

# The Influence of Medicine on Political Economy in the Seventeenth Century

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**Abstract:** The concurrent development of political economy and the modern conception of medicine was reflected from the first decades of the seventeenth century by a degree of interdisciplinary borrowing based on analogy between the human body and the body politic. It seemed perfectly feasible that the growing knowledge of the human body and its diseases might inspire new concepts, and vindicate the use of the scientific method. But while medicine provided new imagery for economic discourse, it would be hard to argue that it yielded new economic knowledge. However, some political economists seem to have become prisoners of metaphor, justifying their own practices by analogy with medicine.

## Introduction

Up until the beginning of the seventeenth century the conception of economic problems, especially those relating to food supplies, was based on simple and unquestioned principles: wares supplied in proper quantities to the market at proper prices, cheap bread and help for the poor. Abundance and low prices were, therefore, the prime objectives. The perception of the nation's economy was simplistic, as was the medicine of the time. But why compare the two? The study of wealth and that of biology, anatomy and medicine seem worlds apart. And yet it is widely accepted that classical and neoclassical economics had been greatly inspired by Newton's mechanical model of the universe (Zouboulakis 1993; Hodgson 1993; Schabas 1990; Mirowski 1989; Ménard 1978). And other models, too, contributed to economic knowledge, as with the animal kingdom (Clément 2002) and anatomy and physiology (Groenewegen 2001; Finkelstein 2000). The connection with the latter model could be made easily, given that a number of economists – Locke, Petty, Barbon and Mandeville included – had studied anatomy and practised medicine.<sup>1</sup> But a few physicians-cum-economists are hardly grounds enough to explain the connection between the two disciplines.

Seventeenth-century medical practice, which generally speaking was amenable both to discoveries<sup>2</sup> and to advances in science, transferred its newly gained knowledge of the human body to the nascent economy. But just how far did medicine's 'great leap forward' - the main points of which we shall review (part 1) – benefit Mercantilist and pre-classical economic analysis? Although analogy and structural comparison in the natural sciences nurtured new knowledge, the transition from the living world to economics, from the human world to the world of wealth, is far from obvious. At best it allowed the use of illuminating metaphor and picturesque imagery of the economic system (part 2). In fact, the body politic/human body analogy also led to the understanding and invention of certain mechanisms including that of the rate of circulation of money, the division of labour (or confirmation thereof), and the hierarchy of economic activity. For likening the body politic to the human body suggests that knowing how one works

will explain the workings of the other (part 3). Yet medical analogy and metaphor were generally used in support of existing theory. This was especially so in economists' responses to the management of crises of subsistence (part 4). But is this not always so whenever a concept or method is transferred from one discipline to another? Are there ever truly fruitful transfers?

The connection forged between political economy and medicine did not, however, concern only methodological and epistemological matters. Connections were also made in more practical domains, as medicine had the immense task of tending to the population (part 5). This task was far from easy at a time when therapeutics did not advance at the same rate as anatomy and physiology. Nevertheless, health gradually became an economic benchmark and any progress in this field was much welcomed, and even sought after and actively promoted by the political authorities. Indeed Jean Bodin's adage – 'The only wealth is men' – was taken up by numerous commentators throughout the seventeenth century and illustrates one of the *leitmotifs* of Mercantilist and pre-classical economic thought: how to enrich the state and the people. People were perceived very quickly as the main producers of wealth. Protecting the physical and moral well-being of the population would contribute to national enrichment.

The objective of this paper is therefore to show, on the basis of a number of representative economic writings of the period, to what extent medical practice and matters of public health actually inspired economic thought, and how they might have been useful in clarifying a number of economic ideas.

## **1 Anatomical and Physiological Discoveries, Medical Studies and Medical Training: An Overview of the Period**

Up until the Renaissance, the vision of the human body was very simplistic, being something like a black box that nobody quite knows what is inside. Medicine, based on Aristotelean and the until then uncontested Galenic legacy, was more of an art than a science. Throughout the seventeenth century, anatomical discoveries allowed the body to be depicted in the most minute detail. Vesalius<sup>3</sup> unquestionably furthered this knowledge by analysing the skeleton and the movement of the muscles under the skin and so discovering their harmony. The functional cohesion, the discovery of the mechanics of the respiratory (Borelli in 1680) and muscular systems, the lymphatic system (Rudbeck in 1653), the pancreatic duct (Wirsung in 1632) and the understanding of interaction among organs, all improved knowledge of the human body. Remarkable evidence of this transformation was Harvey's discovery of the circulation of the blood (1628), which was the first true medical discovery. Harvey's vision was mechanical, affirming that the heart worked like a pump forcing blood through the arteries and drawing it back through the veins. Medicine was in tune with Galilean mechanics of movement (Tubiana 1995).

While the second half of the century yielded macroscopic knowledge of the human body, the next stage was to study the finer constitution of the human machine. Microscopic observation investigated the supposed presence of tiny, invisible machines in perpetual motion within the body (Malpighi, in 1665 and 1673). The work of the iatrophysicians<sup>4</sup> generally was to inquire into the possible reduction of the vital functions of organs to a complex, well-regulated assembly of these tiny machines (Leeuwenhoek in 1722; Swammerdam in 1672). These conceptions also underlay a quantitative approach whereby everything was measured, weighed and compared. This conjunction between medicine and physics

made it possible to introduce inductive and deductive methods into the production of medical knowledge. A separate early seventeenth-century strand of medicine, iatrochemistry, did not share what was thought an overly simple mechanical conception of the human body. Supporters of this 'school' (Van Helmont, in 1648) argued that the body was the seat of chemical transformations as in cooking, or concoction and distillation: digestion was the prime example. Although developing the work of Paracelsus, this school rejected his theory of the three principles.

In the eighteenth century, a new strand – vitalism (Stahl, in 1701) – emerged to reject the seventeenth-century mechanical doctrine. This belief picked up on the ancient idea of the existence of a vital principle, understood as an entity that was separate from organic matter (Grmek and Bernabeo 1997). This throw-back to mediaeval ideas was an impediment to any experimentation until the mid-eighteenth century. However, from the second half of the eighteenth century, medicine gradually escaped from vitalism and machinism to become much more scientific.

In spite of these advances, the first thing to observe is that, in the seventeenth century, there was a large gap between progress in the understanding of anatomy and physiology and the use of new therapies. Advances in medical knowledge had little repercussion on medical practice. It was still held that the human body was based upon an equilibrium that could only be disturbed by illness (which was a punishment sent by God) and the disorder of the humours (Faure 1994). For the physician, any therapeutic treatment was devised first of all to mobilise and assist the natural healing forces at work within the body (Risse, in Grmek 1997, II, p. 177). Notice was also taken of the patient's surroundings, reflecting to some extent the legacy of Greek medicine, especially in *Air, Water and Places*, which describes the impact of the natural environment on the outbreak and the cure of disease.

