the faculties and the spirits, which are the subjects of the faculties, as we shall show.

These, then, are the subjects which pertain to medicine. Familiarity with them gives one insight into how the body is maintained in a state of health, and how it becomes ill. A full understanding of how health is conserved, or ill-health removed, depends on understanding the underlying causes of each of these states and of their “instruments”: for example, the regimen in regard to food, drink, choice of climate, regulations regarding labor and repose, the use of medicines, operative interference. Physicians treat of all these points under three headings, as will be referred to later—health, sickness, and a state intermediate between the two. But we say that the state which they call intermediate is not really a mean between the other two.

Now that we have enumerated these groups of causes we may proceed to discuss whatever medicine has to say concerning the elements; the complexions; the humors, or fluids of the body; the bodily members, simple and composite; the spirits and their natural, animal and vital faculties; the functions; the states of the body—health, sickness, intermediate conditions; and their causes—food, drink, climate, water, localities of residence, exercise, repose, age, sex, occupation, customs, race, evacuation, retention; the external accidents to which the body is exposed from without; the regimen, in regard to its food, and drink; and medicines and manual operations, for
conserving health and curing every illness. [. . . ]

The Complexions

The complexion is that quality which results from the mutual interaction and interpassion of the four contrary primary qualities residing within the elements. These elements are so minutely intermingled as each to lie in very intimate relationship to one another. Their opposite powers alternately conquer and become conquered until a quality is reached which is uniform throughout the whole: this is the complexion. Inasmuch as the primary powers in the aforesaid elements are four in number (namely, heat, cold, moisture, dryness), it is evident that the complexions in bodies undergoing generation and destruction accord with these powers. A simple rational classification is into two modes. One is the equable or balanced, in which the contrary qualities are present in the complexion in equal quantities—neither of them being in excess or deficiency. This complexion is the quality which is exactly the mean between the two extremes. The other mode is when the complexion is not the absolute mean between the contraries, but tends a little more to one—whether between hot and cold, between moist and dry, or both.

A complexion, as understood by medicine, is never strictly equable or strictly inequable. The physician should abide by the philosopher who is aware that the really equable state we have defined cannot be found, especially in a human complexion or member. The term “equable,” used by doctors in their treatises, does not refer to weight but to an equity of distribution (justitia in divisione). It is this distribution which is the primary consideration in the complexion—whether of the body as a whole, or of some individual member—so that the measure of the elements in it, as to quantity and quality, is that which human nature ought to have—both in best proportion and in equity (equitatem) of distribution. As a matter of fact, this distribution of qualities, such as is characteristic of man, actually is very close to true equality . .

In saying a medicine is temperate (that is, of equable complexion or
temperament), we do not use this expression in the absolute sense, because that would be an impossibility. Nor do we mean that it is tempered corresponding to the complexion of the human temperament, for in order to be that the medicine would have to be actually composed of human substance. We mean this—that when the medicine is exposed to the action of the innate heat within the human body, its quality will not overreach either of the limits of the range of equable temperament proper to the human being. Consequently it will not produce an effect beyond those limits. Therefore, in regard to its actions within the human body it is of equable complexion. Similarly, when we say a drug is hot or cold, we do not mean an absolute heat or coldness of substance, or that it is hotter or colder in substance than is the human body; for if it were so, a drug whose complexion was like the human complexion would be temperate. What we mean by the statement is that through the drug hotness or coldness comes to the body, over and above that which it has itself. Consequently a medicament may be at the same time cold—that is, compared with the human body—and hot—that is, compared with the body of a scorpion; it may be at the same time hot—that is, compared with the human body—and cold—that is, compared with the body of a serpent. More than that, a medicament may be hotter towards the body of Peter than it is to the body of Paul. It is therefore essential for those who wish to alter a complexion to abandon any medicine which cannot have the effect desired.

