

dissolution, sublimation, “and other similar operations which occur in the body of an animal as in the laboratory of a chemist.”⁵⁰

THE DEBATE OVER DIGESTION

A sharp debate occurred in the medical literature between 1709 and 1715. This was chronicled in Jean Astruc’s (1684–1766) *Traité de la cause de la Digestion* (1714). In his account, Astruc referred to mechanical descriptions of digestion given by Leeuwenhoek in 1684 and by Pitcairne in 1693. However, Astruc continued, neither of these accounts greatly affected the current debate that had begun with an article by the mechanist, Philippe Hecquet (1661–1737), in 1709. Both Astruc and Raymond Vieussens replied to Hecquet the following year and in 1712 Hecquet published his *Traité de Digestion*, which was answered by Astruc in 1714.

Here we need only sample the works of these authors to obtain some sense of the issues being discussed. Philippe Hecquet graduated in medicine at Rheims (1684) and then took his M.D. at Paris ten years later. A convinced mechanist, he presented his views in a *Traité des Dispenses du Carême* (1709), which he followed with *De Digestion et des Maladies de l’Estomac; Suivant le système de la Trituration & du Broyement, sans l’aide des Levains ou de Fermentation, dont on fait voir l’impossibilité en santé & en maladie* (1712). Here and in later works [*De Digestion . . .* (Nouvelle édition, revised, corrected and augmented, 1730); *Le Brigandage de la Chirurgie* and *Le Brigandage de la Medecine Pharmacie* (1738); *Le Brigandage de la Medecine* (1733, reprinted 1749)], we can follow his views on chemistry and mechanism in medicine.

For Hecquet the chemical physicians had effectively declared war on the true medicine.⁵¹ They had neglected the study of anatomy and quite incorrectly substituted for it analysis by fire. But chemistry is more a manual art

⁵⁰*Journal des Sçavans*, 38, 336–338.

⁵¹Philippe Hecquet, *Le Brigandage de la Medecine, dans la maniere de traiter les petites véroles & les plus grandes maladies par l’Emétique, la Saignée, du pié & le Kermès minéral . . .* (3 vols., Utrecht: Corneille Guillaume le Febure, 1749; 1st edition, 1733), vol. 1, p. 10. L. W. B. Brockliss has studied the relation of Hecquet’s iatrophysical views with his Jansenist beliefs. He was a convinced mechanist who rejected the views of several iatrochemists in print. As he grew older he became ever more suspect of chemically prepared medicines, but he remained convinced that God expected man to seek truth in the book of nature and that medical cure occurred only in cooperation with the Holy Spirit. Brockliss, “The Medico-Religious Universe of an Early 18th Century Parisian Doctor: The Case of Philippe Hecquet” in *The Medical Revolution of the 17th Century*, edited by Roger French and Andrew Wear (Cambridge: Cambridge University Press, 1989), pp. 191–221.



PHILIP. HECQUET D. REG. ET ANCIEN DOIEN DE LA FAC.
DE MED. DE PARIS,
Né à Abbeville le 11. Fev. 1661. et Mort à Paris le 11. Avril 1737.
Dans son art il n'oublia rien

Portrait of Philippe Hecquet (1661–1737). Courtesy of the National Library of Medicine.

than a true science. Fire only decomposes substances through distillations, fusions, reverberations, calcinations, and other processes that destroy the tissue or the natural arrangement of the parts that compose a body.