However, this period was characterised by growing awareness of the existence of disease as a collective phenomenon and of contagious diseases in particular. The starting point was the thorough examination of the patient and the measurement of a number of variables: fever, pulse rate, etc. Such examination of patients led to the description of a number of diseases (scarlet fever, gout). Reputedly effective medicinal drugs were used, such as quinine (tincture of cinchona). However, no new therapeutic strategy was developed and blood-letting long remained the only treatment. Progress was more visible with contagious diseases, so that health strategies were put in place at a relatively early date. The first theory of the contagion of diseases was advanced by Fracastoro in 1546. So, during the seventeenth and eighteenth centuries, numerous contagious diseases were similarly analysed: smallpox, syphilis, bubonic plague, then malaria, scurvy, and a number of what had been considered occupational illnesses. This approach was revolutionary in the sense that until the sixteenth century disease was perceived as a divine punishment. Henceforth, on the basis of data collected in the field, disease was described and theorised. Rickets was cited for the first time in 1664 in the records of deaths, and Drummond and Wilbraham in their study of nutrition (*The Englishman's Food*) established a connection between periods of scarcity and the prevalence of rickets (Rosen 1958 [1993], p. 67). The physician J.R. Glauber wrote on the health of sailors in 1657 and, in 1700, Ramazzini published a paper on the development of occupational illnesses. He emphasised the ambivalent role of work, which, although necessary, was also a cause of illness. In consequence, the

patient-physician relation was combined with a more global approach directed at prevention.<sup>5</sup>

Lastly, surgery, which at the time was clearly demarcated from plain medical practice, concentrated on the tangible components of the body, localising wounds and trying hard to understand their anatomical structure. Operations consisted of removing wounded sections, or repairing torn flesh and broken bone. However, this ran counter to the dominant idea that illness was engendered by an imbalance of the humours.

In conclusion, over the study period, there was a mixture of speculative theory and of scientific reasoning in both medical knowledge and practice. There was still no medical outlook that was completely free from intellectual constructs that falsified the interpretation of the evidence. These two centuries made possible the transition from Hippocratic medicine to the medical revolution of the eighteenth century. This subject matter variously inspired economists. The absence of any unified medical thought benefited multiple and varied borrowings that fuelled a wealth of contradiction in economic knowledge.

## **2 The Human Body as a Representation of the Workings of the Economy: From a Proclaimed Identity to an Obvious and Imperfect Analogy**

The Mercantilist and pre-classical authors of the seventeenth and eighteenth centuries commonly approached the analysis of economic questions by using analogies, metaphors and identities. In particular they frequently established an almost identical link between the human/animal body and the political body and the State. As in the case of Montchrétien, author of *Traicté de l'Économie Politique*: 'There is a great relation, strong and useful, between the well managed State and the animal body' (1615 [1999], p. 68; my translation) because 'Animals have three faculties, the vegetative that nourishes the body as labourers work and nourish the state, the sensitive that is a source of heat, under which one may class skilled workers, and finally the mental, which makes the body move and to which merchants correspond in our society' (*ibid.*, p. 70; my translation).

Using metaphors, Mun (1664 [1965], p. 70) speaks about the Prince (the sovereign generally speaking) who is like 'the stomach in the body'. Davenant in 1698 substitutes the people for the Prince, who in turn are 'the stomach of the State's Body'. Loans are also of the same vein for the pre-classicals. For Boisguilbert: 'The body of the State is like the human body, all parts of which and all limbs must also contribute to the common sustenance' (1707 [1966], p. 943; my translation). To resume the analysis of the physician Mandeville: 'Laws and Government are to the Political Bodies of Civil Societies what the Vital Spirits and life itself are to the Natural Bodies of Animated Creatures' (1714 [1924], 1, p. 3). All these analogies and metaphors are designed to describe the nation as a whole, each member of which contributes to its proper working.

This assimilation of the political body to the human body was imagined in a wider context, where the body of a man in the ancient and medieval tradition is a microcosm of the universe. It is a replica of it: the four elements of which it is composed (water, earth, fire, air) correspond to the body's four humours (blood, bile, phlegm, melancholy), each one secreted by a particular organ (heart, liver, brain, spleen). The political body became the intermediate link between the universe and the individual, and in turn the replica of the human body. To study the

functioning of the human body was to study the functioning of the universe, and vice versa, as was declared by the sixteenth-century physician Paracelsus in 1520 and attested to by a number of economists. Charles Davenant was even more explicit: 'The knowledge of the sinews, muscles, arteries and veins, with the late discovery of the circulation of the blood and all the parts of anatomy, conduce very much to render this dark science more plain and certain' (1699 [1771], II, p. 169).

Behind this analogy between the human body and the social and political body was a basic metaphor likening the economy to a living organism (Klamer and Leonard 1994). This transition from the workings of the living world to the functioning of societies was common in the seventeenth century in Hobbes and Nicole and then in Boisguilbert (Faccarello 1986). Its sources lay in Renaissance writings, although it was no longer a simple illustrative metaphor in the way sixteenth-century poets commonly used metaphor to discourse on nature as their inspiration.

Nevertheless, for several decades, these borrowings from medicine lagged behind the state-of-the-art of the age. Captivated by the idea that these discoveries would fascinate their own audience, economists, without using them completely, were inspired by the way in which they structured economic thought. Consequently, it would be advisable to speak of an analogical imagination (Ménard 1981). Thus, when Montchrétien spoke of the faculty of the brain that enabled movement, he was not borrowing from medical knowledge of the time – Vesalius (the leader in this field) had been unable to elucidate the problem of the brain – but was referring to common and everyday assumptions about the human body.

