

XI.—A Medical Theory of Cognition

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The first and last paragraphs taken together constitute a summary of this paper.

The primary purpose of the author of the medical work *De Morbo Sacro* contained in the Hippocratic Corpus is his attempt to explain on rational grounds the nature and causes of epilepsy and at the same time to combat the popular superstitions currently existing relative to the "sacred" disease. Because his explanation takes the form it does, basically involving the brain, the author is induced in several places to express his beliefs also concerning the nature of psychical phenomena. Though these statements are for the most part merely *obiter dicta* and are unnecessary for the development of the medical doctrine which is his main theme, they, combined with other ideas which are only tacitly implied, furnish evidence that the author of the work had formed a definite conception and explanation of the mental activities of the organism. It is in fact possible to reconstruct from the treatise a psychological theory which, though it is in some directions incomplete and is not worked out in all the detail that might be desired, is yet of much intrinsic interest, as well as of historical interest, since it shows relationship in some points to the psychological and philosophical theories of earlier thinkers. It is of incidental importance also as exhibiting the psychological doctrine of a physician (of probably the last quarter of the fifth century B.C.), and illustrating in this connection some aspects of the interrelationship between contemporary medicine and philosophy, a factor of profound importance to both disciplines during the latter half of the fifth century.

The author of *De Morbo Sacro* is, as the breadth of his conceptions and his insistence that all phenomena have a natural explanation show, philosopher as well as physician, though predominantly the latter. Like some others who wrote on medicine during this period, he is eclectic, and his psychological theory reflects in some aspects the influence of two preceding thinkers who had also

attempted to give an account of cognition — Alcmaeon of Croton and Diogenes of Apollonia.¹

Alcmaeon's great discovery with reference to the theory of cognition, resulting probably in part from his anatomical researches on the physical organism, led him to conceive the brain to be the essential organ of intelligence and sense-perception. In his view, modifications of the sense-organs were conveyed to the brain through "pores," which were somehow connected with the brain, in which perception resulted. Further, a distinction was made by Alcmaeon between sense-perception and intelligence, the latter being restricted to man.² This basic importance of the brain in cognition is also

¹ Some influence on the part of these two thinkers has long been accepted. Diels-Kranz, *Die Fragmente der Vorsokratiker*,⁵ 64 C 3a, includes parts of chapters 16 and 17 (Littre) of *De Morbo Sacro* as having been influenced by Diogenes' doctrines, and Vors. 24 A 11 assigns two sentences from chapters 14 and 17 (Littre) as reporting the teachings of Alcmaeon. Regarding the *De Morbo Sacro* 17 (Littre), Diels also remarked (cf. on Vors. II 68.11): "Hipp. hat die Pneumatik des Diog. durch seine scharfe Betonung des Gehirns als Sitz der *ἐννοεῖς* nach dem Vorgang des Alkmaions ausgebaut," which is perhaps correct, as far as it goes. J. I. Beare, in his basic book, *Greek Theories of Elementary Cognition from Alcmaeon to Aristotle* (Oxford, 1906) 269, mentioned the theory contained in the treatise as stressing, like that of Alcmaeon, the function of the brain.

Max Wellman, in a learned article, "Die Schrift *Περὶ ἰσῆς νόσου* des *Corpus Hippocraticum*," *Sudhoffs Archiv für Geschichte der Medizin*, 22 (1929) 290–312, discussing the *De Morbo Sacro* as a whole, would apparently trace almost every significant idea in the treatise directly back to Alcmaeon, with no, or only slight, modification. This attempt to derive the doctrine of the treatise so completely from the doctrine of Alcmaeon is rejected by H. Diller, *Wanderarzt und Aitiologe* (*Philologus*, Supplementband 26, Heft 3 [Leipzig, 1934]) 113 and note 176. Diller points out that the author of *De Morbo Sacro*, though perhaps influenced by Alcmaeon, really works out an original theory, and urges especially the improbability that the treatise could reproduce so directly as Wellman thought the ideas of a thinker a hundred years earlier. I believe that Diller is essentially correct in his objection, though the argument from chronology has less cogency in view of the present uncertainty as to Alcmaeon's date. Recent estimates of his *floruit* have ranged from the latter part of the sixth to the latter part of the fifth century B.C. (cf. L. Edelstein, *AJPh* 63 [1942] 371). In my opinion, the evidence is not really adequate to substantiate Wellman's attribution of the doctrines of *De Morbo Sacro* so immediately and completely to Alcmaeon.

Wilamowitz, in "Die hippokratische Schrift *Περὶ ἰσῆς νόσου*," *SPAW*, 1901, 2–23 esp. 12–14, argued that chapters 14–17 (Littre) were not originally part of the work, but interpolated from another source. Later research, however, seems to have established the unity of the treatise. Cf. O. Temkin, *Bulletin of the Institute of the History of Medicine*, 1 (1933) 279–302; M. Pohlenz, *Hippokrates* (Berlin, 1938) 33 and note 2; and Wellman, *op. cit.* 308–10.

² The precise interpretation of Alcmaeon's doctrine, because of the paucity of our fragments, is very uncertain (as it apparently was in the time of Theophrastus), though the major principle concerning the brain seems well established. The testi-

developed by the author of *De Morbo Sacro*, but it is very probable that his conception of the nature and function of the organ differs greatly from that of Alcmaeon.

