spiritual soul. And Helvétius could claim that men always sought physical pleasure without troubling about whether sensitivity existed in the body or in the mind.

Cabanis's association with the philosophes, especially with Diderot, d'Holbach, and the Auteuil circle, predisposed him toward monism as well as empiricism. His inner motivations for irreverence toward orthodox religion, aside from a distaste for abuses and a rebellious temperament, remain an unsolved question, as in the case of the young Diderot. But his specialized training as a physician definitely changed his view of the kind of uniformity existing both in nature and in method applied to all the sciences.

★ CHAPTER II ★

The Body as Mechanism

Ancient Temperament Theory

In the medical literature that Cabanis studied, the mind-body problem was as ancient as the temperament theory in the Hippocratic *Corpus* and the physiology of Galen. Yet the medical legacy left to Cabanis involved a complex change in the idea of temperament—from the Greco-Roman theory of humors to a concept focused on the physical sensitivity of the nervous system. Seventeenth-century concepts of mechanism and Newtonian concepts of force began to displace the ancient concern with bodily fluids. These notions developed in two distinct conceptual models, or paradigms, defined as follows: "mechanism," which stressed the analogy of the body to a machine, and "vitalism," which stressed the nonmechanical, teleological functioning of distinctive living "principles," or forces. We can understand Cabanis only by realizing that these two paradigms gradually and unforeseeably converged as they began to describe the same phenomena in increasingly similar manner. Cabanis ended up with a bias for Montpellier vitalism, which in its view of life and medicine provided a strong antidote to the dose of materialism that he absorbed from Diderot and d'Holbach. From all schools of medical thought—ancient, mechanist, and vitalist—Cabanis appropriated the goal of improving physical health in order to strengthen the mind. Physicians of diverse metaphysical and religious viewpoints could agree on the importance of preventive hygiene and treatment of disease in developing intelligence and character.

Our interpretation of Cabanis therefore requires study of the

ancient temperament theory as well as of the more recent convergence of mechanism and vitalism. French physicians had rarely abandoned their loyalty to the ancients. Galenism had remained dominant in the schools, even when challenged by Paracelsian chemotherapists, and the observational, "Neo-Hippocratic" revival at Montpellier in the sixteenth century further enhanced the prestige of the ancients.[1] The Hippocratic *Corpus* became the most pervasive medical influence. Faculties of medicine commonly required commentaries on the "Aphorisms" or another Hippocratic work in degree examinations. In the reformed Paris School of Medicine in 1798 Cabanis himself prepared lectures on texts from Hippocrates as part of the course in "advanced clinical" observation.[2]

In his homage to Hippocrates (c. 460-377 B.C.), Cabanis recognized the distinction between authentic and apocryphal works. He read the *Corpus* with an eighteenth-century bias and sifted from it whatever seemed consistent with empiricism and clinical medicine. The following aspects of Hippocratic theory had the greatest appeal to Cabanis: (1) a method of observation and reasoning that retained the independence of medicine while also establishing its link to other theoretical disciplines, (2) a full consciousness of human diversity, as expressed by the idea of individual physical equilibrium (*krasis*) among the four humors corresponding to appearance, intelligence, and character, and as affected by inherent factors such as age and sex as well as external influences such as air, season, climate, topography, diet, and physical habits, (3) a therapy based on the healing power of nature, a struggle to restore individual constitution to its natural equilibrium, and (4) the specific unity of the living organism and interdependence of its parts. Cabanis held Hippocrates' philosophy in such high regard that he used a phrase from the "Decorum" as the epigraph to his own essay on medicine, *Coup d'oeil*: "The physician who is also a philosopher is the equal of a god."[3] Hippocrates scorned false systems yet insisted on "ordered experience" (*expérience raisonnée*). Hippocrates' goal was thus to "introduce philosophy into medicine and medicine into philosophy."[4]

The following paragraphs will summarize, in excerpts from translations of the Hippocratic *Corpus*, those observations and theories that seem to have been most significant to Cabanis. Cabanis saw Hippocrates as a forerunner of Locke, Helvétius, Bonnet, and Condillac in his insistence on the primacy of sense observation. Thus, in observing disease, Hippocrates would "perceive and fix the general relationships of all these scattered facts."[5] Yet in the treatise "The Art" (or "The Science of Medicine"), he warned against dogmatic physical hypotheses that suggested a single principle as the cause of disease. The physician must observe all he can—appearance, breathing, excretions of the patient—and perhaps even induce identifying symptoms to reveal the disease. Pondering these signs, the physician can then complete his diagnosis of the disease, prognosticate its future course, and prescribe therapy according to records of similar past cases and cures.[6] Cabanis felt Hippocrates' terse, precise, unemotional descriptions of phenomena in the "Epidemics" and his rules for medical reasoning in "Prognostic" and "Aphorisms" made him a superior model for modern physicians despite his obsolete *materia medica*.

Cabanis was also comfortable with the primary theoretical assumption in the *Corpus*, the definition of health as an appropriate mixture of humors. The author of the lecture "On the Nature of Man" named the four humors—"blood, phlegm, yellow bile, and black bile"— and asserted that the "correct proportion in strength and quantity" of these substances would assure well-being.[7] An excess, separation, dilution, or thickening of a humor might bring on disease.[8] Meanwhile, in characteristic reaction to disease, the body naturally struggled to restore lost balance by "coction," or digestion, of the disturbed humor. The result was either favorable resolution of the crisis (evacuation of the humor or abscess formation) or inability to restore equilibrium, which would be a cause of death. The characteristic periods of crisis in each disease could also become a significant diagnostic tool.[9]

Hippocratic therapy thus had to reinforce, not hinder, the healing force of nature in order to restore natural equilibrium.

"Nature," wrote the author, "is the healer of disease. Nature finds by itself, without intelligence, the way and means; nature, with neither instruction nor wisdom, performs what is suitable; tears, humidity of the nostrils, sneezing, yawning, coughing. . . ."[10] Lest the physician remain passive, however, there was a warning that a "spontaneous cure" was a "false and meaningless idea" in acute diseases and poisonings. The physician must guide the progress of disease, "so that it develops according to its natural tendency." Salutary crises must be neither premature nor delayed. The therapist must do everything possible to oppose the cause of disease.[11]

This principle of balancing medical caution with intervention would become not only an important ingredient in Cabanis's warnings about overactive medicine but also a striking parallel to his political philosophy based on the beneficence of natural law. Neither his medical therapy nor his political thought was deduced from the other, but they had structural similarities. Cabanis did not mean to imply that assisting free operation of natural law, either in medicine or in politics, implied passivity. He recognized that eighteenth-century medical therapy had progressed far beyond simply allowing nature to take its course. Remedies were more plentiful than in the era of Hippocrates. And in any case, physicians had to plan their treatment rationally since they could not rely on natural restorative powers in civilized society. In some cases, Cabanis counseled, "nature's misguided efforts must be stopped or channeled in another direction."[12] Similarly, natural laws of human behavior, such as the prevalence of self-interest or sympathy, had to be actively assisted if the achievement of a harmonious society were to be possible.

What was later called the temperament theory also gave Cabanis his fundamental parameters for internal and external idiosyncratic influences affecting body-mind relationships. In the Hippocratic *Corpus*, therapy had to allow for variation in humors due to age, sex, and specific physical constitution. But external environmental factors were equally important. Seasonal or short-term weather changes affected predominance of

particular humors; thus the physician also had to record atmospheric conditions ("Epidemics"). "Morbid secretions in the air" as well as harmful regimen might induce certain ailments.[13] The author of the treatise "Airs, Waters, Places" provided a comprehensive geophysical account of endemic illness and characteristic health of natives of certain localities. The seasons, wind exposure, and qualities of water and soil as well as habits of eating, drinking, and work were shown to affect puberty, fertility, characteristic mental and physical traits, and susceptibility to disease. The argument, stated simply, says that "climates differ and cause differences in character, the greater variations in climate, so much the greater will be differences in character." An unstable climate would produce diverse characters; a mild climate, cowardly and mediocre minds; and an extreme climate, bold and agile minds.[14]

Despite the intervening revisions of these ideas by more modern physicians, the Hippocratic principles were still recognizable in Cabanis's list of influences on "ideas and passions"—age, sex, individual equilibrium, or temperament, disease, climate, and regimen. Temperament, in the broad sense, was metaphysically neutral—acceptable to Diderot and d'Holbach as well as to dualists. Helvétius, for his part, disputed the importance of internal factors, but the medical tradition was already so strong in Diderot that he had to acknowledge that nuanced efforts to perfect intelligence and character would be necessary in view of the diversity of temperaments. For Cabanis, Hippocrates provided the ideal compromise between the cultural environmentalism of Helvétius and the climatic theory of Montesquieu. In the *Corpus*, Hippocrates spoke of the significance of the tyrannical government as well as the mild, temperate climate in shaping the "docile and cowardly" temperament of Asians. Habits of life, such as the continual horseback riding of the Scythians, were at least as important as climate in affecting their flabby constitutions and the infertility of their women.[15]

While the Hippocratic writings provided precepts for therapy and raw materials for the art of human perfectibility, they also

stressed the physiological unity and interdependence of parts within the body. Cabanis's discussion of internal and external sensations cited a Hippocratic maxim on organic unity: "Tout y concourt, tout y conspire, tout y consent" (Everything cooperates with, conspires toward, and consents to seek that purpose). Expressed differently, "Life is a circle, where we can find neither beginning nor end, since in a circle, each point of the circumference can be beginning or end."[16] This conception of unity provided the blueprint for modern vitalism and for emphasis on organic vehicles of unity such as the nervous system.