It is clear that a chemist will never make a good physician.⁵² Rather, geometry and mechanics are the basic laws required by a physician . . . precisely those laws which are the basis of natural philosophy and have no need of chemical fires. It is true that this subject has presented medicine with some useful preparations, but chemistry is an “art more mechanical or manual than scientific . . . more fit for artisans than philosophers.”⁵³ Indeed, traditional Galenicals are to be preferred to chemically prepared medicinals. Because of the ill effects of fire, Hecquet recommended to those who would study chemistry a recent book by Ernest Gotthold Struve that avoided fire and heat as agents and sought the preparation of substances by other means: mixing, light, natural motion, solution, deliquation, crystallization, digestion, and precipitation.⁵⁴ In this book Struve concluded that pharmaceutical chemistry was equally productive with or without fire.⁵⁵

But what are physicians to turn to instead of chemistry? Here Hecquet wrote specifically against Vieussens. No less than Pitcairne, Hecquet rejected the reliance of physicians on systems—and of all systems none seemed worse to him than that of fermentation and the views of the chemists.⁵⁶ The true answer was to be found in trituration, which avoids many inconveniences of the views of the chemists. It is easy and simple and like the thread of Ariadne leads to truth. Instead of heat, fire, and effervescence, we deal with the oscillations of fibrous matter. The chemists talk of dryness, concentrations, coagulations, and the thickening of liquors, while we speak of pressures. With them we have many salts, tartarous and sticky fluids, while here we have the effect of diameters and sluggish oscillations. Chemists write of bizarre fermentations, while we discuss disordered fibers. It follows that in these chem-

⁵²Hecquet, *Brigandage de la Medecine*, 1, p. 124.

⁵³Philippe Hecquet, *Le Brigandage de la Chirurgie . . . Premiere Partie* [and] *Le Brigandage de la Pharmacie . . . Seconde Partie* (Utrecht: Chez les Soeurs de Corneille-Guillaume le Fevre, 1738), *Seconde Partie*, p. 63.

⁵⁴Ernest Gotthold Struve, *Paradoxum Chymicom sive Igne i.e. Operationes et Experimenta Physico-Chymico-Pharmaceutica, ipsaque Medicamenta Chymica Ignis Operari Solita Sive Igne* (Jena: Ernest Clavd. Bailliae, c. 1715), pp. 55–61 and *passim*.

⁵⁵*Ibid.*, p. 80.

⁵⁶Philippe Hecquet, *De la Digestion et des Maladies de l'Estomac, suivant le Systeme de la Trituration & du Broyement, sans l'aide de levains ou de la fermentation, dont on fait voir l'impossibilité en santé & en maladie* (Paris: François Fournier, 1712), pp. x–xi.

ical systems of the bile, the saliva, the blood, and melancholy, of acid and alkali, volatility, fixity, aqueous, sulphureous, spiritous and phlegmatic, that all that is really needed is a knowledge of solid and liquid, and in place of all the chemical faculties, qualities and flavors, we really only need resistances and forces. And finally, he added, because one does not want to repeat all these names too often, we insist that all these qualifications are imaginary, while solids and liquids are natural and in nature.⁵⁷

Too many otherwise honest physicians have wasted their time and efforts on chemistry. Surely this was true of Willis and Sylvius, both of whom devoted themselves too much to the dreams of Paracelsus and van Helmont. There are too many French physicians such as Daniel Duncan who even now present their medical studies in terms of chemistry.⁵⁸ Others idolize the works of Paracelsus, Libavius, van Helmont, and the whole tribe of alchemical adepts. Unless this fascination is eliminated, medicine will degenerate to a monstrous science.

Although Hecquet was a friend and supporter of Pitcairne, he was strongly opposed to the views of Raymond Vieussens (ca. 1635–1715), one of the most distinguished French physicians of his time. After taking his M.D. at Montpellier in 1670, he became a physician at the main hospital there and rose to the rank of chief physician. He is renowned for his anatomical studies and he relates that it was his reading of Willis in 1671 that led to his study of the nerves and the publication of his *Neurographia universalis* in 1684. He then turned to an investigation of mixed bodies and the chemistry of the human body, a work to which he added a treatise on fermentation [*Nouveau Système des Liqueurs du Corps humain Vaisseaux*, 1705].⁵⁹ Of particular interest for the development of iatrochemistry is Vieussens' discussion of fermenta-

⁵⁷*Ibid.*, pp. xxix–xxx.