The psychological conceptions of Diogenes of Apollonia were radically dissimilar to those of Alcmaeon. An eclectic philosopher, Diogenes, reviving the monistic doctrine of Anaximenes, assumed air as his primary element. But, being influenced by Anaxagoras' doctrine of *Nous*, he conceived air to be psychical in nature, so that, for Diogenes, air was not only the primary substance but the principle of intelligence as well. Air contained intelligence within itself by virtue of its own nature. Sense-perception and thought in the organism Diogenes explained by the mingling of the exterior air (or its impressions), entering the body through the various sense-organs, with the interior air around the brain, in connection with the air in the heart or thorax.³ It is to be noted that the brain itself was of no significance to the theory of Diogenes.

Now, what was at the time unique in the psychological theory of Diogenes is also reflected in *De Morbo Sacro*, but with a new significance. As in the case of Alcmaeon's basic hypothesis, so with Diogenes' theory of the psychical nature of air. Analysis of the psychological theory of the *De Morbo Sacro* and reconstruction of it, so far as that is possible from the explicit statements and by inference from some of the medical doctrines, will make it clear that, while ideas which are derived ultimately from Alcmaeon and Diogenes unquestionably play an important part in forming the author's theory, what emerges is a new conception. The writer is neither a crude imitator nor mechanical eclecticist of the views of his predecessors.⁴ The most obvious indication of this is perhaps

monia concerning the importance of the brain are found in *Vors.* 24 A 5, A 8 (Plato's *Phaedo* 96 B) A 11, B 1a. Beare, *op. cit.*, especially 251-2 and note 1, has discussed the evidence with due caution. Alcmaeon's real conception of the function of the brain is probably not now discoverable.

³ More evidence is available for the psychology of Diogenes, since Theophrastus, *De Sensu* 39-48, provides an excellent exposition and criticism of his system. Beare, *op. cit.*, especially 258-60 (on the *sensus communis*), furnishes a sound interpretation of Diogenes' whole theory.

⁴ F. Willerding, *Studia Hippocratica* (Göttingen, 1914) 18-24, reviews a number of passages in *De Morbo Sacro* which, so he thinks, show similarity to ideas of Diogenes, and notes also in passing some disagreements. Considering the eclectic nature of the period during which the work was written, it would not be surprising if the author were influenced in various ways by his predecessors. Other works of the Corpus illustrate the same attempt to combine doctrines of earlier thinkers, and to apply cosmological theories to medicine.

the comprehensive manner in which he undertakes to apply his hypothesis concerning the function of the brain also to the explanation of diseases. For physiological as well as psychical phenomena are, for him, traceable to that organ.

It is of primary importance to understand as clearly as possible the peculiar nature and function of *ἀήρ* or *πνεῦμα*⁵ in the thought, both medical and psychological, of the author of *De Morbo Sacro*. In this respect the theory of the author doubtless shows some degree of filiation from the thought of Diogenes, whose doctrines concerning air were already in 423 B.C. so notorious that they could be parodied by Aristophanes in the *Nubes*⁶ and influenced other medical writings also, for instance, *De Flatibus*.⁷ For Diogenes clearly conceived that air, his primary element, contained intelligence or thought within itself. No aspect of his philosophy is better authenticated in the surviving fragments. Air is "divine," and is both *ψυχή* and *νόσις*⁸ in man (*Vors.* II 60.21). If air is lacking to man, *ἡ νόσις ἐπιλείπει* (*Vors.* II 61.2). Again, most pointedly: *καὶ μοι δοκεῖ τὸ τὴν νόσιν ἔχον εἶναι ὁ ἀήρ καλούμενος* (*Vors.* II 61.4). There are many forms or modifications of air and therefore of *νόσις* (*Vors.* II 61.11; cf. 62.7). All things live and see and hear by air, *καὶ τὴν ἄλλην νόσιν ἔχει ἀπὸ τοῦ αὐτοῦ πάντα* (*Vors.* II 62.9). Finally, air is described as *πολλὰ εἶδος* (*Vors.* II 66.5). The same conception of the nature of air is reported and elaborated on several levels in the doxography, particularly throughout Theophrastus'

⁵ The two words are fairly consistently distinguished in the usage of the author, *ἀήρ* being the outer air, *πνεῦμα* being the air which has been drawn into the body. There is no intrinsic qualitative difference between the two, though the *pneuma* is capable of being affected and altered by the moisture and heat of the body. Also, in appropriate contexts, *pneuma* is used also for "winds."

⁶ Cf. especially *Nubes* 225 ff., and the summary of Aristophanes' parody of Diogenes in W. Theiler, *Zur Geschichte der Teleologischen Naturbetrachtung bis auf Aristoteles* (Zurich, 1925) 8-10. Theiler shows that the influence of Diogenes' teleology was widespread, very likely extending to certain aspects of Socratic thought.

⁷ The influence of Diogenes on this treatise, especially chapter three, is very direct and extensive. Cf. W. A. Heidel, *Hippocratic Medicine* (New York, 1941) 52 f. But a comparison of this work with the *De Morbo Sacro* will show how differently the two authors adapted Diogenes' doctrine of air. In *De Flatibus*, air is of no importance at all from the point of view of cognition.

⁸ This is the word regularly used by Diogenes in the extant fragments for the psychical function of air, and seems to be peculiar to him. No other usage by the Pre-Socratics is cited by Diels-Kranz, *Vors.*, Index. The word was doubtless adopted by Diogenes under the influence of the *nous* of Anaxagoras, the conception of which seems to have shaped Diogenes' conception of *noësis*.

explanation and criticism⁹ of Diogenes' theory of sensation and thought. For instance, it is stated most unequivocally in the following comment of Theophrastus with reference to the theory of vision Diogenes advanced: *ὁ ἐντὸς ἀὴρ αἰσθάνεται μικρὸν ὢν μόριον τοῦ θεοῦ* (Vors. II 56.3),¹⁰ that is to say, it is really the internal air conceived as constituting the *ψυχή* which perceives and thinks. Thus, for Diogenes, *νόησις* is an immaterial and immanent principle of air; air is intelligent and is consequently the source as well as mechanism of all psychical activity in man. It seems likely that the remarkable conception of *noësis* as an attribute of the material principle¹¹ was suggested by and developed rather closely from the *Nous* of Anaxagoras, to which it bears considerable resemblance.