What a Humor Is, and What Kinds There Are

A humor is a fluid, moist body [substance] into which our aliment is transformed. A good humor is such as has the capacity for becoming transformed into actual body-substance, either by itself or in combination with something else. In short, it is that which replaces the loss which the body substance undergoes. The residue from such, the bad humor, does not do this, and is only exceptionally convertible into good humor. It is proper that it should be expelled from the body instead. . . . The humors are of four kinds: blood (the best of them all), phlegm, red bile, and black bile.
In nature the blood is hot and moist, and is either normal or abnormal. Normal blood is red in color, has no unpleasant odor, and has a very sweet taste. When blood is abnormal, it is either because its good complexion has become intrinsically altered or vitiated—i.e., has become colder or hotter—but not from admixture with any foreign matter; or because bad humor is mixed with it. This may happen by a humor coming to it from without, penetrating and corrupting it, or by the production of another humor within it—for example, a part of it might decay, the rarefied product becoming red bile and the denser product becoming black bile, and either one, or both together, might remain in the blood.

Phlegm can also be either normal or abnormal. The normal is such as is capable of transformation into blood at any time, seeing that it is in fact an imperfectly matured blood. It is a sort of sweet phlegm which is not very cold; that is, it is cold compared with the blood and red bile, but hardly at all cold compared with the body as a whole. The essential function is twofold: one is that it must be near the members in case they should be deprived of their habitual nutriment (which is healthy blood) by reason of retention of the material, created in the stomach or liver, from some cause. Phlegm is normally acted upon by the natural faculties, which change and digest it and are themselves maintained thereby. The transformation of phlegm into blood is achieved by the innate heat; external heat only putrefies the material and decomposes it.

Red bile too can be either normal or abnormal. The normal form is the foam of blood, red and clear in color; it is light and pungent. The redder its color, the hotter it is. It is formed in the liver, and then pursues one of two routes—it passes either into the blood or into the gallbladder. That which moves with the blood serves both a necessary and an accessory function: its necessary function is to mix with the blood for the proper nourishment of those members in whose complexions red bile is present in a dispersed form, e.g., the lung. Its accessory function is to attenuate the blood so as to enable blood to traverse the very minutest channels of the body.

Black bile can also be either normal or abnormal. The normal form is the lees of
good blood, its sediment or residue; in taste it is between sweetness and bitterness. It is formed in the liver and then divides into two portions, one of which enters the blood, and the other goes to the spleen. The portion which moves with the blood serves both a necessary and useful purpose: necessary because it mixes with the blood as required to nourish those members in whose complexions black bile is present, e.g. the bones; useful because it draws the blood together, thickens and strengthens it. The portion which passes to the spleen is that which the blood does not require, and there serves both a necessary and a useful purpose: necessary because it cleanses the entire body of superfluity and nourishes the spleen, useful in that by traveling to the mouth of the stomach by a sort of milking movement it tightens, strengthens, and thickens it, and by its bitterness causes a disturbance there, exciting it to hunger and creating an appetite. [. . . ] And just as the red bile then arouses expulsive forces below, so the black bile then arouses appetitive forces above . . . .

The Production of the Humors

Aliment undergoes a certain digestion in mastication. The lining of the mouth is continuous with that of the stomach, there being as it were one surface, and therefore contains a digestive force (*virtus*). [. . . ] Some say that a sign showing us that food is already somewhat digested in mastication is that previously there is neither odor nor taste in it. Once the aliment has entered the stomach, true digestion goes on—not so much by reason of the heat of the stomach as by reason of the heat of the enveloping members: on the right, the liver; on the left, the spleen (the spleen warms not in virtue of its own substance, but in virtue of the many arteries and veins within it); in front, the abdomen, whose fat easily takes up heat and reflects it back to the stomach; above, the heart, which warms the stomach by way of the diaphragm.

The first stage of digestion yields the essence of the aliment, which, in many animals, becomes “chyle” by the help of admixture with the fluid which one has consumed; this is a liquid substance, of the consistency of a *ptisan*. The portion of this
chyle which is thus diluted is drawn from the stomach into the intestines, and then is caused to enter into the mesenteric veins: fine, firm vessels which are found all along the intestinal tract. Through these it comes to the vein called the gateway to the liver [portal vein], enters the liver, and travels along finer and ever finer hair-like channels until it comes to the roots of the vein [vena cava] emerging from the convexity of the liver. The passage of the nutriment through these very narrow channels could not take place were it not admixed with water consumed in excess of the strict requirements of the body. When it is distributed through these channels, the liver is almost completely in contact with the whole of the chyle, and for this reason its action is then more violent, stronger, and quicker, and the chyle is digested.