⁵⁸Philippe Hecquet, *De la Digestion et des Maladies de l'Estomac; Suivant le système de la Trituration & du Broiement sans l'aide des Levains ou de la Fermentation, dont on fait voir l'impossibilité en santé & en maladie* (Nouvelle ed., revised, corrected and augmented by the author, 2 vols., Paris: Guillaume Cavalier, 1730), vol. 2, p. 7.

⁵⁹On Vieussens, see the article with references by M.D. Grmek in the *Dictionary of Scientific Biography*, 14 (1976), pp. 25–27. Vieussens wrote of his life and scientific progress in the preface to his *Deux dissertations . . . Le Première Touchant l'extraction du Sel acide du Sang, La Second Sur la proportion de quantité de ses principes sensibles* (Montpellier: Honoré Pech, 1698). For his early work on the nervous system and on fermentation he was awarded an annual pension of 1,000 livres by the king and later named as a councillor of state. See above sig. ãi^r. He spoke further of his research in the *Traité nouveau des Liqueurs du Corps Humain* (1705). See the *Traité nouveau de la Structure et des Causes du mouvement naturel du Coeur* (2 vols., Toulouse: Jean Guillemette, 1715), vol. 1, pp. ê iv^{r&v}; ii^r.



*Raymond Vieussens Con. et Medecin du Roy
âgé de 65. ans.*

Portrait of Raymond Vieussens (ca. 1635–1715). Courtesy of the National Library of Medicine.

tion in his *Traité de la structure du Coeur*.⁶⁰ Here he assures the reader that blood contains both passive and active principles of natural fermentation and that the fermentation process takes place in the ventricles of the heart. The first principle is composed of a volatile sulphur and an acid salt. The second is the active principle of natural fermentation of the blood and nothing else but a spiritous substance impregnated with volatile particles of an acidic salt. "I wish to say that the vital animal spirit is united to the animal spirit . . . and by vital spirit, I understand a very fine liquor, present throughout all of the blood and principally composed of very subtle air, charged with volatile nitrous particles . . ." He goes on to describe the course of this vital spirit through the nerves, veins and arteries, indicating that it finally reunites with the animal spirit sustaining the fermentation process. It takes on its red color from the nitrous particles united to volatile acid salts received from food. Vieussens considered his study of blood his most important work, and indeed, his identification of the vital spirit is the continuation of a century of Paracelsian and chemical investigations seeking the isolation of this substance.⁶¹

Although not normally pictured as an important figure in the history of chemistry, it is clear that Vieussens was influenced strongly by the post-Helmontian authors, Willis and Sylvius. However, he was also indebted to Descartes for his views on the elements.⁶² In the *Traité nouveau des Liqueurs de Corps Humain*, he described the three elements of Descartes—the first, small and moving with great velocity; the second, heavier and slower; and the third, the heaviest, of irregular form and very slow. These he equated with earlier thought, the first with the fire of the ancients, the Platonic soul of the world, and the Hippocratic igneous matter. The second element was an aetherial matter and the third was simply earth.

If then we consider Vieussens as a late seventeenth-century chemical physician as well as an anatomist, we will find it easier to understand his position in the debate over digestion. In January, 1710 he published "De la nature & des proprietéz du Levain de l'Estomac in *Des Mémoires de Trevoux*."⁶³ This was a reply to the iatrophysicists, especially to Hecquet's *Traité des Dispenses*

⁶⁰*Ibid.*, 1, pp. 120–124.

⁶¹Allen G. Debus, "The Paracelsian Aerial Niter," *Isis*, 55 (1964), 43–61; Allen G. Debus, "Chemistry and the Quest for a Material Spirit of Life in the Seventeenth Century," *Spiritus: IV Colloquio Internazionale del Lessico Intellettuale Europeo, Roma, 7–9 gennaio 1983*, M. Fattori and M. Bianchi, editors (Roma: Edizioni dell'Ateneo, 1984), pp. 245–263.