Now, though it is elaborated and worked out in a significantly different manner, this conception of air as the source and principle of intelligence in the organism is explicitly stated and frequently implied in *De Morbo Sacro*. The hypothesis is perhaps most bluntly expressed in the following: while the brain has the important function of interpreter to us *τῶν ἀπὸ τοῦ ἥερος γινομένων*, yet *τὴν δὲ φρόνησιν ὁ ἀὴρ παρέχεται* (19.3).¹² Again, in the immediate context, the

⁹ From his criticism (*De Sensu* 46-48), it becomes especially evident that Theophrastus interpreted Diogenes as meaning that air itself contains *noësis*, and on this basis was therefore the ground of psychical functions in man. It is the "symmetrical" mingling (*krasis*) of the outer and the inner air which is the mechanism of perception, and thought is the activity of the purest, driest air (moisture being inimical to thought) throughout the whole body but especially around the brain and in the thorax or heart (cf. Beare, *op. cit.* 256-8). Theophrastus points out that Diogenes' theory does not restrict sensation and thought as peculiar to animate beings, since they would result wherever air "mingles" symmetrically and under the proper circumstances. Diogenes, for instance, had taught (cf. *De Sensu* 44) that plants lack intelligence because they lack ducts to admit the necessary air.

¹⁰ Theophrastus' description of the inner air may be taken as equivalent to the soul, since for Diogenes the *psychê* was the internal warm air (cf. Vors. II 60.21; 61.15-17), and the air itself was "divine." Thus it was ultimately the *psychê* which perceived and thought.

¹¹ It seems improbable that Diogenes thought of the *noësis* of air as an actual entity. Rather, it was an attribute which he was logically persuaded to assign to his primary element by his desire to derive all phenomena by alteration from his primary substance, by the conception of the Anaxagorean *nous*, and by the teleological view of nature which is such a prominent aspect of his thought. This is indicated also by the use of the word *noësis* itself, and by his close connection of *psychê* and *noësis*. Cf. Aristotle, *De Anima* 405A.21, and the explanation he offers as to why Diogenes took the soul to be air. T. Clifford Allbutt, *Greek Medicine in Rome* (London, 1921) 110 and note 1, suggests that Diogenes conceived *noësis* really as "mind-stuff."

¹² Almost the same statement is found earlier in *Morb. Sacr.* 10.23. Citations from the treatise are made from the text of W. H. S. Jones, Loeb *Hippocrates*, II (1923), which differs somewhat in chapter divisions from the text of Littré.

author asserts that the whole body shares in *phronêsis* in proportion to its participation in air (19.7),¹³ presumably by means of the *pneuma* passing through the vascular system, mingling with the blood, and reaching all or most parts of the body. This idea of air as the source of *phronêsis* for the brain and the body is specifically expressed once again: *τῆς φρονήσιος τοῦ ἥερος πρῶτος αἰσθάνεται* (sc. ὁ ἐγκέφαλος) *τῶν ἐν τῷ σώματι ὄντων* (20.30). These passages express the same hypothesis: that the outer air, when it enters the body, is the source of *phronêsis* for the organism. This, however, leaves the precise status of the *phronêsis* of air or *pneuma* somewhat uncertain and possibly susceptible of varied interpretation. This difficulty is partially clarified by the hypothetical argument introduced next by the author (19.10 ff.): when man draws *pneuma* into himself, it first goes to the brain, then is dispersed to the rest of the body, καταλειπὼς ἐν τῷ ἐγκεφάλῳ ἐωντοῦ τὴν ἀκμὴν καὶ ὃ τῇ ᾧ φρόνιμόν τε καὶ γνώμην ἔχον. If, though this is contrary to the fact, the *pneuma* went to the rest of the body first and then to the brain, then ἐν τῇσι σαρκὶ καὶ ἐν τῇσι φλεβὶ καταλειπὼς τὴν διάγνωσιν,¹⁴ it would reach the brain hot, impure, and imperfect. This would happen because the *pneuma*, ἐπιμεμιγμένος τῇ ἰκμάδι τῇ ἀπὸ τε τῶν σαρκῶν καὶ τοῦ αἵματος (19.19),¹⁵ would be altered, with a consequent modification and

¹³ The implication here and in the following argument that *phronêsis* is a variable quantity or quality should be noted. Jones daggers this sentence as a gloss, arguing (*op. cit.* 333) that it is inconsistent with the later denial of intelligence to the diaphragm and heart (ch. 20). However, this does not seem correct. The apparent inconsistency probably has another solution, and the idea contained in the sentence recurs elsewhere in the work, even if it is not stated so obviously. Most important, the sentence is really required, since it actually explains and justifies the claim made in the previous sentence (i.e., that the hands, feet, etc. do whatever the brain discerns). The meaning of the sentence should not be pressed too literally.

The idea is similar, though there is an obvious difference, to that of Diogenes reported by Simplicius (*Vors.* II 62.12): τὸ σπέρμα τῶν ζῶων πνευματώδες ἐστὶ καὶ νοήσεις γίνονται τοῦ ἀέρος σὺν τῷ αἵματι τὸ ὅλον σῶμα καταλαμβάνοντος διὰ τῶν φλεβῶν. The author of *De Morbo Sacro* would hardly agree with this as stated, especially with the first part, but there is some general agreement.