In every digestion of this sort there is to be found a foam and a sediment, and perhaps as well something burnt (if the digestion was extreme) or something uncooked (if the digestion did not proceed far enough). The foam is red bile; and the sediment is melancholy [black bile], both normal. The attenuated portion of the overcooked product is bad red bile, and the denser portion bad black bile, both abnormal; and the uncooked material is phlegm. But if the digestion is a proper one, what is formed is blood. As long as it stays in the liver, the blood is more attenuated than it should be, because of the excessive wateriness which is necessary for the reason we have given. But when the blood leaves the liver it is freed from this excessive wateriness, which was needed only for a reason no longer valid. The wateriness is taken from the blood into the veins which go to the kidneys, carrying with it the blood quantitatively and qualitatively proper for their nutrition. The fatness of these fluids nourishes the kidneys; then what is left passes to the bladder and finally to the penis. [ . . . ] You must remember that hot and cold, among other things, are causes of the production of the humors. When the heat is equable, blood forms; in excess, it forms red bile; in very great excess it forms black bile, due to the burnt residue. Cold produces phlegm and in great excess produces black bile, because of the excessive condensation. [ . . . ]
On the Faculties

Physicians recognize three kinds of faculties and of functions deriving from them: the vital, the natural, and the animal. It is held by many philosophers and all physicians, foremost Galen, that each faculty has its own principal member, which is its seat, and from which its functions emerge. They hold that the seat of the animal faculty is the brain, and that its functions originate there; that the natural faculty is twofold—one aspect concerned with the welfare and preservation of the individual and securing nourishment to it to the end of life (the seat of this aspect and the source of its functions being the liver), and one concerned with the preservation of the race, governing generation and separating out from the bodily humors the spermatic substance (the seat of this aspect and the source of its functions being the testicles); and that the vital faculty is that which conserves the spirit, which is the vehicle of sensation and movement, and makes it able to receive these impressions when it reaches the brain, and makes it capable of imparting life wherever it spreads (the seat of this faculty and the source of its function being the heart). The greatest of all philosophers, Aristotle, holds that the heart is the source of all these functions, though they are manifested in the aforesaid organs [. . . .]

What a Member Is and What are Its Components: The Simple Members

3. The nerves. These are structures arising from the brain or spinal cord. They are white, soft, pliant, difficult to tear, and were created to subserve (a) sensation, (b) movement of the limbs.

6. The arteries. These structures arise from the heart. They are hollow, elongated, fibrous, and of ligamentous consistence. Their movements consist in expansion and contraction, which distinguishes them from the veins. They were created in order to enable the heart to be ventilated, fuliginous vapor to be expelled therefrom, and the breath distributed by their means to all parts of the body.

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3 "Simple" : Cf. the scholastic sense—homogeneous; indivisible. (See § 19.)—Grant.
7. The veins. These resemble arteries except in so far as they arise from the liver and do not pulsate. Their purpose is to carry the blood away from all parts of the body.

[...]

In every member there is a natural (or vegetative) faculty which subserves its own nutrition. This faculty is the power by which attraction, retention, assimilation, union with nutriment, and expulsion of effete matter are secured. Members may therefore be classified accordingly. But besides that, some members possess a further faculty which passes from them to another member, while others have not such a faculty. Other members again have still another faculty which passes into them from another member, and some have not such another faculty.

The following associations may therefore be assumed: (a) receiving and also giving a faculty; (b) giving and not receiving a faculty; (c) receiving and not giving a faculty; (d) neither giving nor receiving a faculty.

The principal organs necessary for the life of the individual are three in number: 1) the heart, the source or starting-point of the vital power, or innate heat; 2) the brain, the seat of the mental faculties, sensation and movement; and 3) the liver, the seat of the nutritive or vegetative faculties.

Classification of the Members according to their Origin

Some members take their origin from the semen: namely, members composed of like parts, except the flesh and the fat. Other members come from the blood: namely the flesh, and the fat. Other members come from both male and female [semen]. According to the teaching of philosophy, the process of generation may be compared with the processes which take place in the manufacture of cheese. Thus the male semen is equivalent to the clotting agent of milk, and the female semen is equivalent to the coagulum of milk. The starting point of the clotting is in the rennet; so the starting-point of the clot "man" is in the male semen. Just as the beginning of the clotting is in
the milk, so the beginning of the clotting of the form of man lies in the female semen. Then, just as each of the two—the rennet and the milk—enter into the substance of the cheese which results, so each of the two—male and female semen—enters into the substance of the embryo.