While Galen of Pergamum (c. A.D. 130-200) systematically developed Hippocratic equilibrium into the temperament theory, Cabanis devoted only one and one-half pages of his medical history to Galen compared to the eleven pages given Hippocrates. To Cabanis, Galen was a systematizer, a weaver of hypotheses who betrayed the prudence of Hippocratic observation. Yet because Galen was unhampered by Christian scruples concerning materiality of the soul, he could set certain precedents for physical-mental correlations, and did so, especially in his treatise showing that the "habits of the soul are the consequence of the temperaments of the body."[17] As in Platonic theories of a hierarchy of souls, Galen believed that a "psychic pneuma" (later called "animal spirits") in the brain and nervous system controlled sensation, muscular motion, and reasoning, and that "vital pneuma" in the heart enriched the blood, assisted ebb and flow of blood, and controlled complex passions such as ambition. Later Galenists added a "natural pneuma" in the liver to control vegetative processes, nutrition, and simple appetites for physical pleasure.[18]

Galen also established nine classes of temperaments: four simple classes, with the dominance of each of the four qualities—warm, cold, dry, and moist; four composite classes—sanguine (warm and moist), phlegmatic (cold and moist), bilious (warm and dry), and melancholic (cold and dry); and one ideal "temperate" state. Arabic commentaries on Galen emphasized the importance he placed on the "non-naturals" in shaping the soul. He defined non-naturals as being things

neither natural to the body, nor against nature, yet indispensable: (1) air, (2) motion and rest, (3) sleep and wakefulness, (4) *ingesta* (food, beverages, drugs), (5) *excreta* and *retenta* (things excreted or retained), and (6) emotions or passions. Even in the original Galenic view, changes in non-naturals through diet, habits, or exposure to a different climate were thought capable of altering temperaments sufficiently to make citizens more virtuous.[19]

Iatrochemistry and Iatrophysics

While Cabanis supported critics of Galenism, he had only faint praise for Paracelsus (c. 1490-1541) and little sympathy for the Iatrochemical school of Franciscus Sylvius of Leyden (1614-1672) or the English physician Thomas Willis (1621-1675) who reduced temperament to an acid-alkaline balance. Yet Cabanis did see a reaffirmation of Hippocratic principles in the antihumoral physiology of an heir of the Paracelsians, the Flemish alchemist and physician Johannes Baptista van Helmont (1577-1644).[20] For the Hippocratic "healing force of nature," van Helmont substituted a spiritual guiding principle, or *archeus*, immanent in material ferments. The *archeus* controlling the stomach and diaphragm, with their "system of epigastric forces," could affect the mortal, sensitive soul and therefore mind-body relations. Moreover, van Helmont believed that a principal *archeus* supervised a subordinate hierarchy of organic *archei*. The entire body was thus a federation of organs, each with its inherent dynamic principle. When Cabanis studied eighteenth-century Montpellier physiology, he recognized that van Helmont's *archaeus*, stripped of mystical trappings, could be converted into the peculiar physical sensitivity of each organ. Therefore, van Helmont was a valuable progenitor of Cabanis's ideas.

The Iatrophysical school of the seventeenth century presented a more formidable challenge to concepts of the uniqueness of life and the autonomy of medicine. Inspired by Descartes's mechanical philosophy and by the statics and

kinematics of Galileo and Torricelli, a number of physicians who flourished in Italy, England, France, and the Netherlands adopted the image of the body as a hydraulic machine.[21]

DESCARTES

Descartes's portrait of man in the posthumously published *De L'Homme* and in the more subtle *Traité sur les passions de l'âme* borrowed much from Galen as well as from medical contemporaries to produce the paradigm of dualist mechanism. Cabanis certainly respected Descartes's attempts to localize the area of body-soul interaction and to study the cerebral and nervous systems. He took issue, however, with Descartes's fundamental premise in *De L'Homme*—that the body is like a "statue or machine composed of earth," acting according to the laws and mechanisms of ordinary, passive matter.[22] For Descartes, all corporeal phenomena, sensory awareness, memory, "passions of the soul," and the substrate of ideas occurred physically and corresponded with the abundance, flow, activity, and homogeneity of animal spirits. Only thought and will were the province of the rational soul. In animals, consequently, all motion was corporeal and mechanical. The unsolved problem for Cartesian physiology was how inert matter could move itself unless it contained an active material principle. And if such existed, what was the role of the human soul? Still, the mechanistic approach could produce striking physiological insights. For example, some involuntary muscular motion, such as withdrawal of the hand from flame or blinking of the eye before an approaching object, was seen as strictly mechanical. To a limited extent such a notion anticipated the modern reflex concept, in which involuntary motion requires no conscious intervention.[23]

The body-soul interaction in man was complicated because of the inviolable Cartesian barrier between laws of matter and laws of mind. Descartes searched for a middle term between "the ghost" and "the machine" and found the position and alignment of the pineal gland. According to Descartes, both external

senses and internal senses (hunger, thirst, joy, sadness, love, anger) or the will of the soul moved the gland, which affected animal-spirit flow and therefore affected feeling and movement. If the mechanism was vague, the interaction was undeniable. Descartes himself maintained that "even the mind is so dependent on temperament, and on the dispositions of the organs of the body, that if it is possible to find some way to make men wiser and more clever than they have been thus far, I think it must be sought in medicine."[24] Descartes agreed that the physician was the prime auxiliary in the struggle to control passions by reason.

DUALIST MECHANIST PHYSIOLOGY: BOERHAAVE AND GAUB

Though the Iatrophysical school was not all Cartesian, all of its members proceeded to relate body to soul without surrendering the dualist idea of active soul and passive, or mechanical, body. The renowned Dutch clinician, chemist, and botanist Hermann Boerhaave (1668-1738) was a pious Calvinist who in his youth wrote dissertations against Epicurean, Hobbist, or Spinozist heresy. Fascinated by the Italian mechanist physicians Giovanni-Alfonso Borelli (1608-1679) and the contemporary Giorgio Baglivi (1669-1706), Boerhaave unhesitatingly accepted a mechanical view of the body. In his *Institutiones Medicae* (1708) and his *Aphorismi* (1709), Boerhaave helped establish the distinctive eighteenth-century mechanist notion of temperament as an equilibrium between solids (membranes, vessels, and fibers) and fluids, or humors. Boerhaave realized that physicians could contribute to healing mental disturbance by healing physical disease, including disturbances in solid-fluid equilibrium. Body-soul interaction was phenomenally observable, while study of the soul itself was beyond the ability of the physiologist.[25]

Despite Boerhaave's praise of Newtonian caution on ultimate causes, his elaborate medical theories impressed Cabanis as more oversystematic betrayal of Hippocratic empiricism. Boerhaave used the evidence of mechanics, microscopy, and

vascular injections to postulate ever smaller vessels and ever more subtle fluids—in short, a series of invisible mechanical agents—to explain all major bodily functions. Cabanis was particularly critical of Boerhaave's concern with vessel diameter, fluid impulsion, and digestive chemical "acrimony." Yet Boerhaave's observation of mental and emotional phenomena could not avoid recording apparently nonmechanical upsets. By 1731 he used a Hippocratic term *enormon* to denote a mental principle of arousal that acted in some unknowable way to influence bodily movements as well as ideas. He had no fear of localizing this principle in the "sensorium commune"—"all the places where the union of the cerebral cortex and spinal medulla gives off the origins of the elementary . . . nerve fibers."[26] The sensorium commune played a role above and beyond the merely corporeal cerebral cortex, which was, to Boerhaave (as to Baglivi), a kind of gland that secreted very fine nerve fluid. Because it was neither wholly physical nor wholly mental, the sensorium commune was a safe, neutral term that disguised the difficulty concerning the essential mystery of mind-body interaction.[27]

Boerhaave's temperament theory and mind-body phenomenalism were thus components of the classic dualist mechanist paradigm. In principle, mechanists were committed to explaining as much as possible by treating the corporeal as mere matter and extending the explanations of physics into physiology. Even if the soul remained unknowable and matter remained passive and inert, a science of man dedicated to improving intelligence and character would be, for Boerhaave as for Galen, theoretically possible.

One dualist pupil of Boerhaave in Leyden, Jerome Gaub (1708-1780) explicitly studied mind-body relationships and illustrated the flexibility in the mechanist tradition. At the same time, an erudite member of the Paris Faculty of Medicine, the Cartesian dualist Antoine Le Camus (1722-1772), showed how far a mechanist could develop a "hygiene of the soul." Neither yet took account of new physiological experiments that

could potentially undermine the dualist aspect of mechanism.

In two closely reasoned lectures delivered in 1747 and 1763, *De Regimine Mentis Quod Medicorum est . . . (On the Duty and Office of Physicians in the Management of the Mind)*, Gaub developed Boerhaave's suggestions concerning the *enormon* and introduced the idea of mutually responsive active powers in body and soul.[28] Cabanis was probably familiar with lectures so closely related to his own themes in the *Rapports*, though he directly cited only Gaub's esteemed pathology textbook. To Cabanis, Gaub was more a "semi-animist" than a mechanist—someone who, like certain physicians of Montpellier and Edinburgh, believed in active principles of motion within the body.[29]

In his first lecture Gaub provided a sharply focused restatement of the traditional temperament theory and of its effect on the mind. He maintained that age, sex, disease, and mode of life (including the non-naturals) would obviously affect mental clarity. The mental effects of fever, intoxication, and pregnancy were commonplaces of daily experience, and physical disturbance might even be detrimental to moral character. Gaub remained faithful to phenomenalism, believing that one could know only the "kind and degree of . . . reciprocal power" of mind and body, not their ultimate nature.[30] The soul and body coexisted, and the existence of the soul without the body was not verifiable by the physician.