⁶²Vieussens, *Traité nouveau de la Structure*, vol. 2, p. 2.

⁶³Hecquet (1730), vol. 2, pp. 507–520.

du Carême, published the previous year. In this article Vieussens refuted those who argued that the coction of foods begins mechanically in the mouth by biting and chewing and then continues in the stomach, which is viewed as a hollow muscle that kneads the food particles and finally dissolves them by the force of moving fibers. In this mechanical fashion the food is turned into a fine and delicate cream.

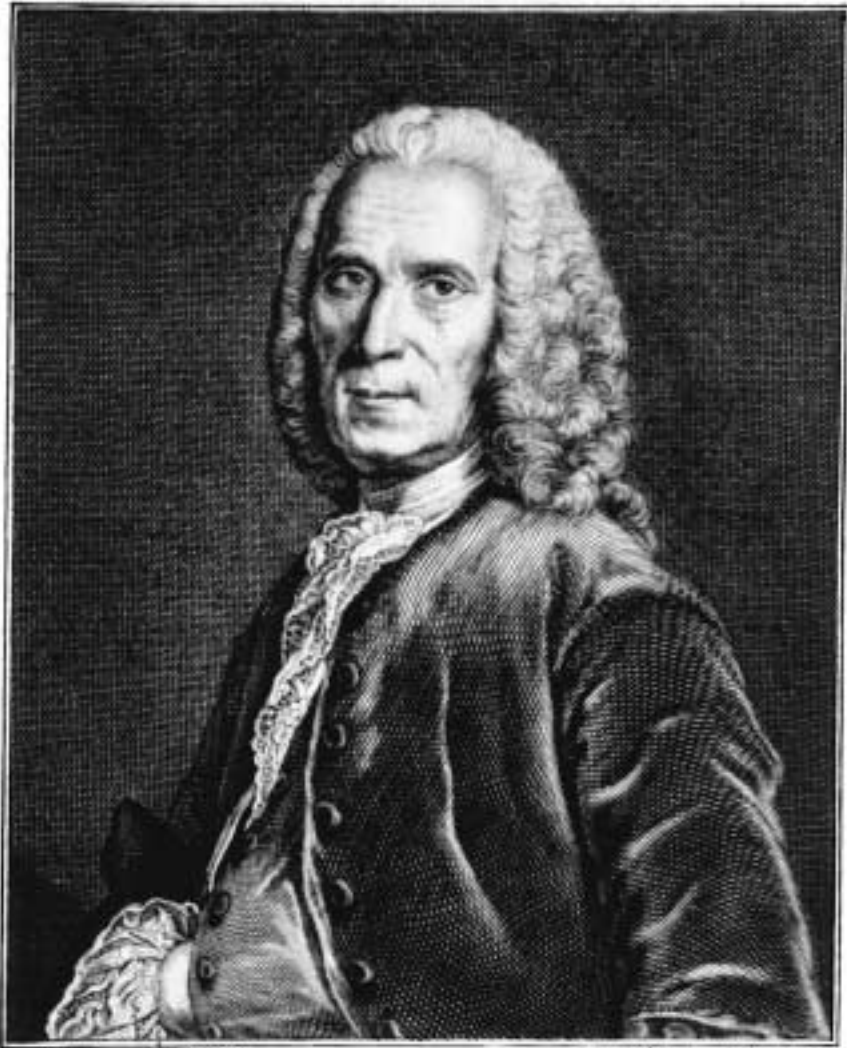
Vieussens replied that such an explanation was not accepted by physicians who understand the perfect natural structure and function of the stomach. As for the mouth, the action of the teeth is quite different from that of the stomach and the chemical action of the saliva is a significant factor in the digestive process. It is true that there is a motion of the stomach, but it is not a crushing and grinding action as Hecquet would have you believe. Rather, it is gentle and cannot explain the reduction of the food into a cream-like consistency.⁶⁴ One can only conclude that digestion is accomplished by a fermentation process and that the ferment is composed of volatile parts, of phlegm, of sulphur, and of an acid salt.⁶⁵ In short, digestion is basically chemical, not mechanical. Needless to say, Hecquet remained a convinced mechanist and when he expanded his 1712 work on digestion to two volumes in 1730 he reprinted Vieussens' 1710 article in its entirety to emphasize the truth of his own work in comparison with that of the Montpellier physician.