¹⁴ Diels, on *Vors.* II 68.21, proposed to read instead of this word τὴν ἰδίην γνώσιν. The emendation is not unlikely and would express an idea in accordance with the doctrine of the nature of air held by the author, that air contained a peculiar, inherent psychical property. It is true that *diagnôsis* is a rather strange term to apply to the *phronêsis* of *pneuma*. But in this statement the author probably had in mind the function of *phronêsis* in the brain, and its use seems justified by the occurrence of διαγινώσκωμεν in a context referring to the function of the brain (17.6). Perhaps, too, the common medical use of the word influenced him here.

¹⁵ The author is reflecting in part a definite point of Diogenes, the doctrine that moisture was harmful to thought (cf. Theophrastus in *Vors.* II 56.17 ff.). The word

diminution of the *phronêsis* which it contained. Though the author was here attempting to express a difficult conception and one which he perhaps comprehended not too concretely, this hypothetical argument must surely show that air in itself is conceived as the source of *phronêsis*, which is somehow deposited in the brain and then pervades the organism generally.¹⁶ Equally, though the language is not unambiguous, it seems certain that the *phronêsis*¹⁷ of air is thought of as an actual entity (whether substantial or not), a quality or *dύναμις* of air, of such a nature and function that it could properly be conceived as the potential source of intelligence in the body. This conclusion is suggested¹⁸ particularly by the theory that *pneuma* leaves in the brain *ἑωυτοῦ τὴν ἀκμὴν καὶ ὃ τι ἂν ᾗ φρόνιμόν τε καὶ γνῶμην ἔχον*, before it is further dispersed so as to make sensitive and animate the organism. There is here also a clear inference that *phronêsis* varies qualitatively, as well as quantitatively.

If then it is air which is the source of *phronêsis*, one must ask whether the author has a clear conception of the manner in which air is introduced into the body and distributed so that its intelligence may be utilized. The theory the writer holds is that of *ἀναπνοή*, and the process is described at some length in two passages. When air is breathed in through the mouth and nostrils (10.13-27;

ικμάς was a technical term of Diogenes (cf. Diels-Kranz' citation of the usage on *Vors.* II 68.22). But the objection that the *pneuma* would be "hot" and therefore inferior would not be in accordance with Diogenes. It is also doubtful whether the moisture which Diogenes thought to be hostile to thought was the moisture of the blood and flesh.

¹⁶ The same idea is expressed and implied more generally a great number of times in medical remarks, when, for example, it is said that the veins do not receive air and hence men *οὐδὲν φρονέουσιν* (e.g. 10.6, 24); but when the veins receive air again, they become intelligent again (10.53, 12.7).

¹⁷ The word is probably best translated by "intelligence," though, as Jones (*op. cit.* 179, note 1) says, there are really no equivalent terms in modern psychology for most of the concepts used in *De Morbo Sacro*. Since the treatise is written in the Ionic dialect of science, most of the terms used have a different meaning compared with the same word in Attic. Wellman, *op. cit.* 291, note 1, translates *phronêsis* as "das Vorstellungs- und Willensvermögen, das im ganzen Körper steckt, soweit er an Pneuma teil hat." However translated, the *phronêsis* of *De Morbo Sacro* and the *noêsis* of Diogenes must be of a very different nature, as conceived by the two men.

¹⁸ This is implied again (20.30) when it is said that the brain, since it first perceives the *phronêsis* of air, becomes different from itself whenever a violent change takes place in air because of the seasons. The modification of the brain indicated here is also psychical, not simply physiological. It is evident that the author encounters some difficulty in trying to conceive realistically the nature of *phronêsis*. But it is to his credit that he does not, like Diogenes, solve the difficulty by saying that the air is "divine" or the *psychê*.

cf. 19.10 ff.), it goes first to the brain, then, for the most part, to the belly¹⁹ to "cool" it, but some also to the lungs and veins, and thence to other parts of the body. The function of this air, primarily, is that it furnishes *phronêsis* to the brain (10.23). Earlier, because it is vital to his explanation of the cause of epilepsy, the vascular system of the body has been described fairly extensively (ch. 6 and 7). There are some points in this description of interest for the present purpose. The veins from the whole body extend to the brain, many thin ones and two thick ones, from the spleen and the liver. The latter (*κοίλη φλέψ*) stretches below the liver to the foot; above the liver it passes through the diaphragm and lung, and branches off to the heart and arm. Continuing upward through the neck, it branches near the ear, the *παχύτατον καὶ μέγιστον καὶ κοιλότατον* part ending in the brain, the other parts ending in the ear, the eye, and the nostril (the vein from the spleen is analogous, except thinner).²⁰ Immediately following this description of the vascular system, the author continues with the statement that we take in the greater part of our *pneuma* through these veins²¹ *αὐται γὰρ ἡμῖν ἀναπνοαὶ τοῦ σώματος τὸν ἥερα ἐς σφᾶς ἔλκουσαι*, channeling it to the rest of the body, after which it is again breathed out, since the *pneuma* cannot stand still. The process of respiration, then, in the author's view, has two functions, but the essential function is the admission and supplying of the *phronêsis* of air or *pneuma*, first to the brain and thereafter to the organism generally, through the *φλέβες* and *φλέβια*.

