

Achim Trunk \*

## An early concept of G.W. Leibniz regarding medicine

### (1) Gottfried Wilhelm Leibniz's *Directiones ad rem medicam pertinentes*

The Leibniz Edition Project, Series VIII, is currently dealing with the scientific, medical and technical papers Leibniz wrote in his early phase, i.e. until the year 1676.<sup>1</sup> This phase covers Leibniz's years in the service of Kurmainz as well as his four years in Paris.

Among these early papers there are lots of documents so far practically unknown or which, at least, have been neglected by research up till now. Others, though, have already been dealt with by historians of science. This contribution presents an outstanding example of the latter category: It is a sixteen-page concept paper Leibniz probably wrote in 1671. The dating is based on aspects of the content as well as on the literature Leibniz referred to. It implicates that Leibniz wrote the document at the age of twenty-four, in the year before he moved to Paris. This explains why most of the text is written in German. Approximately one tenth of the text, however, is in Latin. This is true also for the title Leibniz chose: *Directiones ad rem medicam pertinentes*, or, in a free translation, "Instructions Regarding Medicine".<sup>2</sup>

Meanwhile, the document is accessible to the public in triple regard: First, there is a reliable print edition of it, performed in 1976 by Fritz Hartmann and Matthias Krüger, who also outline the philosophical context of the text.<sup>3</sup> (An insignificantly improved version will be included in the first printed volume of Leibniz Edition Series VIII, which is going to be published in 2007.<sup>4</sup>) Second, the document finds itself among a variety of edited Series-VIII-documents presented via Internet at Leibniz-online. Here, an interactive version can be found, providing information on text layers, literature Leibniz used, and persons Leibniz mentioned.<sup>5</sup> And third, this online edition can be compared at Leibniz-Online with a high performance scan of the original.<sup>6</sup>

So far, there is very little literature touching the *Directiones*. Hartmann and Krüger do not restrict themselves to editing the document, but also deliver an elucidating introduction dealing with the document's place in Leibniz's work and with the long-range impact of Leibniz's ideas regarding medicine. Besides this, there is a short paper, written in Czech by E. Wondrak in 1990,<sup>7</sup> as well as an essay of François Duchesneau (in English language), published in 2003. Duchesneau deals with Leibniz's methodology concerning the investigation of biological phenomena, thus touching the

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\* Historisches Seminar, University of Cologne, Cologne, Germany; email: [atrunk@uni-koeln.de](mailto:atrunk@uni-koeln.de).

<sup>1</sup> *The Leibniz Edition Series VIII — Scientific, Technical and Medical Writings* — was started in 2001. It is directed by new ESHS President Eberhard Knobloch, and is managed by Hartmut Hecht.

<sup>2</sup> The original is kept by the Gottfried Wilhelm Leibniz Bibliothek, Hanover (Germany), LH III 1, 3, folio 1–8.

<sup>3</sup> See Fritz Hartmann and Matthias Krüger, "Directiones ad rem Medicam pertinentes. Ein Manuskript G.W. Leibnizens aus den Jahren 1671/72 über die Medizin", in: *Studia Leibnitiana* 8 (1), 1976, p. 40–68.

<sup>4</sup> Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe*, Series VIII: *Naturwissenschaftlich-medizinisch-technische Schriften*, edited by the *Leibniz-Editionsstelle Berlin* of the Berlin-Brandenburg Academy of Sciences and the Humanities, First Volume: 1667–1676, forthcoming (Berlin 2007).

<sup>5</sup> Navigate to [http://leibnizviii.bbaw.de/Leibniz\\_Reihe\\_8/](http://leibnizviii.bbaw.de/Leibniz_Reihe_8/), find the *Directiones ad rem medicam pertinentes*, and click on one of the buttons on the left.