Jean Astruc (1684–1766) was surely no less prominent than Vieussens or Hecquet. A student at Montpellier, where he took his M.D. in 1703, he was later named to the medical faculty of that school while serving at the same time as the professor of anatomy at Toulouse and First Physician to the King of Poland. Later he was to be named Professor of Medicine at Paris. It would seem that Astruc was fully aware of both iatrophysical and iatrochemical viewpoints. As early as 1702 he had published on the mechanism of fermentation and in 1710 he produced a *Dissertation Physico-Mathématique* on muscular motion that reflected the principles of Borelli.⁶⁶ But in the same year he began his work on digestion that was to result first in his *Mémoire sur la cause de la Digestion*, later reprinted by Hecquet in the 1712 edition of his work on digestion. In 1714 Astruc published his *Traité de la cause de la Digestion ou l'on*

⁶⁴*Ibid.*, p. 509.

⁶⁵*Ibid.*, vol. 2, p. 518.

⁶⁶On Astruc, see the article by Pierre Huard in the *Dictionary of Scientific Biography*, vol. 1 (New York: Scribner's, 1970), pp. 322–324 with references. The early works referred to here are the *De motus fermentativi causa* (Montpellier, 1702); *Responsio critica animadversionibus F.R. Vieussens in tractatum de causa motus fermentativi* (Montpellier, 1702), and *Dissertatio physico medica de motu musculari* (Montpellier, 1710).



Peint par L. Vivier

*Gravé par J. Daulle
G. de Rou. 1766.*

JOANNES ASTRUC

Portrait of Jean Astruc (1684–1766). Courtesy of the National Library of Medicine.

refute le nouveau Système de la Trituration & du broïment. Et où l'on prouve que les alimens sont digerez & convertis en chile, par une veritable Fermentation.

In his treatise on digestion Astruc wrote first of the mechanistic interpretation of Pitcairne, whom he praised for his vivacious style. However, “we defend our views with moderation driven by a love of truth rather than passion.”⁶⁷ And the truth clearly is that “all changes of food in digestion are products of fermentation” . . . and indeed . . . “we regard fermentation as the principle agent of the animal economy.”⁶⁸

In a short history, Astruc cited the ancients in support of fermentation⁶⁹ and disagreed with Hecquet’s harsh view of van Helmont.⁷⁰ He affirmed that in digestion chemical dissolution occurs through the action of liquors called menstrua or ferments that penetrate and detach the parcels of food little by little until there is an entire dissolution. There are those who say that digestion only depends on trituration,⁷¹ but in truth digestion is fermentation resulting from the leaven of the saliva, the bile, and the pancreatic juice. Those who, like Hecquet, insist on digestion through trituration are wrong on four counts. *First*, in digestion there is a veritable transmutation of the food, something that cannot be explained by mechanical means;⁷² *second*, the force of the muscles of the stomach is not capable of crushing the food;⁷³ *third*, the structure of man’s stomach proves that it is not destined to crush food;⁷⁴ and *fourth*, in the system of trituration one cannot explain hunger, indigestion, or appetite.⁷⁵ In short, Hecquet was wrong, digestion does result from fermentation.

The work of Astruc was replied to by a student of Pitcairne, Thomas Bower, a professor of mathematics and doctor of physic at the University of Aberdeen.⁷⁶ It is a work that Astruc replied to the following year.⁷⁷ Bower’s

⁶⁷Jean Astruc, *Traité de la cause de la Digestion ou l'on refute le nouveau Système de la Trituration & du broïment. Et où l'on prouve que les alimens sont digerez & convertis en chile, par une veritable Fermentation* (Toulouse: Ant. Colomiez, 1714), sig. ã v^v.