Organs of the human body were often taken to illustrate very varied roles: the stomach was alternately likened to the people (the ploughmen feed the nation in Montchrétien and in Davenant) or to the Prince (in Mun). It was assigned a function of production or of redistribution. Mandeville, who was closely associated with the vitalistic doctrine, believed that while reference to anatomy was interesting, it could not be of great assistance in explaining the workings of the body:

We may admire the curious Duplicate of Coats, and close Embroidery of Veins and Arteries that environ the Brain. But when dissecting it We have viewed the several Pairs of Nerves with their Origin, and taken Notice of some Glands of various Shapes and Sizes, which differing from the Brain in Substance, could not but rush in View; when these, I say, have been taken notice of, and distinguished by different Names, some of them not very pertinent, and less polite, the best Naturalist must acknowledge, that even of these large visible Parts there are but few, the Nerves and Blood-Vessels excepted, at the Use of which he can give any tollerable Guesses: But as to the mysterious Structure of the Brain itself, and the more abstruse Economy of it, that he knows nothing. (1714 [1924], II, p. 165)

The breath of life is imperceptible but nevertheless remains the spring of the workings of the body. In this case, the connection with the body was much less effective than either the laws or the manifest action of the government, which were the mainsprings of the economy (Landreth 1975) (rather than some invisible hand).<sup>6</sup>

What is most significant about these analogies and metaphors is that they produce a new representation of the economy, but as spatial instead of point-like (Does not the body represent extension according to Descartes?). This provided insight, through the idea of the complementarity of the functions of the human

body, into the complementarity of the actors and/or the complementarity of the sectors of the economy, whose common purpose was supposedly the enrichment of the Prince and so of the nation, with all the parts of the body contributing to the survival of the individual as a single entity. While analogy between the social body and the human body thus cast new light on the complementarity between economic activities, it also introduced a rank-ordering of functions, through the use of metaphors associating a given organ with a particular function (or particular social category): the choice of organ for a precise function reflected the relative importance of each component. Boisguilbert set the function of the farmer above that of the trader, while Montchrétien took the opposite view, as in the *Traicté de l'Économie Politique* the intellect is devolved to the traders, while in the *Factum de la France* it is the poor who in the country 'are the eyes and the brain-pan, and by consequence the weaker and feebler parts' (1705 [1966], p. 943; my translation) but also the most essential.

Much more problematic is the idea of competition and the question of self-interest, found in Mercantilist economic thought and in Mandeville, which do not seem to derive from any simple analogy with the human body or the lessons of anatomy. More often than not, we begin with the principle that all the organs of the body work towards the same purpose and the breath of life fires the whole body. On the contrary, says Mandeville, in society, each individual and each social category looks to their own interests ('Everybody works for himself') and satisfies their own passions, which often run counter to those of others, and it is simply the state which has to intervene, to harmonise, and even impose a common policy. Government should employ measures that ensure full employment and maximum output: 'Government's first care (is) to promote as great a variety of manufactures .... and the second to encourage agriculture and fishery in all their branches that the whole Earth may be forced to exert itself as well as man' (1714 [1924], I, p. 197).

In the human body, it is the breath of life that is the spring which allows all complementary and non-rival parts to sustain the individual; in society, the function of the state is not only to light the spark that drives the economy, but also to structure, govern and ensure the compatibility of divergent interests. This opposition is confirmed in the relationship between states. Indeed, the theory of the balance of trade based on the principle of the maximum relative enrichment for a country, a dominant theory in seventeenth-century Mercantilist thought, relied on a conception of the relationship between nations as one of conflict. This account challenges the initial postulate of a parallel between the universe, the human body and society.

### **3 From Criticism of the Use of Analogies and Medical Metaphors to Their Reintroduction in the Output of Economic Knowledge**

#### *3.1 A new scientific method in the service of medicine and the economy*

Analysing the economy by means of metaphors and analogies, interesting as it is, soon came in for criticism during this period by authors who preferred a more objective approach. Locke, in his *Essay Concerning Human Understanding*, asserted that 'If we would speak of things as they are, we must allow, that the art of Rhetorick, besides Order and Clearness, all the artificial and figurative application of Words Eloquence hath invented, are for nothing else but to insinuate wrong

*Ideas*, move the Passions, and thereby mislead the Judgement; and so indeed are perfect cheat' (1690 [1975], p. 508). It is the condemnation without further right of appeal which is nevertheless immediately contradicted by the use of metaphor!<sup>7</sup> Some seventeenth-century Mercantilists, the arithmeticians in particular, preferred another less speculative and normative method.

For pre-seventeenth-century scholars, nature took on features of a great living being and a maternal, protective force (Lenoble 1969). With the scientific revolution of the seventeenth century, nature became a machine, where science was the technique for investigating this machine and humankind the divine engineer. The world was by essence a mechanism involving geometry, movement and extension (as argued by Descartes in 1637). Undoubtedly, the notion of the geometric form of the human body existed in the Renaissance on account of a direct correspondence between the macrocosm of the universe and the microcosm of man, but what changed notably was the mode of imposing the primacy of geometry on common sense (as in Kepler in 1604). The developments of physics, the leading science of the seventeenth century, oriented medical research. Descartes claimed that any living or inanimate thing was subject to the same laws because of a single, unifying principle in the natural sciences. This was a major step relegating the life sciences to within the framework of biology, life being considered as just one of many phenomena governed by physical and chemical laws. However, the economy did not fit readily into the same mould since every economic action was felt to be primarily a moral act (Letwin 1963, pp. 79-98).

As for the method, Bacon, considered as the founder of the English empiricist school, set out the main lines, exhorting his readers to examine facts scrupulously. He used observation and experience to support conclusions in the place of *incantations* by *inductions*. Bacon, who had extensively criticised Aristotle's methods, while defending knowledge based on fact and experience, exercised a strong influence on science and on medicine in particular, and indirectly on the economy through his followers, in particular Petty and the political arithmeticians. Natural processes were not just simply observed, but subjected to experiments and then the results were generalised and expressed by a mathematical formula. On the purely therapeutic level, the physicians of the seventeenth century referred to the same scientific method. So observation of the patient became more precise and was also quantified. Weight, fever and pulse rate were all measured, because such data were supposed to aid diagnosis. Nevertheless, all these measurements and advances had very little effect on medical practice (Tubiana 1995).

And what about the economy? Petty was the most significant figure in terms of the direct link between economy and medicine. After beginning medical studies in Utrecht in 1644 he moved to Paris in 1645, where he pursued his studies of anatomy. He saw Hobbes regularly and worked for him. His methodological principles were the same as those of Hobbes (Aspromourgos 1996). Thanks to Hobbes, he discovered Andreas Vesalius's work. Petty also met Descartes. In *Political Arithmetick*, written between 1671 and 1676 but published posthumously in 1690, he set out his method, recognising that it was not very common:

The Method I take to do this, is not yet very usual; for instead of using only comparative and superlative Words, and intellectual Arguments, I have taken the course (as a Specimen of Political Arithmetick<sup>8</sup> I have long aimed at) to express my self in Terms of *Number*, *Weight*, or *Measure*; to use only Arguments of Sense, and to consider only such

Causes, as have visible Foundations in Nature; leaving those that depend upon the mutable Minds, Opinions, Appetites and Passions of particular Men, to the Consideration of others. (1690 [1963], I, p. 244)

The model referred to in that work is a mathematical model.<sup>9</sup> Accurate economic accounts should enlighten government policy. Such political arithmetic should ultimately lead to solutions in order to ‘procure Peace and Plenty to Body and Soule before Death’ (quoted by Asproumouros 1996, p. 17). However, this did not exclude biological models and medical metaphor, first because measuring methods were common to arithmetic, science and medicine. In particular, examination of a patient and examination of the economy required similar tools. Then the title of Petty’s work on Ireland<sup>10</sup> testifies to the tenuous bond between economics and medicine. Finally, the economic problems addressed were not considered in isolation but as an integral part of a greater whole (body politic).<sup>11</sup> It was probably on this point that Petty was most influenced by anatomy and medicine.