<sup>6</sup> A scan of each of the 16 pages of the document is presented in the Internet: Go to [http://leibnizviii.bbaw.de/Leibniz\\_Reihe\\_8/](http://leibnizviii.bbaw.de/Leibniz_Reihe_8/), look for *Directiones ad rem medicam pertinentes*, and choose one of the buttons on the right.

<sup>7</sup> See E. Wondrak, "Directiones ad rem medicam pertinentes" (the Czech sub-title meaning: "On the Medical Manuscripts of G.W. Leibniz from Approximately 1680"), in: *Casopis lékaru ceskych*, 129 (3), 1990, p. 90–92.

document and stressing Leibniz's own view of the originality of his concept regarding medicine.<sup>8</sup>

## (2) Young Leibniz's state of knowledge in the field of medicine

The *Directiones* are a very substantial and remarkably complex piece of writing, which show the young Leibniz as someone who had already developed a consistent picture of future medicine as a science. In this document, Leibniz shows that he knows the relevant literature in the field of life sciences, and how well informed he is about actual research questions and controversies.<sup>9</sup>

In the first line, he quotes newly published works, but he knows also medical standard publications that were nearly one century old.<sup>10</sup> He is referring to modern editions of Hippocrates or Galenos,<sup>11</sup> as well as extracting ideas from recent publications such as Niels Stensen's *Anatomy of the Brain*, Daniel Ludwig's *Pharmacology*, Giuseppe Borri's *Restitution of the Eye Liquid*, Richard Lower's *Work on the Heart*, or Lorenzo Bellini's *Paper on Respiration*.<sup>12</sup> He is especially interested in spectacular new findings, e.g. the allegedly successful transfusion of sheep blood to a horse or new ways of prolonging life.<sup>13</sup>

Furthermore, Leibniz integrates new ideas of important natural philosophers and researchers like Thomas Sprat, Robert Boyle, or Francis Bacon.<sup>14</sup> In the paper, Leibniz develops many ideas regarding the development of new medical knowledge by means of the empirical and the experimental methods, but he also deals with public health, and he outlines a new structure for health care.

## (3) A new structure for the health care system proposed by Leibniz

For a start let us have a look at Leibniz's proposals regarding the health care system. The central idea in Leibniz's concept concerning this issue is that "you have got to arrange medical affairs according to

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<sup>8</sup> See François Duchesneau, "Leibniz's Model for Analyzing Organic Phenomena", in: *Perspectives on Science. Philosophical, Social, Historical*, 11 (4), 2003, p. 378–409.

<sup>9</sup> For example, Leibniz takes interest in the late 1660's dispute between physicians and pharmacists in England. Here, he is referring to the work of Sébastien Colin, published under the pseudonym 'Benacio', translated and edited by Thomas Bartholin: *Lisset Benacio, Declaratio fraudum et errorum apud pharmacopoeos comissorum*, Francfort (Main) 1667.

<sup>10</sup> E.g. Santorio Santorio, *De statica medicina aphorismorum sectionibus septem comprehensa*, Venezia 1614.

<sup>11</sup> Leibniz probably worked with the following editions: Marin Cureau de La Chambre, *Novae methodi pro explicandis Hippocrate et Aristotele specimen*, Paris (1652) 1668; Claudius Campensis, *Hippocratis aphorismi ex nova Claudii Campensii interpretatione, ejusdem in aphorismos annotationes, quibus illustrantur evidentissima Galeni errata, his deinde nexae sunt animadversiones simul cum apologia in Galenum, itemque naturales animadversiones in Aristotelem, nunc primum in lucem editae*, Leyden 1579; Galen, *De praecognitione libellus, Leonardo Jacchino interprete, ejusdem explanationes in eundem Galeni libellum*, Lyon 1540.