Yet Gaub departed from Cartesian mechanism in the way he perceived mind-body interaction. Rather than focusing on detailed analysis of the nervous system or brain structures, Gaub postulated three principles of spontaneous arousal—one in the mind and two in the body (an adaptation, in fact, of the Galenic pneumas). The unlocalizable *enormon* of the mind, active in sensation and motion, violently shook and agitated the mind in response to desire or aversion. The *enormon* of the body, contained in the nervous system, or what Gaub called "neural man," had two parts—the mentally activated principle of sensation and voluntary motion (the cerebrospinal system) and the

enormon of the vital and natural functions, including movements of excised organs. Otherwise, the body was inert and mechanical.[31]

Once again the principle of therapy was to use the nonnaturals to affect the *enormon* of the body and thereby improve mental acuteness and moral dispositions. Variations in temperament were thought to be responsible for diversities in mind and character. No amount of sermonizing would cure the drunkard if he were allowed to consume wine. Gaub wrote, "The root deeply seated in the body must be torn out . . . in the case of Alcibiades, not even the teachings of Socrates would prevail." Physicians ought to make men "as superior in character and behavior as possible." In order to do so, they need to search for "special regimens, universal therapeutic methods, and particular remedies with which we can awaken, sharpen, or strengthen any faculty of the mind whatsoever, and moderate, arouse, or repress its paroxysms, instincts, and propensities as needed."[32] These suggestions had great potential in the approach to nervous disease. Treatment of the body, in Gaub as in Descartes, was the key to treatment of the soul.

Clearly, the pious Gaub was sensitive to the potentially heretical implications of introducing an active principle into the body. He devoted a second lecture to stressing the power of the mind over the body. In addition, in its introduction he publicly denounced "a little Frenchman" and "a repulsive offspring, to wit, his mechanical man" published "not long after sitting before this chair and hearing me speak, and in such a way that it seemed to many people that I had furnished him with, if not sparks for his flame, at least matter for embellishing his monstrosity." Gaub was clearly referring to Julien Offray de La Mettrie and to his book *L'Homme machine* (1747). The charge was only partially true, however. La Mettrie borrowed anecdotes easily available elsewhere and did not owe his initial inspiration to Gaub.[33]

Unlike La Mettrie, Gaub demanded equal status for the mind. In his second lecture, he once more appealed to common experience to show that anger, fear, envy, hatred, and even

great joy might corrupt the humors or cause digestive upsets. Repressed passions, whether anger, grief, or love, might also have dangerous physical effects. The physician, "more effective and specific than moral preachments, must act on the body to restrain, moderate, and bring to order the principle of arousal, the *enormon*, whose vehemence leads the thwarted mind of man astray to the detriment of the body." Gaub cautioned, however, that only in extreme cases, such as attempted cures of paralysis, might violent emotional shocks be salutary.[34]

CORRELATION OF MIND AND BODY: LE CAMUS

While Gaub refined the mechanist paradigm, Antoine Le Camus developed its premises more systematically in a study of correlations between mind and body. The three books of *Médecine de l'esprit* (1753; revised ed. 1769) offered a complete analysis, in the fashion of Condillac, of intellectual and moral faculties (the understanding and the will), their correspondence with the physical, and a therapy to maintain desirable, and correct harmful, influences. Because the treatise anticipated the goals of Cabanis's unfinished projects, one modern critic has claimed that Le Camus was a forerunner of Cabanis.[35] We have already shown, however, that internal and external influences on temperament were so integral a feature of eighteenth-century medicine that no one work could have been Cabanis's major inspiration. While Cabanis himself never cited Le Camus, Diderot named him in a manuscript note as a source for his *Eléments de physiologie*.[36] In any case, Le Camus is an important control for this discussion. His optimistic objective of human perfectibility and his adherence to the empiricist psychology of Locke and Condillac illustrated how acceptable and ordinary a medically based science of man was, so long as there was no assumption of activity in the body.

Le Camus clearly stated that the soul was neither material nor mechanical, but a "contingent, rational, spiritual, and immortal substance." Yet he assumed it could be "constrained in its own operations by truly mechanical operations . . . often . . .

against its will." In his analysis of the understanding and the will, he acknowledged the primacy of sense-knowledge while insisting that this view did not threaten the truths of religion. Like Descartes, Boerhaave, and Gaub, Le Camus classified thirst, hunger, and sexual appetite as "internal sensations" and dreams and hallucinations as "reflected" sensations. Only the 1769 edition devoted a chapter to "Sensitivity and Sensations," to acknowledge the research of Haller and Encyclopedist physicians. Still, Le Camus envisaged sensitivity not as a special active property of matter, but rather as a mechanical "tonic force," or "muscular force," in animal fibers.[37]

In the second book of *Médecine de l'esprit*, Le Camus listed eight physical causes affecting the mind and will: generation and heredity, sex, climate and seasons, education of the mind and body, temperaments, regimen, age, and health and illness. This list is clearly derived from ancient tradition and from the notion of the non-naturals. But Le Camus followed Boerhaave and other mechanists in asserting the correspondence of size of vessels, elasticity of solids, and state of fibers—not just humors—on mental aptitude, character, complexion, and hair color. Since climate, manner of life, and physical exercise all influenced the blood, and therefore, temperament, "by these mechanical causes . . . one can procure a particular kind of character or genius; one can transmute (*permuter*) sterile, unrewarding terrain into an abundant and fertile one: thus temperaments are a physical means of acquiring intelligence, or correcting its defects."[38]

In the final book of the treatise, Le Camus synthesized empiricist psychology with mechanist physiology. He proposed to adjust climate, mental and physical education, and regimen (duly proportioned to age, sex, and individual temperament) in order to remedy assorted excesses or deficiencies in sensitivity, memory, imagination, judgment, virtues, and passions. From his tedious catalogue, two therapeutic prescriptions will suffice as illustration: for overly relaxed nerve fibers due to a wet climate, watery blood, or the natural temperament of women and

children, move to a hot, dry climate, exercise frequently, sleep less, and eat hearty foods to strengthen the stomach; and stiff fibers need humidity, baths, rest, a vegetarian regimen, and perhaps some bleeding. What greater powers, Le Camus wondered, would one need to engage for each person to become intelligent?[39]

Despite these remarkable anticipations of psychosomatic medicine, Le Camus could not be an ideal model for Diderot, d'Holbach, or Cabanis, for without inherent activity in the fiber, the physical body could never generate thought. Le Camus marked a milestone in a typical eighteenth-century approach to hygiene. In addition to the philosophical postulate of dualism, Le Camus's prescriptions were limited by an individualistic approach—personal self-improvement rather than a social commitment to public health. Insofar as this private approach characterized all such medical works from the time of Galen to that of the Idéologues, they were, as a recent article argues, elitist. Only those who were literate, leisured, and wealthy could afford travel to a different climate, the luxury of a varied diet, or the opportunity to change work habits or life styles. Publicizing precepts of hygiene was no doubt a way of overcoming the secrecy of the medical guild. But more important for the social commitment of Cabanis and his colleagues, the physicians active in politics during the French Revolution did not rest their hopes on private hygiene alone but also on a thoroughgoing medical and hospital reform that implied a right to health through public measures.[40]

In the theoretical medical legacy left to Cabanis, the dualist soul-body polarity had to be broken by a new idea—a nonmechanical, but corporeal, force—before there could be convergence of the mechanist and vitalist paradigms. To escape the Cartesian impasse, in which animal motion could not be satisfactorily explained either by body or soul, physiologists turned to what Thomas Steele Hall has called the "physiological unknown," an "inexplicable explicative device" that was the counterpart of Newtonian gravity in physics.

HALLER AND THE PRINCIPLE OF IRRITABILITY

The renowned Swiss experimental physiologist, physician, poet, and polymath Albrecht von Haller (1708-1777) used such a device to explain the peculiar behavior of nerve and muscle fibers. He made muscle fiber the bearer of an active, irreducible property of "irritability." Unwittingly, he became a crucial link between vitalists, who celebrated the uniqueness of life, and materialists, who celebrated the dynamic properties of matter. Vitalists and mechanists were confronted with the same phenomenon, and to explain it, they continued to patch and repair anomalies in their respective paradigms. Gradually their labels described phenomena so similar that the difference in terms seemed a purely metaphysical choice.

In the seventeenth century, several physicians had questioned the traditional Galenic explanations of muscular contraction as the flow of animal spirits through the nerves. The English physician Francis Glisson (1597-1677) had first used the term "irritability" as a general property of living matter in his *Tractatus de Ventriculo et Intestinis* (1677). Glisson's work brimmed with obscure scholastic and Helmontian terminology, but among other insights, he saw the importance of the nerve fiber as an element in "natural perception," which did not always produce conscious sensation.[41]

As a commentator on Boerhaave's lectures, with full awareness of the work of Glisson and Stahl on muscle tone, Haller developed the notion that some organs, such as the stomach and heart, "do not sense distinctly" and that these "obtuse" sensations were independent of the nerves.[42] Moreover, Haller's pupil J.-G. Zimmermann began animal experiments in the 1740s (described in an inaugural dissertation of 1751) that pursued the subject of non-nervous contractions.