Petty’s method was taken up by Graunt, who presented his *Natural and Political Observations* in 1662 to the Royal Society of Philosophy considering his work as a contribution to the constitution of natural history. For Graunt: ‘The Art of Governing, and the true Politiques, is how to preferre the Subject in *Peace* and *Plenty*’ (1662 [1973], p. 72). Now it would be better to:

Know the *Geometrical* Content, Figure, and Situation of all the Lands of a Kingdom .... for if men knew the People as aforesaid, they might know the consumption they would make, so as trade might not be hoped for where it is impossible .... I conclude, That a clear knowledge of all these particulars, and many more, whereat I have shot but at rovers, is necessary in order to good, certain, and easy Government. (*ibid.*, pp. 72-74)

Let us not be mistaken, however, about the reach and use of these data, which often vindicated what were really foregone conclusions. These statistics became evidence for the necessity of the reforms that Petty and the arithmeticians thought necessary (Endres 1985). The new method based on the principle of accounting explained the real origin of wealth and the source of value. Charles Davenant, Petty’s other heir, summarised this particularly well: ‘The wealth of all nations arises from the labour and industry of the people; a right knowledge therefore of their numbers, is necessary to those who will judge of a country’s power and strength’ (1698 [1771], I, p. 138).

So *Political Arithmetick* became an essential instrument for those in charge of national policy.

### 3.2 *The return to analogies and medical metaphors*

While *Political Arithmetick* was a perfect expression of the philosophy of Bacon and of the programme of the Royal Society (Letwin 1963, p. 122), Petty also agreed upon the usage of analogy and metaphor, again referring explicitly to Bacon himself:

Sir Francis Bacon, in his Advancement of learning, hath made his judicious Parallel in many particulars, between the Body Natural, and Body Politick, and between the Arts of preserving both in Health and Strength: And it is as reasonable, that as Anatomy is the best foundation of one, so also of the other, and that to practice upon the Politick, without knowing the Symmetry, Fabrick, and Proportion of it, is as

casual as the practice of Old-women and Empricks. (1691 [1963], 1, pp. 129-30)

The trilogy of *Symmetry*, *Fabric* and *Proportion* of the *Political Anatomy* corresponds to: 'the Number, the Weight and Measure' of *Political Arithmetick*. The choice of Ireland was also justified by a revealing metaphor in the Foreword of the *Political Anatomy*: 'Furthermore, as Students in Medicine, practice their Inquiries upon cheap and common Animals, and such whose Actions they are best acquainted with, and where there is the least Confusion and Perplexure of parts; I have chosen Ireland as such a Political Animal' (*ibid.*, 1, p. 129).

In his introduction to *Leviathan*, Hobbes, with whom Petty maintained close ties, presented natural man and artificial man as real animated machines.<sup>12</sup> The social body, like the human body, had to be fed, so money and blood played analogous roles. Hobbes likened money to the blood of the Republic, allowing nourishing resources to be stored, conserved and then distributed at any time or place. Commodities were reduced to gold and silver as food was reduced to nutritional elements:

By Concoction, I understand the reducing of all commodities, which are not presently consumed, but reserved for Nourishment in time to come, to some thing of equal value, and withal so portable, as not to hinder the Motion of Men from place to place; to the end a Man may have in what place so ever, such Nourishment as the place affordeth. And this is nothing else but Gold and Silver and Mony. .... By the Means of which Measures, all Commodities, movable and immovable, are made to accompany a Man to all places of his resort, within and without the place of his ordinary residence; and the same passeth from Man to Man, within the Commonwealth; and goes round about, nourishing, as it passeth, every part thereof ; In so much as this Concoction, is at it were the Sanguinification of the Common-Wealth: For naturall Bloud is in like manner made of the fruits of the Earth; and circulating, nourisheth by the way, every Member of the Body of Man. (1651 [1955], p. 164)

These analyses, directly inspired by Harvey's discovery (Christensen 1989), would echo far in the work of Petty, which extended Hobbes's analysis. Indeed, for Petty:

Money is but the Fat of the Body-Politick, whereof too much doth as often hinder its Agility, as too little makes it sick. This true, that as Fat lubricates the motion of the Muscles, feeds in want of Victuals, fills up uneven Cavities, and beautifies the Body, so doth Money in the State quicken its Action, feeds from abroad in the time of Dearth at Home; evens accounts by reason of its divisibility, and beautifies the whole, altho more especially the particular persons that have it in plenty. (1691 [1963], 1, p. 113)

We deviate from the simple digestive metaphors of Mun or Davenant to what is both a more fertile and more relevant analysis. The understanding of the circulation of the blood and its similarity to monetary circulation allowed Hobbes and Petty better to understand the role of money in the economy while being well aware of the differences between the two.<sup>13</sup> With Harvey's discovery, the blood was no longer consumed but preserved and became the vehicle for transporting nourishing elements. The body was fed by the ingestion of new food, which was transformed into energy and conveyed by the blood. Similarly, the circulation of money provided for the State and fed the citizens from an initial creation of wealth, of which work and land were factors and money the mere vehicle. Money itself was

not the nourishing element. It was first and foremost an instrument. Combining Harvey's discovery and Hobbes's analysis, Petty became the inventor of the velocity of circulation of money (Aspromourgos 2001). But also, by association with the return of the blood, he perceived the reserve function which allowed the initial accumulation of capital (Roncaglia 1985) and contributed to development. So money had to be in proportion to the national wealth and to its components: 1/10 of total spending, 1/4 of the value of exports, 1/50 of the land value, argued Petty. The monetary circuit was the driving element which drew commodities and services into the exchange. The drawback of this model of blood circulation is that it diverted attention away from the conditions of economic activity<sup>14</sup>. But was the model truly imported? Petty readily used other metaphors (money was grease; see above), as if to show his emancipation from any set model (Aspromourgos 2001).

Through the work of Montchrétien, Petty, Davenant, Boisguilbert and Mandeville, the use of the biological model in economics contributed to a holistic representation of the economy. However, likenesses are sometimes dubious since, while economists conceived of the body as a single entity with a single purpose, the economy is made up of citizens usually defending their own separate interests. Conversely, the control of economic crises (and food crises in particular) was broadly inspired by therapy proposed by physicians of the day.