Although this diffusion of *phronêsis* into the brain and through the organism provides the fundamental basis of sensation and in-

¹⁹ The air which, after it has left the brain, goes to the belly, has no further function than to "cool" the belly. One of the purposes therefore of respiration seems to be the "cooling" of the internal heat of the body — the cause of digestion. The same function is suggested also in *Morb. Sacr.* 19.15–18, where it is said that air, if it went to the body first, would reach the brain having become hot. This "cooling" function of respiration was later developed more scientifically by Aristotle (*De Respiratione* 474b.20–25), who thinks of respiration as supplying fresh air as fuel for the internal fires of the body.

²⁰ In *Morb. Sacr.* 18.12 occurs the expression *τὰς φλέβας τὰς αἱματίνιδας* (cf. 18.24 and 31). Hence the writer conceives, possibly following Alcmaeon, that some of the veins are especially filled with blood; but he does not give enough information to make his conception really clear, since other body fluids may be conveyed through these veins also.

²¹ Though this is the prime function, the author, like other early thinkers generally, thought, not very clearly, that the veins also conveyed blood and even other fluids on occasion, e.g., bile and phlegm. On the nature and function of the veins in the works of the *Corpus*, cf. C. Fredrich, *Hippokratesische Untersuchungen* (Berlin, 1899) 67 ff.

telligence, it is not in itself sufficient, as the author recognizes, to account for the psychical activities which occur in the body. What part, then, does the brain itself play in cognition? The answer is expressed in untechnical language and with some consequent obscurity, but the point of essential significance emerges that he, like Alcmaeon,²² regards the brain as the organ of sense-perception and intelligence in man. His summary statement, that he considers the brain *δύναμιν ἔχειν πλείστην ἐν τῷ ἀνθρώπῳ* (19.1) presents the hypothesis which is illustrated and elaborated throughout the work in both the medical and psychological doctrine. This hypothesis is based upon the belief, several times repeated, that the brain is the organ and instrument of *σύνεσις*. Thus, the brain, provided that it is healthy, is the *ἐρμηνεύς* to us (i.e., to *synesis*) *τῶν ἀπὸ τοῦ ἡέρος γινομένων* (19.3), of all the sensory impressions entering through the sense-organs and those occurring within the organism through the agency of *phronêsis*. Again, *ἐς δὲ τὴν σύνεσιν ὁ ἐγκέφαλός ἐστιν ὁ διαγγέλλων* (19.9); the brain is, so to speak, the faculty which receives the "intelligence" of *phronêsis* and transmits it to *synesis*. The causal basis of this capacity of the brain is explained by the remark that *pneuma* leaves in the organ "its essence and whatever it has of intelligence and mind" (19.14), because it is the first part of the body that perceives (*αἰσθάνεται*, 20.30) the *phronêsis* of air. The basic hypothesis is again emphasized by the writer: *διὸ φημὶ τὸν ἐγκέφαλον εἶναι τὸν ἐρμηνεύοντα τὴν σύνεσιν* (20.1). While much is left unclarified, the principal thesis is unambiguous: it is the brain which, because it has received the *phronêsis* of *pneuma*, is the organic center of *σύνεσις*;²³ and it is the "interpreter" and the "messenger" to consciousness of the sensory impressions of the whole organism. Thus,

²² Pohlenz, *op. cit.* 32, note 3, suggests that the author in his conception of *synesis* follows the teaching and terminology of Alcmaeon as to the function of the brain. That Alcmaeon recognized the brain as the center of sense-perception and intelligence is no doubt true. But how he conceived the functions of the brain and to what extent he developed his theory concerning the brain it is unfortunately impossible to discover (cf. Beare, *op. cit.* 251-2), since the available evidence is so tenuous. It would be easy to read more into the surviving fragments than is proper. An examination of the authenticity of the fragments is much needed (cf. L. Edelstein, *op. cit.* 371).

²³ The author conceived and used *σύνεσις* as other thinkers employed *psychê* and, later, *dianoia* or *nous* in psychological theory. Though it is more technical and expressive, it is perhaps generally equivalent to *γνώμη* "mind," as used in the scientific Ionic terminology in the Corpus, a word which the author also used once in the sense: *ἡ γνώμη ἐπινοῇ τι κακόν* (18.28). Wellman, *op. cit.* 291, note 1, explains *synesis* as "die absolute gefasste Intelligenz, für die das Gehirn der Vermittler ist." The author vaguely conceives *synesis* to be, I think, what we would call an "epiphenomenon."

the brain is conceived as both the organ and the instrument of *σύνεσις*, which is clearly to be separated and distinguished from *phronêsis* as well as *aisthêsis*, as psychical entities and psychical functions. As such, it is the organ of synthesis for the body and the central organizing faculty, and on it depend all the psychical activities of the organism. These will, however, be rational only so long as the brain continues in a state of stability (17.24: ὅσον δ' ἀτρεμῆς), a point which again stresses the necessary function of the brain.