<sup>12</sup> See Niels Stensen, *Discours sur l'anatomie du cerveau*, Paris 1669, lat: *Dissertatio de cerebri anatome*, Leyden 1671; Daniel Ludwig, *De pharmacia, moderno seculo applicanda*, dissertationes III, Gotha 1671; Giuseppe Francesco Borri, *Epistolae duae, I. de cerebri ortu et usu medico, II. de artificio oculorum humores restituendi, ad Th. Bartholinum*, Kopenhagen 1669, p. 36–68; Richard Lower, *Tractatus de corde, item de motu et colore sanguinis, et chyli in eum transitu*, London 1669; Lorenzo Bellini, "Consideratio nova de natura et modo respirationi", in: *Miscellanea Curiosa Medico-Physica Academiae Naturae Curiosorum* 2, 1671, p. 135–139.

<sup>13</sup> Leibniz mentions a transfusion experiment, which was conducted by French Mathematician and Natural Philosopher Jean-Baptiste Denis; see *Philosophical Transactions*, 9 December 1665, p. 559. With regard to prolonging the life span, Leibniz is referring to Heinrich Meibom (the younger), *Epistolae de longaevis ad serenissimum celsissimumque principem ac dominum Dn. Augustum ducem Brunsvicensem ac Lunaeburgensem octogesimum sextum annum agentem*, Helmstedt 1664; and especially to Moyse Charas, *Nouvelles expériences sur la vipère, où l'on verra une description exacte de toutes ses parties, la source de son venin, ses divers effets et les remèdes exquis que les artistes peuvent tirer de la vipère, tant pour la guérison de ses morsures que pour celle de plusieurs autres maladies*, Paris 1669. Charas propagated Viper meat consumption as a means of prolonging life; *ibid.*, p. 129 and 135–137.

<sup>14</sup> See Thomas Sprat, *The History of the Royal Society of London for the Improving of Natural Knowledge*, London 1667; Robert Boyle, *Experiments Touching Colours*, London 1664; Francis Bacon, *De dignitate et augmentis scientiarum libri IX*, London 1623; *idem*, *Historia vitae et mortis, sive titulus secundus in Historia naturali et experimentalis ad condendam philosophiam, quae est 'Instaurationis magnae' pars tertia*, London 1623.

the example of the church.”<sup>15</sup> This means e.g., that every parish should not only have a priest, but a physician as well. Both are subordinated to superintendents, and these are subordinated to general superintendents.

In Leibniz’s view, it would be the best to entrust existing clerical orders with the organization of health care, their most important advantage being that the brothers are free of any personal interests. But he also considers the possibility of founding new orders explicitly dedicated to health care. In his eyes, this would not only help to promote people’s health — it would be an excellent means of promoting Christianity, too.

Analogous to the order of the Bartholomites,<sup>16</sup> every village should have not one but two physicians — a young one and an elder one. These are to be commanded to new places regularly. But the physicians are not paid by the patients — the Republic of letters is responsible for the physicians’ subsistence. So it is guaranteed that all patients are treated equally.

In addition to its physician, every parish should be equipped with a surgeon and a pharmacist, all three of them supported by the necessary staff. Every village should have a pharmacy, too. Prerequisite for this is that the abundance of medicaments is reduced to a few main drugs, which have to be capable of curing men of different temperaments.

#### **(4) A brand new tool: The “medical confession”**

A completely new institution is introduced by Leibniz and plays a central role in his conception of a future health care. This institution is likewise copied from the ecclesiastical model. Leibniz wants everyone to go to some sort of confession, reporting everything touching the health subject. This “medical confession” is to be run along the lines of a well-fixed questionnaire. Everybody should be obliged to go to such a medical confession once or twice a year. Leibniz indeed is quite optimistic that people will like doing it.

After the confession, the medical confession father<sup>17</sup> will fix a penance, just as the spiritual confession father does. But the penance will not consist of praying several times the *Ave Maria* — it will give orders for future conduct. Those *regulae in futurum* may for example consist of nutrition rules. Spiritual and medical confession fathers are to communicate with each other. This will allow a better diagnosis of the patient’s temperaments, especially of their grades and combinations. While this is going to be a great help in every aspect of the physician’s work, the priest will learn from the temperamental diagnosis much about the passions of the patient.