#### **4 An Unhealthy Economy and the State as Physician: Illustrative Metaphors**

Progress in anatomy contributed to a better representation of the economy by way of analogies with the human body. But what use was medicine to economics when addressing the disorders of the national economy? Here the chosen vocabulary directly reflected the repeated use of medical metaphors: one spoke about an unhealthy economy, about ailing states, about a state of sluggishness, about the evil which ate away at savings, about indigestion. So a parallel could be drawn between ministering to the human body and ministering to the political body, and between the role of the physician and the role of the State. Charles Davenant stated that:

In the same manner, such as would understand the body politic, its true constitution, its state of health, its growth or decay, its strength or weakness, and how to apply remedies to the various distempers to which it is incident, must study and look narrowly into all the distinct parts of the commonwealth, its trade, the current money (which is its flowing blood) the arts, labour and manufactures, and the number of its people; with many other things which altogether are the members of which the great body is composed. (1699 [1771], II, p. 169).

Even more explicitly, the role of the physician and that of the State are put into parallel by Mandeville: 'Sound politicks are to the social body what the art of medicine is to the natural, and no physician would treat a man in a lethargy as if he was sick for want of rest, or prescribe in a dropsy what should be administered in a diabetes' (1714 [1924], 1, p. 322). But which therapy does one follow in each case?

##### *4.1 Plenty or dearth of food: the therapeutic role of the state*

Environment might be a cause or cure in the face of disease of the political body but generally, however, economic disorders were treated as a disease with some internal cause. Medical analysis provided a parallel between the needs of the human body and those of society. The starting point was the principle of good food and

diet, subscribing to the preoccupations of the time which implied neither excess, nor incapacity and food, in accordance with its nature and its humours while respecting the principle of contradictions as well as the digestibility of food (Flandrin 1996). A number of agricultural and food policies were recommended on the basis of this analogy between the principles of nutrition of the human body and the principles of feeding the nation.

It is on the basis of this analogy between the principles of feeding the human body and the principles of feeding the nation that a number of agricultural and food policies were recommended. After long diatribes against foreign traders, Montchrétien justifies his protectionist policy by a digestive metaphor inspired by the same digestive principles of the time: 'Sustenance of states is like that of the body, which retains of food that part which is necessary and discards what is surfeit.... the good political order chooses what is useful, takes it unto itself and only lets out of its house what is in excess' (1615 [1999], p. 247; my translation).

While Thomas Mun, as a good Mercantilist, was aware of problems arising from exporting wheat from the country, he was careful to add that surfeit of food in a country was as harmful as a shortage. So he did not exclude State intervention (the stomach), even within the country, to better administer the distribution of food. The Prince was the best person to perform this function because: 'if it cease to digest and distribute to the other members, it doth no sooner corrupt them, but it destroyes it self' (Mun 1664 [1965], p. 70). On the other hand, excess of food would bring about slowness (for the body) and idleness (for the people). He suggested establishing a reserve where the excesses resulting from trade with foreigners would be kept and be used: 'to buy and store up corn in the granaries in each province for a years use (at least) aforehand, to serve in occasion of dearth' [*ibid.*, p. 69].

Davenant noted also that: 'It is not the taking in a great deal of food, but it is good digestion and distribution that nourishes the body and keeps it healthy' (1698 [1771], 1, p. 382). To facilitate the efficient distribution of food resources, he proposed: 'To settle a fund for erecting in every county granaries capable of containing such a quantity of corn as may nourish the people a certain time, upon any emergent occasion' (1699 [1771], 1, p. 226), management of which should be assumed by individuals and not by the state. The digestive metaphor provided justification within nations for a public or private reserve function, widely put into practice since antiquity, and which had its equivalent at a purely physiological level in the form of a stock of nourishing reserves like fat.

The interventionist conception was justified in reference to Paracelsus's medicine. Paracelsus argued that the internal alchemist (in others words, the stomach) was always ready to separate bad food from good, and, when food: 'arrives in the stomach, the alchemist is already ready and eliminates what does not bring prosperity to the body. What is bad is sent by the alchemist to a special place and what is good is kept there where it is necessary' (cited by Debus in Grmek 1997, p. 43). The state acted as the alchemist in society, as the stomach in the human body. However Davenant, by contrast with Montchrétien, did not hesitate to see business connections with foreigners as a potential remedy:

It is the radical moisture of the commonwealth, and if it be quite drawn away the body polytick becomes consumptive, hectic, and dies at last (being subject to diseases and death itself, like human frames); and as human bodies are not be kept alive but by receiving in of nourishment, to repair the hourly decays which time produces, so nations cannot

subsist long unless they receive from time to time reliefs and refreshments from abroad. (1698 [1771], II, p. 75)

Mandeville, too, agreed with this conception of the nurturing State, referring to the medicine of iatrochemists. For this economist-cum-physician, the stomach was not only a good cook, because chewing and trituration were not enough for good digestion. A stomachic ferment was needed,<sup>15</sup> and animal spirits<sup>16</sup> played an important role in the production of this ferment, which was essential to digestion. Mandeville viewed animal spirits as laws, and argued that the nutritional functions assumed by the state even sporadically could not be pushed aside. In a number of writings, the metaphor of the stomach showed that state intervention (the nurturing state) was a central economic function and was, to some extent, vital to the functioning of society.

However, for Mandeville, in many cases, the government was there just to regulate the economy. The state did the same job as the physician does for the patient. Mandeville, who shared Sydenham's conception of illness<sup>17</sup> (De Marchi 2001), thought that the physician should observe, listen, and support the patient rather than administer medicines; he should preferably use means that promote transpiration, the evacuation of the offending matter (bleeding, cupping glasses, etc.) In this, he was close to Locke and Boisguilbert.<sup>18</sup>

#### 4.2 *Plenty or dearth of food: Self-regulating nature and the theory of humours*

In England there was another economist who was also a physician and practitioner of Hippocratic medicine: John Locke. Locke employed the doctrine of humours to explain his vision of the market process (Coleman, in Groenewegen 2001, p. 32). But this hypothesis was asserted with some reserve. This respect stemmed from the idea that nature cures its own diseases (Sydenham, in 1676 and 1683). Transposed into economics, this idea allowed Locke to liken market inflows and outflows to the influxes and outfluxes of the human body (Coleman 2001, p.31). As with the humoral doctrine, the state should not regulate the economy. Hippocratic medicine encouraged physicians to refrain from intervention (and likewise the State in the economy).