Haller offered his theory in a dissertation presented to the Royal Society of Sciences of Göttingen in April and May 1752, "De Partibus Corporis Humani Sensilibus et Irritabilibus."[43] In this paper, he reported, "I call that part of the human body irritable, which becomes shorter upon being touched." Irritability was an inherent tendency of the muscle to contract. Haller then continued, "I call that a sensible part of the human body, which upon being touched transmits the impressions of it to the soul, and in brutes . . . which occasions evident signs of pain and disquiet in the animal." Sensitivity, then, depended on transmission by nerve fibers of sense impressions to the brain, though in animals, pain, or later convulsions, was the only observable phenomenon. Sensitivity was inseparable from consciousness and a unified (presumably central) nervous system. Nerve ligatures always affected sensitivity but they did not remove irritability. In a sectioned nerve of a dog, there could be movement with no apparent sensation. Furthermore, there was no proportional relationship between sensitivity and irritability in particular organs. The force of irritability was a muscular property, while the force of sensitivity was a nervous property. Though sensitivity was normally present in voluntary muscular motion, involuntary motion, or residual motion in excised muscle, was due to irritability alone.[44]

Throughout the discussion, Haller kept his agnostic Newtonian reserve—the sources of irritability and sensitivity, he maintained, "lie beyond the reach of the knife and microscope, beyond which I do not choose to hazard many conjectures." He appealed explicitly to Newton's caution:

> What therefore should hinder us in asking why irritability should not be that property of muscular fiber to contract itself when touched and provoked, without it being necessary to assign a cause, just as no probable cause of attraction or gravity has been assigned to matter? The cause of irritability is physical, hidden in the intimate fabric, and revealed by experiments sufficient to show its existence but too gross to trace its nature.[45]

Haller was aware that a metaphysical storm would break over the notion of irritability, an active force in excised muscle tissue. Yet this *vis insita* (inherent force), he insisted, was no mere arrangement of matter but a divine power. No corporeal

forces could produce motion. His own dualist mechanist outlook rejected the contention that physical phenomena *caused* mental phenomena. As the hands of a watch at noon corresponded to the sun at the meridian, so did body and soul correspond; yet the sun did not move the hands.[46]

The semi-animist physician of Edinburgh, Robert Whytt (1714-1766), launched a bitter attack against the materialist implications of the idea of motion that was neither strictly mechanical nor initiated by the soul. Whytt argued that there must be sensitivity and a sentient principle that was the instrument of the soul wherever there was motion.[47] Meanwhile, as early as 1747, the scandalous La Mettrie used the concept of an active force in living matter to question the existence of the soul. In 1752 Haller felt compelled to reject both animism and materialism. He argued that there was no part of the soul or consciousness in flesh cut off from the body. Irritability was therefore independent of the soul, which was neither extended nor divisible, and also independent of the nerves. Haller astutely warned that "those who, like Stahl, attribute irritability to the soul, and make both things inseparable, give Demetrius [La Mettrie] more plausibility. If both are inseparable, and one invisible while the other is evident to the senses, one has nearly excluded the first."[48]

Both Haller and semi-animists could now accuse each other of materialism. To Whytt, any active force in the body would assign to mere matter a capacity to move that should be assigned to the soul. Self-sufficient matter threatened the whole idea of Creation and Providence. To Haller, a single force of sensitivity would involve the soul in all kinds of merely bodily motions that needed no conscious or mental direction. In this, there would be a risk of equating spiritual activity with the merely physical.

Subsequent eighteenth-century nerve physiologists quoted or contested Haller's experiments to their own purposes. Many debated the existence of animal spirits, nerve fluid, or vibratory aethers. But most tended to accept the existence of nonmechanical forces, either nervous or muscular, over the image of pas-

sive, inert, living matter.[49] The pious physicians of Edinburgh could be confident that their sentient principle would avoid the theological dangers of mechanism. And students of libertine tracts and clandestine manuscripts could use Haller's experiments as a catalyst to promote materialism. To Diderot and Cabanis, Haller's experimental physiology was a great repository of reliable information in need of interpretation.

The Activation of Matter: La Mettrie

When the notorious physician La Mettrie dedicated his *L'Homme machine* to an outraged Haller, it was a stroke of malicious humor and ironic justice. After receiving his M.D. at Reims in 1733, La Mettrie studied with Boerhaave in Leyden in 1735-1736 and translated an abridgment of Boerhaave's *Institutiones Medicae* into French. In 1747, when he heard Gaub in Leyden, he became aware of the experiments of Haller's circle in Göttingen. Haller himself complained La Mettrie "learnt all he knew about [irritability] of a young Swiss with whom I am not acquainted; who never was my pupil, nor is he a physician, but he had read my works, and seen some of the famous Albinus's experiments [Bernhard Siegfried Albinus, professor of medicine at Leyden] and upon these La Mettrie founded his impious system, which my experiments totally refute."[50] (A medical historian has identified the "young Swiss" as a minor philosopher and economist, Georg Ludwig Schmid (1720-1805) of Avenstein, a correspondent of Haller and later tutor to Duke Ernst-August of Weimar.[51])

While La Mettrie amply praised the dualist mechanists Descartes and Boerhaave, his own mechanism followed more closely still another paradigm—that of Newtonian inexplicable forces. Lester Snow King summarizes a conventional interpretation of La Mettrie's role: "While Descartes had regarded animals as machines, the dualistic philosophy gave to man a soul which the animals lacked, and which differentiated a human from a machine. It was only a small step, but a mightily important one, to say that the mind of man was not a separate sub-

stance."[52] Certainly La Mettrie showed great respect for Descartes and even speculated that Descartes might have been a materialist had he not feared theological censorship. But Vartanian's critical edition of *L'Homme machine* has gone far to balance La Mettrie's loyalty to Iatrophysics with his original conception of motion in the body.[53] Descartes's living body was an automaton with a mainspring continually running down; La Mettrie's was a perpetual motion machine with an inherent active principle. A self-winding machine was neither ordinary mechanism nor Cartesian automaton. Certainly La Mettrie's intention, like Diderot's and d'Holbach's after him, was to assimilate the human species to the animal kingdom and to support the idea of a corporeal Chain of Being with one substance of varying complexity. Yet unlike Maupertuis, he never attributed inherent activity or intelligence to all matter, only to living matter.

In developing the man-machine image, La Mettrie listed irritability in his catalogue of phenomena of involuntary motion. In this catalogue, he also cited ordinary reflex phenomena (pupillary contraction in increased light, vomiting, and excretory processes) as well as residual reflexes after death (contraction of excised muscles, palpitation in dead animals, persistent intestinal peristalsis, heart and muscle revival after injection of hot water into blood vessels, and persistent movement of a frog's heart, previously noted by Boyle and Steno). These empirical observations led La Mettrie to the hypothesis that "each little fiber," independent of the nerves, had an "innate force." The structure of the nervous system led to certain other properties of sensitivity. By analogy to the "small subordinate springs" in many organs, La Mettrie argued that the brain had, at the origins of the nerves, an "inciting and vigorous (*impétueux*) principle that Hippocrates called enormon (the soul)." By this elementary principle of motion, "animate bodies will have all needed to move, feel, think, repent, and behave; in a word, for all physical and mental behavior."[54]

Refusing to accept nonempirical metaphysical entities, La Mettrie asserted that the soul was not separate but "only a prin-

ciple of motion, or a sensitive material part of the brain . . . a principal spring of the entire machine." Organization of the body was paramount. No one could know how movement and feeling reciprocally excited each other. Somehow movement produced sensation, and by Locke's empiricist philosophy, sensation produced thought. La Mettrie speculated, "I think thought so little incompatible with organized matter, that it seems to be a property of it, as is electricity, the motive faculty, impenetrability, extension." Like Newtonian gravitation, thought was an inexplicable property of matter. For all his fascination with ancient Epicureanism, La Mettrie required neither Epicurean chance nor the God of the orthodox for an explanation—only the awesome power of Nature.[55]

All the familiar body-soul correspondences detailed by Gaub and Le Camus or by contemporary speculative psychologists like David Hartley and Charles Bonnet could now assume a new significance. The influences of age, sex, temperament, disease, and the non-naturals (including diet and climate) on mind and character could now be interpreted as the interactions of portions of a single uniform substance. With no spiritual soul, there was no difference in kind, only in degree (primarily in use of language) between apes and men. Consequently, an image of the universe including Final Causes or divine Providence seemed inappropriate. Yet in *this* treatise, La Mettrie chose to mute his much-vaunted mockery of conventional morality and natural law (as he did not in *Discours sur le bonheur*, 1st ed., 1748). Like d'Holbach later, he here argued that a natural law controlled both animals and men and, at least in the human species, assured that virtuous acts would bring pleasure, except to the depraved. Thus, criminals might be malformed individuals needing medical treatment. Man composed of material substance would still act in moral fashion, and the merely natural and material was therefore so much more extraordinary.[56]

La Mettrie's own irreverent satires on the medical profession, his alleged gluttony, insolence, and personal hedonism only confirmed the conviction that metaphysical materialism threatened morality as well as religion. Even the atheist d'Hol-

bach labeled La Mettrie "insane," while Diderot described him as "frenetic" and was clearly disgusted with his ethical views. And while no one ever doubted La Mettrie's influence on Cabanis, there were no references to La Mettrie in Cabanis's works. Whether this remarkable silence was due to La Mettrie's overly mechanistic metaphors remains a moot point.[57]

To be sure, La Mettrie was more impressionistic in *L'Homme machine* than either Le Camus or Cabanis were in their methodical treatises. Like the works of dualist mechanists, La Mettrie's considerations on the human body tended to stress the similarities in the corporeal Chain of Being and the legitimacy of a single scientific method for physics and physiology. With elimination of the spiritual soul, there was an even more decisive unity in nature and in the sciences. Yet La Mettrie certainly illustrated how Haller's experiments could modify the mechanist paradigm. After the postulation of the inexplicable force of irritability, life was not *merely* mechanical. Surely La Mettrie himself did not hesitate to use the term "materialism."[58] But living matter was no longer inert and passive. The irritability of muscle fibers was a property of matter, as incomprehensible as gravity. If the soul was a motive principle, it could be a corporeal motive principle, a kind of complex cerebral muscle.