The doctrine advanced by the author here is direct and circumstantial. The brain, therefore, is very explicitly recognized as the organ of consciousness, and its various functions, normal and abnormal, are described or referred to throughout the work. It is by means of the brain that sensation and perception occur: τούτω (i.e., the brain) βλέπομεν καὶ ἀκούομεν (17.5). It is regrettable that, since the purpose of the author does not offer occasion, there is no detailed description of the mechanisms involved in sensation, though it is hardly to be doubted that the *pneuma* in the veins ending in the eye, ear, and nostrils was thought to be the basis of the physical processes,²⁴ for three of the senses. But in the discussion of one type of irrationality, how intimately dependent sensation is upon the brain becomes clear. Whenever the brain becomes unnaturally moist, the author writes, it must necessarily be moved, and being moved, μήτε τὴν ὄψιν ἀτρεμίζειν μήτε τὴν ἀκοήν, ἀλλ' ἄλλοτε ἄλλα ὀρᾶν καὶ ἀκούειν, and the tongue utters such things οἷα βλέπη τε καὶ ἀκούη ἐκάστοτε (17.19 ff.).²⁵ The passage is important as showing that *aisthêsis* depends directly upon the brain, perceptions varying

²⁴ The author probably thought of air as causing the stimulations of the sense-organs, and the stimulations or impressions as being conveyed to the brain by the *pneuma* through the veins, which also convey intelligence from the brain to other parts of the body. As Beare, *op. cit.* 5, remarks, "the veins, with the blood or (as some thought) the air coursing through them, were looked upon as discharging the functions now attributed to the sensory and motor nerves." This is correct for the author of *De Morbo Sacro* also, but he does not have any conception of nerves as such, I think. The veins fulfil their function because they convey *pneuma* with its *phronêsis*. Alcmaeon, on the other hand, in his doctrine of "pores" (as Plato in the *Timaeus* in his use of φλέβια), did perhaps, at least vaguely, conceive the "pores" as nerves, or at any rate as different from veins. Cf. the discussion of A. E. Taylor, *A Commentary on Plato's Timaeus* (Oxford, 1928) 465, on *Timaeus* 65c.6-D4.

²⁵ The idea strongly resembles that of Alcmaeon concerning the connection of sense-organ with the brain. According to Theophrastus (*Vors.* I 212.6 ff.), Alcmaeon taught: ἀπάσας δὲ τὰς αἰσθήσεις συνηρτῆσθαι πῶς πρὸς τὸν ἐγκέφαλον· διὸ καὶ πηροῦσθαι κινουμένου καὶ μεταλλάττοντος τὴν χώραν· ἐπιλαμβάνειν γὰρ τοὺς πόρους, δι' ὧν αἱ αἰσθήσεις.

according to the physical condition of the brain and the consequent proper or improper "interpretation" by the brain in its condition of stability or instability. The implicit recognition of the possible unreliability and untruthfulness of the sensation provides a hint concerning the author's epistemology.

Further, it is by means of the brain that we *φρονέομεν μάλιστα καὶ νοεῦμεν* (17.5),²⁶ and the same point is made by implication in the denial that it is possible for the heart and the diaphragm *νοεῖν τε καὶ φρονεῖν* (20.5). The meaning of the faculty termed *διάγνωσις*, which is attributed to the brain by implication (19.18), is perhaps clarified in the statement that it is with the brain that we distinguish (*διαγινώσκουμεν*) the ugly and the beautiful, the bad and the good, the pleasant and the unpleasant, *τὰ μὲν νόμῳ διακρίνοντες, τὰ δὲ τῷ συμφέροντι αἰσθανόμενοι* (17.6 ff.).²⁷ The several psychological terms used in these remarks to indicate functions of the brain, as well as the criteria which are mentioned, point to the brain as the center of the higher functions of the intellect, i.e., of *synesis*. Although the brain is the center organically for these higher psychical activities as well as for perception, the author would obviously not equate them. For in such functions as these, the brain is conceived as the organ of synthesis of the perceptions.

Another function of the brain is to control and direct the activities of the organism. The eyes, ears, tongue, hands, and feet *οἷα ἂν ὁ ἐγκέφαλος γινώσκη, τοιαῦτα πρήσσουσι* (19.5 ff.), this being possible because all the body shares in *phronêsis* insofar as it participates in air. Again, in the discussion of one type of madness, the tongue is said to utter *οἷα ἂν βλέπη τε καὶ ἀκούη ἐκάστοτε* (17.22), whether or not the brain is stable, and whether or not the resulting perception and action is rational or irrational. From these statements, it is evident that the *aisthêsis* and *kinêsis* of the organism are intimately connected and are to be referred to a common center, the brain. This is confirmed by a brief but explicit remark which, though it is made in passing, gives a suggestion of the author's theory of the cause

²⁶ Jones omits *καὶ νοεῦμεν* from his text, although the MSS, except *θ*, contain it. Probably, however, the author did not use the two verbs here to describe equivalent functions, and the same two verbs occur again in a similar context, so that there is no very good reason for excising it.

²⁷ The idea is somewhat reminiscent of Plato's doctrine in the *Theaetetus* (186A-C) that the ugly and beautiful, the bad and the good, are distinguished by the *psychê* alone, acting directly upon the sensations; and one of the criteria mentioned there is "usefulness."

of the *kinêsis* of the organism.²⁸ In the description of respiration (10.13 ff.), the air first goes to the brain, then most of it to the belly, being thereafter functionless, and the rest to the lungs and the veins. The latter, entering the cavities and the brain, οὕτω τὴν φρόνησιν καὶ τὴν κίνησιν τοῖσι μέλεσι παρέχει (10.23). It is a natural consequence of this *dynamis* of *pneuma* that, if *pneuma* is prevented from reaching the brain and the veins, the individual becomes speechless and senseless, the hands are paralysed, etc. That is to say, both *aisthêsis* and *kinêsis* are destroyed in the organism. Taken together, these three passages yield definite evidence that the author attributed the function of motivity as well as cognition to the brain.²⁹