One example of this outlook was Boisguilbert in early eighteenth-century France. Boisguilbert, a staunch adversary of Mercantilism, used the digestive metaphors and the theory of humour<sup>19</sup> to explain the agricultural crises and to justify an unpopular liberal food policy. Boisguilbert suggested new explanations for crises in agriculture, which were diseases of society striking the country and in turn leading to general depression. For him, taxation and the regulation of trade were the two major causes. France experienced agricultural difficulties because the price of wheat was much too low, the cause being the abundance of cereals, which was related to restrictions on foreign trade in grain. This situation was similarly likened to the digestive problems of man: 'Food taken without measure causes a man to die just as surely as too long an abstinence from any food at all' (1704 [1966], p. 845; my translation). Now the low price of wheat and the depreciation in price was the symptom of 'this type of indigestion of the state [...] caused by excessive abundance' and the consequences were equally dramatic in both realms: indigestion or death for the one, price fall and economic crisis ending in a scarcity of agricultural products for the other. Indeed, surplus domestic output lowered production prices, which in turn caused a decline in production (as it was

insufficiently profitable)<sup>20</sup> and so famines. On the other hand, the market, which had to register a level of profitable price for the producers, would be cleared only by free trade.

Boisguilbert drew on the humoral doctrine to illustrate his liberal response to the economic evil afflicting France. Humoral medicine concentrated on the fluid constituents of the body which move about and must be evacuated when surplus by bleeding or diet. Disease was a consequence of plethora, either a local or a general excess of humour. In a similar way, to rid the economy of its excess grain, Boisguilbert suggested setting up a free trade policy. The opening of borders was the remedy for economic decline, just as blood-letting was the remedy for humoral congestion. Boisguilbert proposed, first of all, free trade within the country because the absence of trade between regions meant that 'food rots even in the places where it grows, while in other places everything is exorbitantly expensive' (1707 [1966], pp. 590-91).

Similar freedom had to be applied in international trade by abolishing export taxes. If goods could not be exported, then Boisguilbert advocated internal bleeding (!):

But if there is no one outside because of war to perform bleeding or this discharge of an overabundance of blood, then the King must do it as in all the countries of the world where the people have a share in government... the King's Ministers should order that His Majesty wishes to have grain houses in nine or ten cities sited on rivers some forty or fifty leagues from Paris. (1705 [1966], p. 708; my translation).

'An internal bleeding': Boisguilbert sometimes took liberties with humour medicine in order to prove the necessity for some policy, this being to some extent against his general principles.

The diversity of answers to the problems of diseases in the human body allowed economists some leeway in the answers they proposed to the food problem. More precisely, one could speak of an analogical imagination, implying that one could adopt a remedy in agreement with the economic thought adopted previously, a biological reference being relegated to the rank of illustration rather than heralded as a source of new knowledge. The theory of humours and liberalism on one side,<sup>21</sup> iatrochemistry, vitalism and interventionism on the other: each drew its inspiration from the strand of medical thought closer to its initial outlook.

While medicine and political economy could apply the same 'recipes' to remedy the disorders of the human body and the social body, another connection could be made between medicine and economy other than through the influence of scientific method or through being inspired by observing the workings of the human body: health became a necessity, a concern for individual and collective reasons, with medicine affecting people's health and indirectly affecting the health of the economy. This is the final connection between medicine and economic health that we shall explore here.

## **5 Medical Practice and the Beginning of Health Economics**

The quantitative approach to health problems developed while establishing links with the economic and political requirements of modern states, and it is significant that, in this context, 'The puritan utilitarianism gave a stimulus to the development of both medicine and economics' (Coleman 2001, p. 40).

### 5.1 *Physical health as an economic asset*

Health became an individual and social benchmark. ‘Individual’ because patients were eager to be cured, and ‘social’ because it was mainly the state that turned its attention to medicine. Descartes was probably the first to assert that health was primary, and was the condition for everything else, and that medicine was the best way of making men wiser and more perfect. Locke also sought to preserve health, recommending six hours a day of ‘honest labour’ (Coleman 2001, p. 41). But also the constitution of an army involved an appeal to a healthy population. The constitution of a national economy – and, as Bodin’s adage had it, ‘The only wealth is men’ – made the health of the population a significant asset. Davenant spoke of the: ‘Bodies of men without doubt the most valuable treasure of a country, and in their sphere, the ordinary people are as serviceable to the commonwealth as the rich’ (1699 [1771], 1, p. 202).

So any government wishing to become rich had to promote a health policy able to reduce death from disease. Petty was one of the first to recognise and to quantify these problems. Graunt also noted the regularity of certain diseases and concluded that: ‘Chronical diseases shew the ordinary temper of the place, so that upon the proportion of chronical seems to hang the judgment of the fitness of the country for long life’ (1662 [1973], p. 16). Attention focused on factors that could increase or diminish the population by including diseases as one of the possible causes. So in *Verbum Sapienti*, Petty deplored that: ‘The late mortality by the pest, is a great loss to the kingdom’ (1691 [1963], pp. 109-10). In *Another Essay in Political Arithmetick* he weighed the advantages and drawbacks of the Greater London project, which would stimulate activity through the concentration of people, but would risk decimating the population by contagion of the plague (1682 [1963], p. 475). He insisted that the control of contagious diseases and the prevention of infant mortality contributed more than any other factor to maintaining the population, and he recommended establishing isolation hospitals for plague victims (Rosen 1958 [1993], p. 91).

In France, Colbert was more aware than anyone of public health issues, and measured all their possible impacts. In 1668, for example, when the plague invaded the northern cities of France, he was torn between allowing business to continue as usual or isolating regions by suspending commerce between Amiens and Paris (Cole 1939, 1, p. 468). Colbert was also interested in the development of thermal spas (Vichy, Saint Galmier), giving credence to the iatrochemists who increasingly advocated the need to drink water, and who praised the mineral and chemical properties of certain springs.

### 5.2 *Mental health and economic policy*

The second evil which European economies faced in the seventeenth century was poverty. Massive poverty was perceived as a real gangrene (Boisguilbert (1704) [1966], II, pp. 979-85), and the connection between idleness, considered largely as a matter of individual will, and poverty was constantly underlined. Poverty was not only perceived as a social and political danger, but also represented a loss for nations engaged in a ruthless economic contest. Medical thought on this question converged with public policy in a surprising way.

Indeed, seventeenth-century medicine quite often viewed the unemployed as *dissolute*, and had no place for the insane, or did not concern itself with acquiring about scientific knowledge of them. It heaped the insane into an

undifferentiated crowd. By erasing clear demarcations: ‘it mixes the debauched, venereal, the licentious, the beggars’ (Foucault 1961, p. 135; my translation). It is not surprising, then, that hospitals housed the poor, the unemployed and the insane.

Physicians held that work was the medicine of the soul and as medicine had blurred the boundary between the poor, beggars and madmen, the same treatment was applied to all: a policy of compulsory labour. The economists in their turn took up this analysis.<sup>22</sup> For economists, the fight against idleness was waged in the name of protection of moral virtues, and in the name of the preservation of the mental health of a whole population which was in danger of coming adrift: ‘Work takes away from soul the opportunity to do harm, gives peace, and finds good and agreeable things, Neither justice, order, or peace can exist without labour’ (Laffemas 1602, p. 4; my translation).