For Cabanis, the oversystematic mechanists had attempted to reduce the human body to dynamics and hydraulics against all the canons of Hippocratic empiricism. At the same time, mechanists like Boerhaave had used a Hippocratic term *enormon* to indicate a nonmechanical principle of arousal. Gaub had developed this notion to interpret the phenomena of mental-physical correspondence, and Le Camus had shown the limits of dualist mechanism without such a notion. Now the solid-fluid balance theory of temperament was ripe for revision to account for the forces of irritability and sensitivity. La Mettrie had stood Haller on his head to arrive at a monism that was not entirely mechanical. The animist and vitalist physicians would also use inexplicable principles allowing degrees of spiritual activity sometimes scarcely distinguishable from corporeal activ-

ity. If they ultimately appealed more to Cabanis, it was their precise analysis of degrees of nervous activity that seemed to him to best refine the notion of temperament. Then, too, the vitalists, or philosophers inspired by them, especially preserved the respect for the uniqueness of the living body that was the foundation of Cabanis's physiology.

★ CHAPTER III ★

The Soul and the Vital Principle in Physiology

The Omnipotent Soul: Stahl

While the mechanists were assigning strange active forces to living matter, the vitalists, like Descartes, were confining the soul to reason and inventing special "principles" to perform seemingly purposive bodily functions. Just as Descartes had insisted that everything corporeal was mechanical, so the forerunners of vitalism insisted that the soul or its spiritual agents directed all corporeal activities. The late seventeenth-century medical world was filled with concerns of the Iatrophysical school, such as measurement of fluid forces and vessel diameters, and with concerns of the Iatrochemical school, such as acrimony of humors. Against this background, the cantankerous chemist and physician of Halle, Georg Ernst Stahl (1659-1734), demanded a return to Hippocratic empiricism and a useful sifting of the theories of Paracelsus and van Helmont.[1] Stahl believed that nature could not be understood by use of the chemical balance and that only clinical observation would reveal the incalculable properties of life. He had both a pietistic and scientific sense of the limitations of the intellect and thus rejected the overweening effort of mechanists to explain what he felt had to remain mysterious. At the same time, he helped create the distinctiveness of the term "physiology" as a subject apart from physics. While his medicine was based on external observation, his physiology was peculiarly life-oriented. Its testimony alone should make historians skeptical of Michel Foucault's contention that the idea of life could not be developed in an era when

the study of animals was dominated by natural history classification.[2]

Although a renowned theoretical chemist himself, Stahl thought chemistry and other "accessory sciences" to be useless in medical theory. In a characteristically entitled dissertation, *Paraenesis, or the Necessity to Remove from Medical Teaching All Foreign Objects* (1706), Stahl chided anatomists for being more concerned with counting torn fibers than healing a wound.[3] Anatomy ignored the nonmechanical, purposive, directing principle of life. While Cabanis believed in linking scientific and medical knowledge, he approvingly quoted Stahl's strictures on the "most serious efforts" of applying doctrines from other sciences to the "sciences seeking to know and to regulate the animal economy."[4]

Stahl based his disdain for medical systems on the radical discontinuity between medical subject matter and the inanimate objects of the physical sciences. Anticipating Bichat, Stahl believed life to be the force that prevented the decay of the inherently corruptible and heterogeneous elements of "organic aggregates." Harmonious organization was neither mechanical nor chemical. In physiology, the soul held corporeal activities under absolute control, though "the soul does not perform its actions or achieve its goals *immediately*, but in mediate fashion and for the most part entirely by means *corporeal* and infinite in number." The soul was the directing agent of the corporeal instruments. It lent cohesion to material constituents that would otherwise disintegrate.[5]

Though Stahl insisted on divine purpose and the powers of the soul, he refused to postuate a hierarchy of souls or spiritual agents. While he distinguished *logismos*—the conscious intellectual faculty—from *logos*—the "instinct of reason" supervising voluntary motion, conscious sensation, and involuntary vital processes—he never distinguished two or more souls. The soul as *logos* controlled circulation, heartbeat, and muscle tone in an intelligent and rational way. No mechanism could explain the specific capacities of each structure. As Cabanis noted, Stahl believed that the soul "digests in the stomach, breathes in the

lungs, filters bile in the liver, and thinks in the head. . . ."[6] Stahl thought that neither the quality nor the heat of the humors could be chemically or mechanically maintained. By circulation, secretion, excretion, and variation of tonic motion the soul refreshed the body and expelled corrupted matter. In pathology, the "substantial motive force" of life was identifiable with the Hippocratic healing force of nature, needing only assistance by the physician to overcome disease. Medical therapy would most profitably stimulate the appropriate secretions and excretions to rectify errors of the soul.[7]

Stahl particularly stressed the activity of the soul in impressing tonic motion on nerves to convert sense-stimuli into conscious useful perceptions. Sensation served a specific purpose—that of preventing bodily harm. While Haller later acknowledged the importance of brain response in perception, Stahl's imagery more clearly stressed the freedom of the soul to direct attention at will. A weary soldier would sleep through a cannonade, while a mother would hear a child's cry. The soul was no more passive in sensation than a man is in hunting birds. Even in assimilation of nutritive substances, the separation of appropriate "corpuscles" was a "truly elective act."[8]

While Stahl emphasized the sovereignty of the spiritual principle, especially in the physical effects of powerful emotions, he adopted the common dualist doctrine of temperament and the non-naturals. He did not hesitate to correlate qualities of mind and character with density, velocity, and chemical composition of the humors, or with hardness, compactness, and diameter of the solid vessels.[9] The insistence on the dominion of the soul ran all the dangers later noted by Haller. In Stahl's own lifetime, the philosopher Leibniz, in a bitter correspondence (published in 1720 under the appropriate title of *Negotium Otiosum*) argued that only a corporeal substance could have direct action on the body. Stahl weakly replied that the soul could move living matter because there had to be an "immaterial cause" for motion, an "incorporeal thing."[10] Stahl repeated so often and with such conviction that the body was only the instrument of the soul that we must dismiss Leibniz's accusation

of materialism as a characteristic ploy against philosphical adversaries (as in the famous exchange with Newton's spokesman Samuel Clarke). But Cabanis himself deliberately ignored the "animist" aspect of Stahl's physiology (rational control of all bodily functions by the single soul). He claimed, rather incredibly, that Stahl used the term "soul" to please the orthodox but meant by it a synonym for terms such as *enormon*, sensitivity (the explanatory term of the Montpellier school), living solid (used by Friedrich Hoffmann of Halle, Gaub, and William Cullen of Edinburgh), or vital principle (Barthez of Montpellier).

This disingenuous interpretation precisely reflected Cabanis's desire to purge Stahlian thought of its animism while retaining its vitalist aspects (in this case, the belief in a nonphysicochemical conserving principle that would function as the inexplicable forces of mechanists did). Cabanis valued Stahl's image of the self-conserving, unified living organism as a legitimate revival of ancient clinical observation. Indeed, Cabanis lavishly praised Stahl as the "greatest physician to appear since Hippocrates," primarily because of his detailed observation—as of hemorrhages and chronic abdominal infections.[11]

"Semi-Animism": Whytt

While Stahl had several disciples at German universities, the most significant revisionists were active at Edinburgh and Montpellier. At the Medical Faculty in Edinburgh, the renowned experimental physiologist and clinician Robert Whytt (1714-1766) studied with Alexander Monro *primus* and, before his return, also with Boerhaave and Albinus at Leyden and with the neuroanatomist James Winslow in Paris. Several times Cabanis cited Whytt's justly admired treatise on nerve disease, published in 1764 (translated into French in 1767 and 1777).[12] Like Stahl, Whytt contested Cartesian mechanism but he denied charges that he was a Stahlian.

In an *Essay on the Vital and other Involuntary Motions of Animals* (1751; rev. ed. 1763) as well as in the treatise on nervous disorder (1764), Whytt painstakingly refuted explanations

of reflex phenomena and muscular contraction by mechanisms, chemical reactions of nerve fluid and aether, or electrical effluvia.[13] From experimental evidence—oscillatory, diminishing responses of muscles to stimuli and contraction of the membranes, rather than of the internal fibers of muscles—Whytt arrived at the hypothesis of a purposive "sentient" principle governing muscular contraction. Similarly, he attributed pupillary contraction to a sentient principle in the brain that, excited by unpleasant light stimuli, determined nerve action. He attempted to show mathematically that the heart could not produce sufficient mechanical force for circulation, or the nerve fluid, for muscular contraction. Involuntary responses also might follow imagined rather than actual stimuli, "as when salivation follows the sight, or even the recalled idea of *grateful* food." In modern terms, Whytt described an integrated functional response, with a conditioned reflex as a special case. In his own terms, Whytt described "feelings" of the sentient principle rather than properties of matter. The human body was so constructed that "the whole is a system far above the power of mechanics."[14]

Whytt's twelve-year debate (1752-1764) with Haller on irritability focused on his refusal to admit nonnervous contraction. For Whytt, irritability was merely a special case of sensitivity. He maintained that Haller's experiments were inaccurate because the shock to already injured animals had masked the additional pain they felt on stimulation of "insensitive" organs. For Whytt, sensitivity was present in every organ, not merely in nerves; even tendons had "obtuse" sensation. Various animal experiments performed after decapitation as well as the contraction of irritated excised muscle fibers showed "traces" of the sentient principle. Any dissociation of sensitive phenomena into two forces was unjustifiable on grounds of simplicity of explanation and was also potentially materialistic in attributing active motions to the body.[15] Conversely, critics charged that Whytt made the soul physically extended. To Haller, activity of the soul in excised muscles was itself potentially materialistic.

For his part, Whytt carefully refined his notion of degrees of activity of the sentient principle. The principle explained, for example, organic "sympathies" where no nerve connections were observable or where mental phenomena played an inhibiting role. Sympathies between stomach and brain or between uterus and mammary glands were commonplaces of medical experience. They were no more mechanical than was thought "a motion of the particles of the animal spirits, or other subtile matter in the brain." At the same time, sympathies were preeminently attributable to the brain itself and to "spinal marrow."[16] The role of the spinal cord, effectively established by Whytt, could be illustrated by the residual sympathies in decapitated animals. In an experiment performed by his friend, the physiologist Stephen Hales, Whytt discovered that such sympathies could be inhibited by pithing the spinal cord of a decapitated frog.[17] Consequently, the spinal cord was part of the sensorium commune, and "reflexes," whether of the cord or pupillary contraction, were special cases of sympathies.