⁶⁸*Ibid.*, p. 6.

⁶⁹*Ibid.*, pp. 12ff.

⁷⁰*Ibid.*, pp. 30ff.

⁷¹*Ibid.*, pp. 52–53.

⁷²*Ibid.*, p. 102.

⁷³*Ibid.*, p. 138.

⁷⁴*Ibid.*, p. 183.

⁷⁵*Ibid.*, p. 209.

⁷⁶I have been unable to locate a copy of the Bower (or Boër) response to Astruc. It is not in the holdings of the Wellcome Historical Medical Library or the British Library. Nor is it listed in the National Union Catalog.

⁷⁷Jean Astruc, *Epistolae Joan. Astruc, quibus respondetur epistolari dissertatione Thomae Boeri de concoctione* (Toulouse, 1715).

work was originally to be included in the collection of Pitcairne's medical writings, but was eliminated by G. Sewell, the editor, who felt that the volume should only include genuine writings by Dr. Pitcairne. In any case, Pitcairne continued to publish in defense of his views until his death and he contributed a prefatory piece to the collected volume in which he wrote that "I will not call Astrucius' Book *Cacata Charta*, since Astrucius, in my Opinion seems never have gone to Stool, otherwise he must have perceived that the Muscles of the Abdomen have a Power of *Contraction* and *Expulsion*."⁷⁸

It is not difficult to conclude from this early eighteenth-century debate that chemists continued to support their views in opposition to the mechanists. Joannis-Baptista Gastaldi questioned *An Alimentorum Coctio seu Digestio, à Fermentatione vel à Tritura fiat* (1713). After discussing the works of both Astruc and Vieussens to that date, he concluded that the coction of foods, or digestion, proceeds from fermentation rather than trituration.⁷⁹ The standard texts continued to be published well into the new century. The final edition of the *Opera* of van Helmont appeared in 1707,⁸⁰ while that of Thomas Willis saw several eighteenth-century editions to 1720 and that of Franciscus de la Boë Sylvius appeared as late as 1736. A four-volume edition of works by Vieussens was printed in 1774 and 1775. But the tide was clearly running in an opposite direction. Hecquet's work on digestion was published in an expanded two-volume edition in 1730 and again in 1747. In addition he attacked the chemists in his *Novus Medicinae Conspectus* (2 vols., 1722),⁸¹ while in his posthumous *La Medecine naturelle* (2 vols., 1738), Hecquet complained that chemistry was a false analogy for the physician and that some young practitioners have been debauched by the charms of chemistry. Young doctors should accustom themselves to learn the causes of disease. They should seek the laws of health, which are the laws of motion, fluids, and solids. "They will learn nothing in the boutiques of the chemists."⁸² Pitcairne's works reached a third edition by 1740 and Baglivi's opera had reached an eighteenth edition by 1737, while other editions appeared as late as 1788.

⁷⁸Pitcairne, sig. B2 verso.

⁷⁹Johannes Baptista Gastaldi, *Quaestio Medica. Proposita ab ill. ac nob. D.D. Joanne- Baptista Gastaldi, An Alimentorum Coctio seu Digestio, à Fermentatione vel à Tritura fiat* (Avenione: Joannem Delorme, 1713). After referring to both Astruc and Vieussens, Gastaldi concludes (p. 45) that "Ergo Alimentorum coctio, seu digestio fermentationi potius quam triturae, est tribuenda."

⁸⁰See the lengthy and favorable review of the 1707 edition of the *Opera* of van Helmont in the 1708 volume of the *Journal des Sçavans*, pp. 123–129.

⁸¹*Journal des Sçavans* (1723), pp. 409–427.

⁸²*Journal des Sçavans* (1739), p. 234.