Work, like medicine, then, allowed the authorities to find relief in the traditional duty of assistance. Food was provided only in return for services rendered to society. The promotion of compulsory work within the *ateliers nationaux* in France and the workhouses in England from the beginning of the seventeenth century was an answer to a dual goal of national enrichment<sup>23</sup> and improvement of the population’s health. Mercantilist thought supported by physicians managed to transform the danger of having a population of idle and starving people into a cheap and disciplined source of labour, which, through the policy of imprisonment, contributed to national wealth.

## Conclusion

The seventeenth century and the first part of the eighteenth century were the centuries of representation in the same way that the sixteenth century was that of interpretation. Phenomena were perceived as the workings of a machine, but the machine itself was a thing without purpose. In particular, the human body was a machine of which medicine was gradually discovering the cogs and functions. The representation of economic questions could not escape conventions, especially since authors conceived of an economic order on the basis of an analogy between the human body and the political body. Other instruments and methods were also used to achieve economic goals and to interpret economic phenomena (for example the balance of trade and the analogy with domestic economy), but resorting to analogies and medical metaphors was very meaningful. In a science which was widely undeveloped and where a methodology was still to be invented, and a science that was mostly in the hands of physicians or professors of anatomy, it seemed natural that the knowledge of the human body and its diseases should be the main source of inspiration, if only for reasons of familiarity. In wanting to take up the challenge, even the inventors of political arithmetic were unable to do without analogical reasoning (that of the circulation of blood, in particular).

It was felt particularly important to construct this history because it provides further confirmation that economics first formed as a science of interdisciplinary exchange (Le Gall 2002). Above all, the medical references had a major role which should not be overlooked, whereas physics had been the preferred reference from the second half of the eighteenth century onwards. We have shown that the enrichment of economics through medical practice and thought was not the work of physicians alone (Montchrétien, Mun, Davenant, Graunt and Boisguilbert were not medical practitioners), even if in many instances the association between medical practice and the development of economic knowledge was to prove

decisive (Groenewegen 2001). This cross-fertilisation between disciplines is particularly interesting in that the advances in medicine were almost immediately transferred to economics. The discovery of the circulation of blood and the embryonic concept of the speed of circulation of money were virtually simultaneous discoveries. The likeness is all the more striking in the debates about what policy to implement. Controversies about the best ways to heal the body had an effect on the forms of intervention in economics. Should government become involved in the economy like the physician at the patient's bedside, or should it let nature take its course? Both approaches were defended in parallel and simultaneously in both disciplines. The choice of borrowings from medicine reproduced the internal debates of economics.

Economics gained a lot from this connection, if only in its approach to questions of national food supply, in the consideration of space, in the justification and the place of the various actors of the economy and the state in particular, and lastly in the significance attributed to the state of health of economic agents through its consequences for the state of the economy. The issue of therapeutic intervention also foreshadowed the state/market debate, which would develop more clearly from the middle of the eighteenth century. So the economists of the seventeenth century cleared the way for investigating the parallel between the functioning of the economy and the functioning of the human body.

Despite the ongoing attachment of some economists to the medical frame of reference – a matter that would be taken up again in the eighteenth century by Quesnay, then notably by Spencer<sup>24</sup> in the nineteenth century and in the twentieth century by Walter Cannon (1941), albeit with a better defined analogical and homological method – this framework became more limited over time as the mechanical model became prevalent. And yet, the biological model, and the medical version in particular, appears just as legitimate as the mechanical model, since, as Hodgson, writes: 'Clearly, real world economic phenomena have much more in common with biological organisms and processes than with the mechanistic world of billiard balls and planets. After all, the economy involves living human beings, not merely particles, forces and energy' (1993, p. 24). Despite this clear disjunction between medicine and economics, the connection was never completely severed. This may well explain the persistent and recurrent use of medical terms in today's economic discourse. Economies are still often spoken of like living organisms and, when difficulties arise, they are said to be in poor health! But the medical metaphor usually plays an illustrative role here;<sup>25</sup> it is there to persuade, whereas throughout the seventeenth century it was partially<sup>26</sup> a source of concepts and methods. So, to Morgan's question: 'Did metaphors play important roles in descriptions, in policy prescriptions, or even in methods of analysis?' (Morgan, in Maasen 1994, p. 313) we would be tempted to reply in the affirmative as concerns the use of medical metaphors in the seventeenth century, a fertile period in the formation of economics. Today, medical metaphors 'simply remain metaphors' (*ibid.*, p. 313) when they enter the domain of economics.

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## Notes

1 Other economists too, whether merchants (Davenant, Mun), government advisors (Montchrétien) or holders of high office (Boisguilbert) also made reference to medicine. Economists such as Quesnay and Juglar were also physicians, but our study covers only the seventeenth century. This century, which continues through the early years of the following century (until about 1720), is characterised by the development of the first overall representations of economic activity (Wolff 1988). As such, the century is something of a detachable period, although it includes disparate analyses which are sometimes Mercantilist, sometimes pre-classical (in the pre-Smithian sense: Blaug 1961).

2 See on this point Webster (1975).

3 Andreas Vesalius had been appointed a professor at Padua's famous university at a very young age. In this college, corpses were dissected. Vesalius corrected the errors of the Greek anatomists and questioned, without ever condemning him, the anatomical work of Galileo, which had been uncontested until then (Tubiana 1995).

4 The iatrophysicians considered that the human body worked in accordance with the laws of physics set out by Descartes. Some argued that living beings were machines, barely more complex than watches or automata. La Mettrie in *L'homme machine* even provided a purely mechanical view of mental activity (Tubiana 1995).

5 See Olivier Faure, *Histoire Sociale de la Médecine*, Paris: Anthropos, 1994, p. 33-42.

6 One example from the same period, that is the most precise and the most remote from biological truth, is that of Malynes in 1622: 'And then he shall finde, that as the Liver (Money) doth minister Spirits to the heart (Commodities) and the heart to the Braine (exchange) so doth the brayne exchange minister to the whole Microcosm or the whole body of Traffique. Let the heart therefore by the liver receive his Tinctured Chilus by his owne mouth and stomacke, and the bloud full of Spirits, shall fill all the Veines, and supply the want of monyes' (quoted by Finkelstein 2000, p. 36).

7 On the same page, the following passage contradicts Locke's position: 'Eloquence, like the fair sex, has too prevailing Beauties in it, to suffer it self ever to be spoken against. And it is vain to find fault with those Arts of Deceiving, wherein Men find pleasure to be deceived' (*ibid.*, p. 508).