Like Stahl, Whytt insisted on the unity of the soul that supervised involuntary motion. But he explicitly defended himself against Haller's charges of Stahlianism by differentiating rationality and consciousness in the soul (absent in "infants, idiots, and brutes") from the feeling of the sentient principle.

> The mind, therefore, in producing the vital and other involuntary motions, does not act as a rational, but rather as a sentient principle; which, without reasoning upon the matter, is as necessarily determined by an ungrateful sensation or *stimulus* affecting the organs, to exert its power, in bringing about these motions, as is a balance, while, from mechanical laws, it preponderates to that side where the greatest weight prevails.[18]

At one point, Whytt even used the term "quasi-mechanism" for involuntary motions, despite his principles of "semi-animism." While he believed that spiritual activity endowed the body with peculiar properties, he also acknowledged that it was a strangely enslaved spiritual principle that was "necessar-

ily determined" in vital phenomena. Whytt even admitted that animals have sentient principles differing only in degree from men.[19]

Semi-animism could thus be the mirror image of La Mettrie's addition of an unexplainable active property to the Cartesian beast-machine. Whytt, no less than Haller and La Mettrie, was using a "physiological unknown." Vitalists could maintain their orthodoxy by stressing the purposeful activity of the sentient principle, and mechanists could stress the determined response of merely inert and insensitive matter. But the convergence of paradigms facilitated the tasks of Diderot and Cabanis. Activated matter or unfree sentient principle—either interpretation might threaten belief in the soul and lead to heretical monism.

An interesting corollary to Whytt's nerve sympathy doctrine might have suggested to Cabanis his cherished analogy between physical and moral sympathies. Whytt first noted that if, as Scottish philosophers claimed, we instinctively approved or disapproved of moral phenomena, then the involuntary physiological reaction of stimuli to organs might seem more plausible. No reasoning was involved in either realm. The next year (1764) Whytt reversed the argument to give a new wrinkle to the ancient "body politic" metaphor. Organic sympathy, he suggested, was a model for the cooperation observable in social sympathies.[20] In the individual, nature had illustrated desirable harmony, and healthy societies followed the same premise.

Montpellier Medicine

More influential than Edinburgh in the development of the thought of Diderot and Cabanis was the doctrine of the venerable University of Medicine in Montpellier—vitalism in theoretical medicine and cautious Hippocratic clinical observation in practical medicine. Endowed by Pope Honorius III in 1220 and placed in a medieval commercial crossroads, the Montpellier Faculty had retained its preeminence long after the economic decline of the city. In several ways Montpellier medicine played

a significant role in the late Enlightenment.[21] Its emphasis on sensitivity in physiology reinforced Condillac's empiricist theory of sensation as the basis of knowledge and motivation. Several Montpellier physicians were Encyclopedists, close friends of Diderot or members of the *coterie holbachique*. In fact, one may argue that Montpellier physiology shaped Diderot's materialist world-view as much as did his fascination with the naturalists, with Lucretius, and with clandestine materialist manuscripts. For both Diderot and Cabanis Montpellier medicine was an antidote to mechanical reductionism and a stimulant to interest in the dynamic philosophy of life of Buffon and Maupertuis. When Cabanis reviewed modern medical developments, he asserted that the doctrine of Montpellier, perfected by the "application of philosophical methods" and by the "progress of collateral sciences" more and more "approaches the truth," which would not be the property of a school but of all.[22]

BOISSIER DE SAUVAGES

The first Montpellier professor to leaven Iatrophysics with "vital principles" and "physiological unknowns" was François Boissier de Sauvages (1706-1767). Known as the "physician of love" for his dissertation on simple remedies to "cure" love, Sauvages was a Montpellier graduate (1726) reared in the mechanist tradition. He translated the Iatrophysical classic *Haemastaticks* by Stephen Hales (as *Statique des animaux* [1744]) and attempted quantitative measurement of heart force, arterial pulse, blood circulation, and organ density. A confirmed Newtonian, he saw the basis of medical theory in experimental physics, "mathematical philosophy," and precise anatomical knowledge.[23] Yet in his later works, after study of Stahl, he came to recognize "a principle of vital movements, superior to ordinary mechanism." Sauvages himself legitimized, in Newtonian fashion, use of inexplicable principles: "One sees, however, mathematicians who use the letters x and y to designate unknown quantities, and with so much greater

success, that they discover by such means truths inaccessible to other philosophers." To control pulse, respiration, secretion, assimilation, and other involuntary motions, there was need of an "intelligent force," for all the hydraulic structure of the body. Everyday experience showed that the mind, or "soul," could accelerate the heartbeat, and one must assume that other faculties of the soul direct other motions.[24]

The physiology of Sauvages represented a curious transition between animism and mechanism. His pathology brought into France the methods of "nosology," or classification of disease, of the English physician Thomas Sydenham (1624-1689).[25] While Sauvages was a botanist and corresponded with Linnaeus, the first French sketch of the *Nosologie* appeared in 1731, even before Linnaeus's *Systema Naturae* (1735). Sauvages followed Sydenham in describing a two-stage classification—first, a history, or "graphic and natural description," and second, "philosophical nosology," or reduction of all diseases to "definite and certain species."[26] Sauvages would observe only evident symptoms in the attempt to differentiate the idiosyncratic effects of age and temperament from the "peculiar and constant phenomena" of the disease. In this respect, Foucault has correctly argued that eighteenth-century classifiers emphasized the external rather than the internal location of a disease. While Cabanis clearly considered Sauvages's nosologies artificial and inadequate, the Baconian-style observation and classification was later at the heart of Cabanis's "analytical" method in medical theory.[27]

BORDEU AND SENSITIVITY: RESTRICTION OF THE SOUL

For Cabanis, the most significant Montpellier physician was the Gascon, Théophile de Bordeu (1722-1776, D.M. Montpellier 1743), staunch advocate of inoculation, personal physician to Madame du Barry, and principal character in Diderot's dialogue *Le Rêve de d'Alembert*.[28] Cabanis not only cited Bordeu's original works, but often followed Bordeu's history of medicine in

his *Coup d'oeil*. He also claimed that his own mentor Dubreuil had medical theories related to views of Bordeu.[29]

From fragmemts of the dogmatic structures of Iatrophysicists and Stahlians, Bordeu constructed an original conception of life and physiological function. For Bordeu, life consisted of the "faculty of the animal fiber to feel (*sentir*) and to move itself . . . inherent in the primary elements of the living body [like] the gravity, attraction, and mobility of various bodies."[30] The primary living structure was the nervous system, which controlled the equilibrium of two inversely proportional forces—sensitivity and muscular mobility. All nervous activity was sensitive, and Haller's irritability and Whytt's sympathies were special cases of nervous sensitivity.[31] As early as 1742, in his baccalaureate dissertation *De Sensu Generice Considerato*, Bordeu had divided functions into those of "evident motion and occult sensation," such as circulation and respiration, and those of "evident sensation and occult motion," such as internal and external sensation.[32] Thus, Boerhaave's notion of obscure sensation could reappear in a different context, a context in which a kind of feeling could remain subconscious. In a later treatise, Bordeu refined the idea of sensitivity to include not merely the "fiber," but the arrangement, cohesion, and composition of the sheaths of fibers, the nonsensitive mucous "cellular tissue" (Haller's *tela cellulosa*, the modern areolar connective tissue).[33]

Bordeu always carefully allowed for the active influence of the spiritual soul and he recognized its primary role in conscious functions and emotions. But he subsumed all vital activity under the guidance of a distinct animal being, namely the force of nervous sensitivity. As his thought matured, sensitivity overshadowed the soul in nearly all discussion of corporeal activity.[34]

Bordeu's "federative" concept of the body (as Moravia has called it) shaped the medical presuppositions of Cabanis's science of man. Unwilling to limit sensitivity to the brain and spinal cord, yet unsure of the precise relationships of central and sympathetic nervous systems, Bordeu revived van Helmont's

hierarchical *archei* in the form of three centers of sensitivity. The brain was the primary center, but there were two subordinate centers—the heart, or precordial region, and the stomach and diaphragm, or epigastric region.[35] The relative strength of each center, and of the sphere over which it presided, could account for the diversities observed according to age, sex, and temperament. Internal organs also had nerve connections with a corresponding "department" in the brain. Tension changes in these connecting fibers could explain the physical effects of emotional reactions (nausea, salivation, tears). All individual characteristics were thus a function of equilibrium of centers of sensitivity or relative activity of these nerve networks.[36] Bordeu now transformed the Hippocratic "unbroken circle" metaphor into the image that fascinated Diderot:

> A swarm of bees, gathered in clusters and suspended from a tree as a vine; each part is, so to speak, not an animal, but a kind of self-contained machine, which in its fashion concurs in the general life of the body.[37]

For therapy, the inferior centers might even be more important, since the brain was not an autocrat, and each "partial life" interacted with the "general life."[38]

If the federative concept was essential for Cabanis's physiology, so was the model of active sensitivity. Bordeu's description of gland functioning was at once a pioneering work of endocrinology and a model for the active sensitive response. To Bordeu, glandular secretion was no mechanical compression or separation, as in Iatrophysical theory, but a response to an irritating body or other stimulus from nerves linking the gland and brain. After a preparatory spasmodic state, or "erection" (the genital and mammary models were appropriate), there was extension of glandular ducts, activation of blood vessels, and nerve convulsions that contracted and emptied the reservoir of the gland. Secretion was a "kind of sensation," even a kind of "taste," without consciousness in which the nerves would "retain and choose" substances in the blood. The nerves of external sense-organs, like the nerves of glands, reacted, after preliminary arousal, to extend toward pleasurable sensations and withdraw from unpleasant ones.[39] Although Bordeu associated sensitivity with nerve structure, he believed sensitivity to be a basic force in all living matter and dared to speculate that it might be either essential to matter or a necessary attribute of organization.[40]