Galen gives a contrary account. He considers that each of the semens has both a coagulative power and a receptive capacity for coagulation; so he says that the coagulative power is stronger in the male than it is in the female, but the receptive capacity for coagulation is stronger in the female than the male.

But the real truth of the matter is expounded in our own works dealing with the fundamental principles of natural science.

Relations between the Female Menstrual Blood and the Embryo

During pregnancy, the blood which is otherwise discharged from the female at the time of menstruation becomes nutriment (for the embryo) in three ways. One portion is changed into the likeness of the substance of the semen and the members derived therefrom. This is the nutriment which enables growth to take place. Another portion is not nutriment of that kind, but is capable of being aggregated into the material which fills up the interstices in the principal members and becomes flesh and fat. A third portion is effete material, and not utilizable for either of the two preceding purposes. It remains in the same situation until the time of birth, and is then expelled with the infant. After birth, the blood which the liver of the infant makes takes the place of the maternal blood. So it arises from an organ which itself was formed out of the maternal blood. The flesh of the infant is derived from the gross blood, congealed by heat and dryness [cf. the fact that a moderate degree of heat coagulates egg-white]. The fat of the infant is derived from the aquosity and unctuosity of the blood, which cold has congealed and heat dispersed.

The Pulse
**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.

**Description.** Every beat of the pulse comprises two movements and two pauses. Thus, expansion . . . pause, contraction . . . pause.

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 knowledge. After that, the doors of the pulse 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;

**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. 3) the artery runs in a straight course, which is no small help towards accuracy of diagnosis; and 4) the distance from the heart is not great.

**Technique in Feeling the Pulse**

*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.

*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.

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. Comparison with a normal pulse is thus possible.

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 [Expansion] The kind of pulse [may be given] 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”. [In addition] there are nine compound varieties.

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.

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 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.

2) **Quality of Impact** (lit. *knocking at*) imparted to the finger of the observer at each beat. The varieties are three: strong—this resists the finger during expansion; weak—the opposite character; and the intermediate.

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.

4) **Consistence of the artery** (resistance to the touch). There are three variants: soft or easily compressible; hard, firm or incompressible; and one of moderate compressibility.

5) **Emptiness or fullness** of the vessel between the beats. The full (high) pulse seems to be overfull of humor and gives the impression that it needs liberating. The empty (low) pulse is contrary in character. There is an intermediate between the two.

6) **The feel of the pulse.** Whether the pulse feels hot, cold, or intermediate.

—The remaining features concern several beats—

7) **Duration of time occupied by the pauses.** 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.

8) **Equality or inequality** of force in successive beats.

9) **Regularity or irregularity; orderliness or disorderliness**

10) **Metre; rhythm; harmony; measure; accent.**
The Urine

It must be collected in the early morning; it must not have been kept over from the night before. The person must not have taken either food or drink before passing it. The previous food must have been free from coloring 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 color of the urine similar to themselves). The patient should not have been given an agent which expels some humor (a cholagogue or phlegmagogue) by the urine.

Physiological state: The patient should not have undertaken severe exercise or toil, or be in a praeternatural mental state; for in each case the color 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 color 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 color changes; the sediment goes partly into solution; and the density increases. Personally I think that such changes begin within an hour. 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. 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.

Inspection of Urine

The following are the points to observe in a sample of urine: quantity, odor, color,
foam, texture, clearness, and sediment. Some persons add other two: the feel and the taste, but we reject them as objectionable.

The degrees of yellowness: Among the shades of yellow color 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 in temperament, in degrees varying with the amount of exercise, pain, fasting, and abstinence from water. The fourth variety denotes predominance of the bilious humor.

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 humor, for dullness of color points that way. A flame-yellow shows the presence of more heat than dull red because it shows there is bilious humor in it, and this is hotter than sanguineous humor.

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.

Deepening of color from lemon-yellowness towards a flame—yellow shade shows that the innate heat is steadily increasing. The color 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 odor, 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 odor.

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 (i.e. its color becoming normal) 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 unfavorable unless the change has been gradual and progressive.

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 is not subsiding, the advent of dropsy is to be feared.

Fasting is among the conditions which render the urine high-colored and of marked acridity. [ . . . ]