Like most of the earlier thinkers on the subject of cognition, the author has a conception of the nature of emotions, memory and forgetfulness, sleeping and dreaming, though his views are not usually stated directly but must be abstracted from remarks of a medical nature. Thus, it is from the brain that αἱ ἡδοναὶ καὶ εὐφροσύναι καὶ γέλωτες καὶ παιδιαὶ arise, as well as λῦπαι καὶ ἀνίαι καὶ δυσφροσύναι καὶ κλαυθμοὶ (17.2 ff.). There is no elaboration, but this forthright claim that the brain is the organic center of the emotions is remarkable and, I think, previously unanticipated.³⁰ They would perhaps be explained causally as the result of a πάθος παρὰ τὴν φύσιν ὃ μὴ ἐώθει (17.19). Both memory and loss of memory are dependent upon the brain, for the latter occurs when the brain is chilled and contracted παρὰ τὸ ἔθος because of the superabundance of phlegm in

²⁸ The explanation of *kinêsis* was attempted by almost all early thinkers. Aristotle, in the *De Anima* 1.2, reviewing his predecessors' theories of motion, points out that all had attempted, however they had conceived the soul, to explain *kinêsis* as one of the distinguishing characteristics of the soul. The view of the author of *De Morbo Sacro* does not resemble Alcmaeon's (cf. *De Anima* 405A.30-B.2). It is possible that Diogenes' view (cf. *De Anima* 405A.22-25) that the *psychê*, being air, causes for that reason the movement of the body, has indirectly influenced the author. But the view reflected in *De Morbo Sacro* does not involve the *psychê*. The author perhaps held some conception of the soul, but he nowhere mentions it and it apparently played no part in his thinking, perhaps because his interests are essentially medical and scientific.

²⁹ Aristotle's explanation of *aisthêsis* and *kinêsis* was on an essentially different basis, but he also held that they have a common seat in the organism — the heart, or the region of the heart. Cf. Beare, *op. cit.* 300-1.

³⁰ If Alcmaeon offered an explanation, it is not now extant. Diogenes, according to Theophrastus (*Vors.* II 56.5 ff.), explained pain and pleasure as resulting from the proportion of blood and air in the veins. The attribution of emotions to the brain is also to be inferred from the whole discussion of the feelings arising in the diaphragm and heart (ch. 20).

the brain (18.16 ff.). Memory would then seem to be a natural function of the brain when it is in its normal state of stability. An explanation of the phenomenon of sleep is also to be inferred from the author's remarks concerning dreaming (18.19-31). The phenomena which occur when a man is dreaming are produced when the brain is unnaturally heated by the rushing to it of an abundance of blood, which comes to it through veins which are described as *τὰς αἱματίτιδας* (18.12 and 24). These phenomena cease *ὅταν δὲ ἐπέγρηται καὶ καταφρονήσῃ καὶ τὸ αἷμα πάλιν σκεδασθῇ ἐς τὰς φλέβας*.³¹ The author reasons that sleep occurs when the natural functions of *pneuma* and the brain are interfered with by the abundance of blood surging to the brain, heating and changing it (and hence causing the irrational phenomena of dreams). The re-diffusion of blood from the brain into the body would restore the brain to its natural condition, with a consequent return to the waking state of the body.

Negatively, the denial of mental functions to the diaphragm and to the heart — a view that had been taught previously and was to be held later by various thinkers — and the arguments combating the belief in such functions make some contribution to the understanding of the author's theory. The diaphragm has no power *νοεῖν τε καὶ φρονεῖν* (20.2 ff.); the name is due not to reality and nature but to chance and convention. The feelings which seem to originate in the diaphragm are due to the thinness and weakness of its structure and its sympathetic convulsion with the rest of the body, since in itself it has no cavity into which it can receive any *pathos*, *ἢ ἀγαθὸν ἢ κακὸν προσπίπτον* (20.10). It *feels*³² nothing before the other parts of the body. In the argument that follows, it is probably the Empedoclean view of cognition which is opposed. Nor is the heart the organ with which man thinks and the center of anxiety and worry. Rather, the veins which extend to it from

³¹ The view of Diogenes was quite different (cf. *Vors.* II 57.30-3). The theory of Alcmaeon possibly influenced that of this treatise. Alcmaeon (cf. *Vors.* I 214.18 ff.) ascribed sleep to *ἀναχωρήσει τοῦ αἵματος εἰς τὰς αἰμόρρους φλέβας*, while wakening is the *διάχυσιν* of the blood.

³² The verb *αἰσθάνομαι* in *Morb. Sacr.* 20.12, 22, 26, refers not to sense-perception as cognition, but to *aisthēsis* as *feeling*. The same dual meaning is still found in Plato (cf. Beare, *op. cit.* 270, note 3; 273). The verb had not by then been restricted to its technical meaning; and its use in the famous fragment of Alcmaeon (*Vors.* B 1a) cannot be technical, though it is usually so taken (cf. R. Schottlaender, *Hermes* 62 [1927] 438-43).

all the body³³ are enclosed by the heart in such a way that, whenever any excess of pain and tension affects the body, the heart also *feels* it just as the body generally does. The heart and the diaphragm are especially endowed with *feeling*. They have, however, no participation in *phronêsis*,³⁴ but the original cause (*αἷτιος*) of all the feelings of the two organs is the brain (20.26–29). Thus, the author is very explicit. His denial of *phronêsis* to the heart or to the diaphragm or of any cognitive function at all, except sympathetic sensitiveness, reaffirms his theory of the supremacy of the brain as the seat of *synesis* in the organism.