8 The term Political Arithmetic was used for the first time in Discourse of Duplicate Proportions, delivered to the Royal Society at the end of 1673. This society had been created in December 1660, and Petty took an active part in its meetings from the beginning. The Society debated mathematics and experimental problems in particular. The Society was founded to: 'improve practical and experimental knowledge beyond all that has been hitherto attempted, for the augmentation of science and universal good of Mankind' (Evelyn in 1661, quoted by Webster 1975, p. 99).

9 As noted by Aspromourgos (2001), Petty in *Political Arithmetick* in 1690 takes his inspiration from algebra, but in the *Political Anatomy of Ireland* in 1691 he takes his inspiration from medicine and more generally from the functioning of animals. But the dominant model was, in fact, mathematics.

10 In his investigation of Ireland, he endeavoured to measure and describe the economy, to quantify wealth and potential. His method, based on observation and measurement, allowed him to understand the low level of economic development and the economic stagnation of this country and indirectly the reasons why Holland and other small countries were richer than France or England. He also inferred from this that what was important was neither the number of inhabitants, nor the volume of output, but the number of those who could be kept and fed with the surplus production .

11 The term *Political Anatomy* that Petty used for Ireland seems more suitable than *Political Arithmetick*: see Roncaglia (1985, p. 27).

12 Note, however, that for Hobbes man is not simply an animate machine. As Christensen (1989) pointed out, Hobbes does not explain human psychology by mechanics. His model is fundamentally physiological, not mechanical.

13 The difference between the two is well perceived, because if the blood is a vehicle for nourishing elements (and not consumed, as had been thought), money can easily be seen as a vehicle of wealth, but is not in itself a nourishing element. It is primarily an instrument of exchange and has no intrinsically nourishing value.

14 Boisguilbert, in summarising this model, reversed the principle whereby money was the prime mover to give precedence to commodities and services. For him, the moving force behind trade was consumption. Consumption made money circulate: 'And as it is consumption of which it is the slave that leads the dance, from the instant it ceases, it stops too, and remains motionless in whatever hands it finds itself when the disorder begins to be felt' (1695 [1966], 11, p. 619; my translation). Boisguilbert insists on this point: 'it is easy to see that .... to make a lot of income in a country with many commodities, there is no need for much money, but only much consumption' (*ibid.*, p. 619; my translation).

15 Mandeville is doubtless referring to Borelli's (1680-1681) works describing digestion as dissolution of food caused by a juice which would pass along the coating.

16 Mandeville's animal spirits designate primarily the spirit of motion and feeling, regardless of whether they are materialised by a liqueur, vapour or spirit. They are very significant as 'the *internuncii* of the soul or will'. These tiny particles connect the soul and body. An individual's thoughts have a direct influence on his viscera. The stomach is vital in Mandeville's medical language. It is responsible for nervous illnesses (hysterical and hypochondriacal diseases). Thus a digestive disorder stems from excessive expenditure of spirits in thinking, which ends up affecting vital balance. On this point see Carrive (1980) and De Marchi (2001).

17 For Sydenham (writing in 1676 and 1683] illness is a salutary effort of nature, which to save the patient, does all it can to overcome the obstacles to its functioning and to separate and discharge what harms it. The organism does not combat diseases; it is the combat itself that is the disease, see Grmek (1996, p. 170).

18 De Marchi's analysis goes much further. For him, wants (for luxury goods), which are the product of our mental activity, have a direct consequence on commerce through which the goods and services desired are produced. Such commercial activity is healthy for the nation's economy (provided the balance between exports and imports is maintained). Likewise, animal spirits have an influence on appetite and digestion (making it easier), just as our desires have a positive effect on trade and so on the nation's economic activity, but here it seems to me the process works in reverse. The disorders of the stomach (symptoms of mental illnesses such as hypochondria and hysteria) result from excessive discharge of spirits in the action of thinking and are cured by diet (overeating is to be avoided). Commerce only works well if there are many varied wants.

19 Throughout his writings, Boisguilbert uses many metaphors to illustrate, convince and demonstrate his viewpoint: theatrical metaphors, the metaphor of balance, hydraulic metaphors and, of course, medical metaphors. The latter relate to popular and non-scientific knowledge of medical practice, in contrast to Mandeville and Petty.

20 Breaking with the ideal of the low price for bread, seemingly more favourable to consumers, Boisguilbert considers that production prices need to be profitable enough to induce the producer to supply the market and better satisfy people's needs. The price of corn was, for Boisguilbert, 'a never-failing barometer that increased or diminished the cultivation of land depending on whether it rose or fell' (1704 [1966], p. 851; my

translation). It determined the payment received by the producer, allowing him to recoup expenses laid out for production along with the necessary advances for the following cycle.

21 In therapeutic terms, the use of medical metaphors led some pre-classical economists to see in the state the physician of the economy and to adopt the same attitude towards economic matters as towards the patient. It is no more necessary to touch the mechanics of the body than it is to touch the functioning of the economy: 'We must consider in general, that as wiser physicians tamper not excessively with their patients, rather observing and complying with the motions of nature, then contradicting it with vehement administrations of their own, so in politicks and economics the same must be used' (Petty 1662 [1963], p. 48). However if an author such as Petty thought that the laws of society were virtually as inexorable as Newton's laws of physics (Roncaglia 1985, p. 24), an extension of natural laws, he did not exclude state intervention in specific domains. This was certainly true of Boisguilbert.

22 For Montchrétien: 'There are many places and parts of the bodies which are like roads, which give entry to vice so that it can spread about the inside the soul' (1615 [1999], p. 123; my translation).

23 Laffemas advocated the development of national factories and putting the idle to work. Workers should be assigned to two villages in the vicinity of every city, one for men and one for women, by force if they resisted (Laffemas 1602, pp. 27-8).

24 Spencer's entire work relies on the homology and analogy between animal and plants and society: the digestive system is similar to society's means of production, the vascular system to the development of means of communication. For more developments, see Spencer (1876 [1896]).

25 As Assidon, for example, observes about structural adjustment policies in the Third World, the International Monetary Fund is compared with a medical specialist prescribing concoctions 'devised like some sort of purge or bleeding to remove the surplus demand of the 1970s after a debt crisis which revealed their excesses' (2000 [1992], p. 104). This metaphor relates to a form of medicine which is now quite outdated. The medical metaphor here is purely illustrative.

26 Borrowings from medicine were at the same time very fragmented and often approximate, requiring imagination rather than being the object of a structured connection between the functioning of the human body and that of the economy. Commentators still seemed to be prisoners of metaphor by looking, in the choice of images, for representations and medical practices as a justification for their own interpretation of things.

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