The vitalist Bordeu was thus prepared to make statements on the fuzzy borderline of materialism. Yet he would make no concessions at all on the autonomy of medicine. Despite a lively interest in chemical explanation of respiration, Bordeu warned that chemists would never unravel the complexities of digestion. He decried the use of physical instruments, such as a thermometer to measure fever, a meter to record pulse beat, or a microscope to examine fluids, and he used "experimenter" as a derogatory epithet.[41] Like Stahl, he saw the key to prognosis and therapy in careful clinical journal-keeping that correlated individual temperaments, atmospheric conditions ("constitutions"), and the progress of disease.[42]

LACAZE, FOUQUET, AND DE SÈZE

Several lesser-known Montpellier physicians amplified Bordeu's views and gave Cabanis a specific legacy. Bordeu himself and G.-F. Venel, Dubreuil's mentor, contributed to a work (*Idée de l'homme physique et moral* [1755; Latin ed. 1749]) ostensibly authored by Bordeu's "rich uncle," the physician to the duc d'Orléans Louis Lacaze (1703-1765; D. M. Montpellier 1723). Extravagantly conceived and tortuously written, the physiological sections elaborated ideas concerning sensitive-motor equilibrium and ideas on the "phrenic center" (Bordeu's epigastric region) as the regulator of vital forces. Lacaze followed Haller's addition to temperament theory by dividing men into "sensitive" and "motive" categories. The largely nonempirical corollary held that society developed moral sensitivity and reflection while savagery promoted muscular activity.[43] Later, Cabanis would have a prime goal of promoting physical temperaments with socially desirable moral correlates.

Moreover, Lacaze's schema permitted the argument that historical development changed human nature itself—a fruitful view for partisans of human perfectibility.

Lacaze was even more hostile than Bordeu to physiological experimentation and dissection. His idea of sound medical method was good clinical observation, free from the "laws of experimental physics." This deep-seated antagonism toward exportation of the methods of the physical sciences was evident in Cabanis's conception of the autonomy of medicine.[44]

The Montpellier graduate and later professor Henri Fouquet (1727-1806) provided an easily accessible summary of the ideas of Bordeu and Lacaze, among others, in his *Encyclopédie* article "Sensibilité, sentiment." Cabanis placed him among the great physiologists from Montpellier who were responsible for the striking advances in medical theory since the age of Galen. Fouquet's main purpose was to extend the range of the vital or sensitive principle to include Haller's observations of irritability and all other muscular motion. He supported Whytt in reiterating all the arguments of the debate with Haller. His vigorous opposition to "even the best-conducted experiments" on living organisms once again showed the clinicians' fear of distorting the delicate phenomenon of life. Finally, Fouquet indulged in the fascinating Neo-platonic or neo-Stoic speculation that sensitivity was an emanation of a universal intelligence. This latter reflection anticipated the private metaphysical musings of the mature Cabanis.[45]

Still another graduate of Montpellier, a professor at Bordeaux, Victor de Sèze (1760-1830), was Cabanis's colleague after 1796 in the "analysis of sensations and ideas" section of the Second Class of the National Institute. In *Recherches physiologiques et philosophiques sur la sensibilité* (written 1778; published 1786) de Sèze developed even more fully the ramifications of the key concept of sensitivity. Cabanis never cited this volume but presumably he was aware of a work dedicated to President Dupaty of the Parlement of Bordeaux, the godfather of his wife, who was also the intended heiress of Dupaty's papers. Like Lacaze and Fouquet, de Sèze castigated "cruel animal experiments," denigrated the "optical illusions"

of microscopy as an aid to pathology, and even questioned the medical value of Harvey's discovery of blood circulation. Attacking the basic spirit of the *Encyclopédie*, de Sèze doubted that "all sciences are a branch of a common trunk" and questioned the common physiological belief that animal life was governed by mechanical, hydraulic, and chemical laws.[46]

Despite these barriers between the sciences, de Sèze expressed a vision of the unity of nature by means of a hierarchy of affinity-force laws. As a vitalist, he reversed Buffon's order and began at the highest level—the free choice and conscious sensation of the spiritual soul—and descended through subconscious "sensations," irritability, tonic motion (evident in some vegetables), chemical affinity, and attraction. In physiology, de Sèze, like Bordeu, allowed for sensations unrelated to external sense-organs such as hunger, thirst, and sex drive—a view of sensation later stressed by Cabanis. Moreover, he followed Bordeu's notion of sensitive response as an erection, or *érétisme*, of fibers which in the brain, if excessive, could produce a "frenzy." De Sèze thus explicitly developed a new idea of sensitivity in explaining physical-mental correspondence.

Given the hierarchy of forces, de Sèze solved the problem of the emergence of life and feeling by postulating that life was latent everywhere—sensitivity was a "faculty that the true state of organization permits an active principle to display." As Fouquet had already argued, the vital principle might conceivably be an emanation of the "spirit of life circulating in all bodies." For de Sèze, then, the continuities and correspondences in nature posed no threat to a vitalist viewpoint or religious orthodoxy. But like his Montpellier colleagues, he refused to extend methods of study from the inorganic to the organic realm.[47]

BARTHEZ, THE VITAL PRINCIPLE, AND THE CONVERGENCE OF MECHANISM AND VITALISM

Montpellier vitalism reached its culmination in the prerevolutionary era in the works of the vain, ill-tempered Paul-Joseph Barthez (1734-1806), who publicly vilified the "sect" of Stahl

and Bordeu. Barthez was first physician to the duc d'Orléans (1781), later consulting physician to Louis XVI, Chancellor of the University of Medicine in Montpellier, an eminent jurist, contributor to Diderot's *Encyclopédie*, and occasional guest of d'Holbach. After the political passions of the Revolution cooled somewhat in 1798, the young physicians and medical students at the Paris School of Medicine insisted that the former royalist and partisan of noble privilege Barthez be permitted to become a corresponding member of their Société médicale d'émulation, a highly significant research circle. After preliminary expositions of his physiology in Latin orations of 1772 and 1774, his principal work was *Nouveax Elémens de la science de l'homme* (1778). Cabanis was convinced that this treatise was "filled with great medical insights as well as philosophy and erudition" and that it "merits a more striking success."[48] Despite the high reputation of Barthez's work, the greatly expanded second edition (1806) seemed rather quaint in its continued opposition to the new chemical theory of respiration and its preference for vague vitalistic explanations of animal heat.

While Barthez narrowly defined the "science of man" as physiology, he shared Cabanis's view that physiology was indispensable to broader theories of mind and character. The "Preliminary Discourse" to the physiological discussion was also a veritable discourse on method for the life sciences, far more precise than Buffon's remarks in the *Histoire naturelle*. Enshrining the Newtonian explanation paradigm and anticipating the positivist credo, Barthez rejected the search for essences and recommended the quest for laws showing "succession of the phenomena." Observation, said Barthez, would reveal "experimental causes," acting in a fashion as seemingly occult as electricity or magnetism, but in a fashion admissible if effects were empirically evident. The much-maligned "occult causes" were useless only if they transcended the phenomena. In physiology, mechanists erred in expecting the "occult faculty" of impulse to explain all, while animists erroneously explained corporeal motion as the work of a "spiritual being." Both ignored the "most general experimental cause" in man—the "vital principle" causing feeling and motion in the body.[49]

In practice Barthez found it difficult to adhere to his lofty standards. In a treatise entirely concerned with the vital principle, Barthez never could define it unambiguously. It was neither body nor organization nor soul nor any body-soul intermediary. It was purposive, though not conscious; multiform, but not extended. In the "Preliminary Discourse," he insisted that it was not a "distinct being," but rather a "simple vital faculty of the human body." It was determined, not free, and mortal, unlike the soul. Though Barthez scorned Newtonian caution by ascribing to all matter an "activity residing essentially in matter," he refused to admit that living matter *produced* the activity or moved itself. In a supplement of 1806 he warned that organic structure was "absolutely passive."[50] Like de Sèze, he envisaged a hierarchy of principles of motion, from impulse, attraction, chemical affinity, and electricity to "living forces" with "laws of a transcendent order compared to the laws of physics and mechanics." Barthez could not accept any implication, whether from Haller or the vitalists, that fiber activity was of, as well as in, living matter itself. This ambiguity produced scarcely compatible accounts of the vital principle. On the one hand, Barthez had reduced its physiological force to Sauvages's algebraic unknown—an epistemological riddle that was not an explanation, only a name and a "theoretical abstraction." On the other hand, Barthez wrote a lyrical echo of Fouquet's conjectures that the vital principle might be an emanation of a universal principle created by God to animate the universe.[51] At the same time, Barthez could account for the regularity of vital phenomena without surrendering the uniqueness of life or the free, spiritual activity of the rational soul. Cabanis absorbed both the methodological caution and the metaphysical interest in the emanations of a universal intelligence.