The explanation of the causation and conditions of various irrational psychical phenomena displays how comprehensively the author has developed his theory and how uniformly he seeks to apply it. Altogether a large number of abnormal mental activities, forms of madness, and passions are described in some detail or mentioned. The basic cause in all cases is the brain, when it is not in its normal healthy condition — a condition which is essential to its performance of its natural cognitive functions (19.4). For mental aberrations *πάσχομεν ἀπὸ τοῦ ἐγκεφάλου πάντα, ὅταν οὗτος μὴ ὑγίαινη* (17.14), that is to say, whenever the brain becomes hotter or colder, moister or drier, than in its natural state, or when it suffers any other *pathos* contrary to nature to which it is not habituated. Whenever any of these conditions occur for physiological reasons (because, specifically, of the superabundance of phlegm, bile, blood, etc. in the brain), the result is a change and movement of the brain,

³³ Cf. *Morb. Sacr.* 20.21 ff.: ἐξ ἅπαντος τοῦ σώματος φλέβες ἐς αὐτὴν (i.e., the heart) τείνουσι, καὶ συγκλείσασα ἔχει ὥστε αἰσθάνεσθαι, ἣν τις πόνος ἢ τάσις γίνηται. This cannot be taken literally to imply that the heart is the source and center of the vascular system of the body, since such an interpretation would conflict totally with the rather circumstantial description of the veins earlier (ch. 6) in the treatise, which serves as the basis of all the medical doctrine of the work. Further, the word *συγκλείσασα* is strange, seeming to imply that the veins are somehow enclosed by the heart without emptying blood or *pneuma* into the organ. But it is not possible, I think, to secure from the author a really clear conception of his physiology in this regard.

³⁴ This would seem to conflict with the earlier statement (19.7–9) that the whole body shares in *phronêsis* in proportion to its participation in air. But clearly the author conceives that air either does not reach the organs at all or in insufficient quantities to impart *phronêsis* to them. Wellman, *op. cit.* 291, note 1, suggests either that the *pneuma* carried to the heart becomes attenuated because of the heat of the heart, or that the *φλέβες αἰμόρροοι*, which extend to the heart, contain no *pneuma* — both possible solutions. O. Regenbogen, *Symbola Hippocratea* (Göttingen, 1914) 34, suggests a confusion of psychological terms on the part of the author, but this is unlikely. Whatever the physiological solution, the author's view is quite obvious: the *pneuma* does not make *phronêsis* available to the two organs.

which, being then impaired in its natural functioning, causes irrationalities. How definite his conception was is illustrated by the description of the specific mechanism involved in the case of "madness" (17.19–25). Underlying perhaps all these changes of the brain from the point of view of the ultimate causation is variation in the environmental conditions, especially of air — a theme which is fundamental to the etiology of the treatise and is vigorously restated at the conclusion: if some violent alteration occurs in the air because of the seasons,³⁵ then *καὶ αὐτὸς ἑωυτοῦ διάφορος γίνεται ὁ ἐγκέφαλος* (20.29 ff.). This attempt to explain all irrational mental states as arising from and dependent upon the brain is extremely noteworthy.³⁶ It naturally reinforces the theory that all rational cognitive functions are to be centered in that organ as long as it is in its normal, healthy state of stability.

The psychological theory which the author of this work embraced is thus seen to be a purely physical one. All the psychical activities of the organism depend upon the functions of the brain, functions which it is capable of performing because of its reception of *phronēsis* from the *pneuma*.³⁷ The explanation of both psychical and physiological phenomena is subsumed under one comprehensive hypothesis — the basic causation of all the activities of the body stems *ἀπὸ τῶν*

³⁵ The influence of winds on the physical organism, especially the brain, is described particularly in ch. 16 and recurs throughout the work. This theme was important in the medicine of the period and was treated in detail in the *De Aere Aquis Locis*, 3–6. The importance of "astronomy" or "meteorology" to medicine is expressly recognized as great in that treatise (ch. 2 *ad finem*).

³⁶ The explanation of the causes and nature of epilepsy is also connected with the theory of cognition. The basic cause of epilepsy, as of all the serious diseases, is the brain (6.1). The brain, because of a number of physical conditions which are described in some detail, may be so affected that a flux descends from it into various parts of the body, resulting in various diseases depending upon the part of the body to which it goes, their conditions, the age and constitution of the individual, their habituation to the disease, etc. (*Morb. Sacr.* 13, 14, and 16). When the flux descends into the veins, besides physiological effects, intelligence fails (e.g. 10.6). The cause of all the phenomena, including loss of intelligence, is that the flux descending into the veins prevents the air with its *phronēsis* from entering the brain and the veins, and thus the remainder of the body. If, afterwards, the flux is so mingled with the blood as to be mastered and dispersed and to allow the veins to receive and distribute *pneuma* again in the normal fashion of the organism, intelligence returns (10.53–4; cf. 12.7).

³⁷ The part played by *pneuma* in the system of *De Morbo Sacro* is reminiscent of the function of the *symphylon pneuma* in Aristotle's biological and psychological thought, though it is conceived by Aristotle in a very different manner and worked out in a much more profound and complex way. The best recent treatment of Aristotle's *symphylon pneuma* is by A. L. Peck, *Aristotle, Generation of Animals* (Loeb, 1943) App. B, 576–593.

προσιόντων καὶ ἀπιόντων the organism (21.3). Rational psychical activities result so long as the brain continues undisturbed in its natural, normal state; irrational phenomena arise whenever its natural condition is impaired by environmental condition. The conception that the human organism has a normal *physis*, which is, moreover, intimately connected with the *physis* of the universe, both undergoing uniformly the same processes according to the same laws (cf., e.g., ch. 16), is profoundly implanted in the writer's mind. The "divine," immaterial *psychê* plays no part in his system, because his attitude is essentially empirical and scientific and because of his fundamental belief that, as he several times insists, πάντα θεῶα καὶ πάντα ἀνθρώπινα.