Barthez's physiology discussed the activities of the vital principle in sensitive and motive forces, as well as in sympathies and in "modifications" due to age, sex, temperament, disease, and the non-naturals. Against Haller, he argued for the primacy of a "sensitive principle" in irritated excised muscles. Against Whytt and the vitalists, he contended that some sensitivity can

be independent of nerves, as in pathologically inflamed ligaments and tendons and the response to stimuli of nerveless zoophytes.[52]

Unlike his Montpellier colleagues, Barthez insisted that motive forces had "characteristic primordial laws" and were therefore as significant for the vital principle as nerve structure and sensitivity were. A paralyzed patient, asserted Barthez, might recover movement without feeling; hence no nerve movement or animal spirit flow could in itself be necessary to move muscles and internal organs. The motive forces regularly controlled imperceptible "tonic movement" in muscle fiber molecules and spasmodic, perceptible tonic movements in reactions to cold or fever.[53]

Similarly, Barthez refused to attribute to nerve connections alone the sympathies (transfer of disturbance) or "synergies" (cooperation of organs) occurring in organs with functional relations but no direct nerve connections. Barthez thought that even Whytt had considered sympathies "too materially." Sympathies such as that between the brain and epigastric regions were sometimes products of immediate activity of the vital principle.[54]

While Cabanis followed more closely the Montpellier physicians who encompassed all such phenomena under the heading of "sensitivity," he was very much indebted to Barthez for placing in fresh perspective the concept of temperament. Moving beyond the solid-fluid balance theory, Barthez redefined temperament as the "ensemble of constant affections which specify in each man the system of forces of each individual." Traditional, indirect methods of determining temperament required either external observation of appearance and behavior or medical analysis of the elasticity, dryness, and strength of fibers (solids) and abundance and density of humors (fluids). The ancient classes of temperament were a valuable guide, but Barthez preferred a direct determination. The crucial factor was the "total energy of the radical [potential] forces of the vital principle in the entire body" and its "respective energy in various organs." Indicators of this energy might be convulsive movements or

weakness or uncommon liveliness in sensations and appetites. These movements and sensations might in turn suggest chronic organic disturbance that would influence temperament classification. One also had to observe modifications produced by habits or use of the non-naturals in the forces of the vital principle. Changes in air, climate, diet, and exercise would all affect sensitivity and mobility. Temperament classification was important, because any therapy had to adjust these environmental agents to restore natural equilibrium.[55] The concept of temperament was thus for Montpellier physicians either associated with an all-encompassing nervous sensitivity itself or with an indefinable vital principle that controlled both sensitive and motive forces in the body.

In Montpellier medicine, the active forces performed more and more corporeal functions while Stahl's omnipresent soul was confined to thought, its Cartesian essence. This refinement in views of purposiveness in the body was not entirely regressive in the history of the life sciences. Montpellier caution curtailed the mania for physical and chemical hypotheses and increased respect for factual observation. At the same time, Montpellier physicians no doubt discouraged physiological research and experimental medicine. Their epistemology involved importing Newton's concept of unknowable forces into an area where its usefulness was doubtful. Barthez thought that his vital principle was as valuable an experimental cause as gravitation was; yet Newton could assign mathematical relationships to the forces observed and, for all his piety, encouraged hypotheses and experiments without suggesting that the human intellect was all-powerful. To the Montpellier school, measuring life like brute matter was a kind of sacrilege. Yet they certainly had a well-developed concept of life before the age of biology, and their clinical approach to medicine anticipated the marked advances of the early nineteenth century.

In forming Cabanis's thought, the mechanist-vitalist convergence was crucial. To Descartes and Le Camus, matter was passive and mechanical. Mental feelings and passions could be correlated with the merely mechanical strength of fibers or flow

of animal spirits. Nowhere in the body was there the activity of thought and will. To Stahl, a spiritual soul was responsible for direct supervision of all true activity in its corporeal instruments. The Montpellier vitalists suggested that corporeal forces were indeed active, though not spiritual. As sensitivity or the vital principle explained more and more physiology, the spiritual soul was crowded out of all but rational activity. Since nervous sensitivity was not mechanical, merely corporeal forces could account for mental phenomena—sensation and feeling. While there was no satisfactory solution to the age-old dilemma of how the physical becomes the mental, Condillac's psychology deduced thought from sensitivity, and therefore an active force of sensitivity could plausibly generate the active function of thought. Thus, for those with sufficiently unorthodox inclinations, Montpellier vitalism could be as provocative as the modified mechanism of Haller. La Mettrie could claim that irritability was the single active physical principle necessary to produce feeling and thought. Diderot could claim that the active sensitivity of Bordeu could explain the emergence of feeling from material organization. To be sure, neither Haller nor Bordeu could be accused of dangerous heresy. But just as the materialist La Mettrie could transmute mechanism, so could the materialist Diderot turn Montpellier vitalism to his own purpose.

The convergence of vitalism and mechanism certainly did not dictate the choice of monism or dualism. Bonnet could have a sophisticated view of nervous sensitivity while remaining a dualist. D'Holbach would choose a monism filled with physical and chemical terminology, speculate on a hierarchy of forces of affinity, and yet be little influenced by the vitalist-mechanist convergence. Nor would all those influenced by physiology become monists. The Montpellier physicians carefully reserved a place for the rational soul. But those with unorthodox inclinations, such as Diderot or Cabanis, were deeply affected by the vitalist-mechanist convergence. Their monism had a distinctly vitalist tinge in which the forces accounting for nervous sensitivity could also account for intelligence. For them, a simplistic mechanist materialism was now untenable.

DIDEROT AND MONTPELLIER PHYSIOLOGY

Diderot's hypotheses on spontaneous generation, species change, and the awakening of sensitivity might have been inspired by Buffon, Needham, and Maupertuis. But he gleaned from Montpellier physicians the physiological vocabulary that enabled him to place so much faith in the capacities of organized matter. In a letter of 1765, he had explicitly maintained that "sensitivity is a universal property of matter, inert in inanimate bodies . . . but activated by assimilation with a living animal substance."[56] But Diderot exercised none of the caution of de Sèze or Bordeu in speaking of latent sensitivity. In private letters or reading notes, he left no room for the soul or for free will in psychophysical correlations. Diderot's influence on Cabanis's physiology seems definite, but no easier to substantiate than in the case of transformism. Grimm published fragments of the *Rêve de d'Alembert* in 1782, and the Committee on Public Education of the National Convention allegedly received a copy in 1794 (accessible to Cabanis's friends Garat and Ginguené). Cabanis's acquaintance with Diderot's literary executor J.-A. Naigeon would also suggest access to the *Rêve* and possibly to Diderot's voluminous reading notes.

From about 1765 to his death (1784), Diderot gathered materials for a collection later entitled *Eléments de physiologie*. In a manuscript note dated 1778, he proposed to consult many of the same authors who influenced Cabanis—Stahl, Whytt, Bordeu, Barthez, William Cullen (Whytt's colleague at Edinburgh), and Pierre Roussel of Montpellier among the animist, semi-animist, and vitalist physicians; Le Camus, Haller, and La Mettrie of the mechanist or modified mechanist tradition; and Bonnet and Helvétius among the naturalists and philosophers.[57] The order of presentation and sometimes the substance of entire sections followed Haller's *Elementa Physiologiae Corporis Humani* (8 vols., 1757-1766). But Diderot was undeniably radical in his views on mind-body interactions. He relentlessly attempted to show how the soul depended on health, age, fatigue, and diet and asserted that life in excised organs undermined be-

lief in unity of the soul. Like d'Holbach, he argued that the soul was merely a portion of the body correlated to other portions—merely a name for the "organization of life." Sensation, memory, affection, and the will were merely corporeal functions of the brain and nervous system, organs with no special distinction in status. The human body was certainly not reducible to a traditional image of mechanism but it was still a passive machine. Voluntary motions were not "free," but "necessary," either because of the needs of our organs and passions or because of our habits.[58] Once again, what Bonnet and Condillac would call "liberty" became "necessity" in the terminology of Diderot and d'Holbach.

Diderot continued to insist on the unity and interdependence of the organism. He found the "vibrant sensitive cord" of the fiber the key to the active force of sensitivity. Moreover, he adopted Bordeu's swarm-of-bees image in which each organ was like a "distinct animal" having its "particular kind of touch," its particular manner of sensing.[59] As in Montpellier medical works, the diaphragm had a particular sensitivity important in emotional expression, and fits of sensitivity meant spasms in nerve tension, which, in their extreme state, were, as Bordeu might have said, an *éréthisme violent*. The brain was the seat of consciousness and dominated subordinate centers of sensitivity except in sleep, illness, or violent passions. Diderot also repeated the common conception (from the time of Malpighi, adopted by Baglivi, Boerhaave, Cullen, and Buffon) that the brain was a secretory organ and that the variable composition of the nerve fluid it secreted could affect minds and characters. This glandular image of the brain was specifically rejected by Bordeu, and though Cabanis notoriously adopted it, he hardly used it in a gross materialistic fashion.[60]

Thoroughly consistent with his views in *Le Rêve de d'Alembert*, his refutation of Helvétius, and his letter to Hemsterhuis, Diderot combined a monistic metaphysics with an unmistakably vitalist physiology in his *Eléments*. He tried to reconcile the model of sensitivity as active with his conviction that sensitive response was determined rather than free. Yet assimilating man

to nature did not mean denying the distinctiveness of life or denigrating human stature, as his refutation of Helvétius clearly illustrated. Diverse human temperaments prevented treatment of men as if they were all from the same mold, and human pleasures of memory and anticipation were far different from animal pleasures. In Diderot's ethical thought, far too complex for thorough discussion here, human beings were neither inexorably fated nor mere automata. As with d'Holbach, there was ample room for improvement even in a refractory temperament. Men were modifiable, and they could strive for self-realization.[61] Diderot had synthesized the Encyclopedic aspirations for unity in nature and the sciences with the medical experience of diversity.

Since Cabanis had a similar intellectual heritage, it was hardly surprising to find his thought to be an amalgam of insights from the philosophes and theories from the physicians. Before beginning his major work on psychophysiology, he would arrive at definite opinions concerning method in medicine and the need to apply the clinical approach to hospital reform. These early essays illustrated his commitment to the unity of the sciences as well as to the special status of medicine. Within a year of completion of his early essays, he was caught up in the whirlwind of revolutionary politics. Practice had to precede fully elaborated theory. Assumptions about human nature had implications for social policy, and method in medicine could be applied in reorganized hospitals and amid new professional standards.