In Leibniz’s opinion, it surely must be a punishment by God that so far nobody has dealt with things of such an importance. He states, “it is no surprise that man in his ignorance does not pay any regard to his salvation, as nobody so far has seen a saved or a condemned soul.” But in his eyes, it is incomprehensible that man “does not care for his physical health, either”, as the “infernal tortures” of bad health are clearly “visible in everyday life”. In disregard of this, man obviously worries “more about material goods than about his body (not to mention the soul)”.

#### **(5) Empiric research: Collecting data, creating knowledge**

The proposed structure of a health care system is designed to provide the population with the best possible medical treatment. And it also follows another main goal: In Leibniz’s concept, health care and medical research are tightly interwoven, and an extensive health care system also allows to raise data in an extensive way.

This data raising starts with the collection of all popular medical knowledge, especially of the healing secrets of old women. Anyone who gives details about a credible way of medical treatment shall be honoured. The village physician who collects a great amount of interesting knowledge will be decorated with honours as well. Anyway, physicians are obliged to record everything of importance. In the first line, this refers to the cases they deal with, but they have to keep their eyes open and try to find out about anything that might be relevant to medical progress.

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<sup>15</sup> “Man muß *rem medicam ad exemplum Ecclesiasticae* ordenen”, *Directiones*, folio 5v<sup>o</sup>.

<sup>16</sup> The Bartholomite congregation was founded in 1640 in Suevia by Bartholomäus Holzhauser. It pursued the aim to educate in its seminaries capable priests and pastors.

<sup>17</sup> “Der medicinalische Beichtvater”, *Directiones*, folio 6r<sup>o</sup>.

Leibniz reminds the reader of Hippocrates who founded medicine as a science by installing a vast register in the Aeskulap temple on the island of Kos. In this register, every successful cure of any individual case was filed; Hippocrates then wrote an abstract of the case studies. While the temple had been destroyed for ages — Leibniz concludes —, the abstracts have survived, still representing the foundations of medical science. The application of this procedure would still be extremely fruitful: Leibniz postulates that within ten years it would generate more medical knowledge than there was during the two millennia preceding his century.

Standard questionnaires have to be established to serve as a tool for this sort of research. Data have to be raised regarding the preferences in food and in drinking, but also in music. The questionnaires could be given to educated people, encouraging them to write down their own *historia naturalis*.

Mortality statistics have to be introduced not only in the big cities but in rural areas as well. Their evaluation and interpretation are to be conducted by specialists. These have to correlate the results with climate, soil, air conditions and so on.

Pharmacology, in Leibniz's view, also plays a role in this concept. All existing knowledge in this field has to be collected and tested. The regulations for pharmacists of all places have to be collected, too. Leibniz even wants to send expeditions to all foreign countries so that the drug and healing secrets of the whole of mankind can be collected and recorded. The information and samples gathered by the expeditions will then have to be tested for their applicability in Europe.

Leibniz is also open for the fields as astrology or chiromancy,<sup>18</sup> and he demands that they are tested empirically. All in all, Leibniz proposes an extensive data-collection programme with the goal of finding new, valid theorems.

## (6) Analytics: New instruments and methods

According to Leibniz the mere collection of data is not enough. It must be assisted and supported by the use of the new methods and instruments, now available to science. A main source of knowledge, thus, will be the microscope. Other newly invented or improved instruments as the circular thermometer or better clocks will support research. With the help of those instruments, e.g. all sorts of body liquids — blood, urine, sweat, and saliva — are to be analyzed with regard to their quality as well as their quantity.

A major means of analyzing things has to be the sense of taste. The Republic will educate specialists who are capable of tasting even nearly tasteless things. Those specialists must not eat anything but bread or flour, and they are forbidden to drink anything but water. When they have established a correlation, for example between a certain taste of a liquid and its salt concentration, it is possible to substitute one analyzing method by the other.

## (7) Anatomy: The crucial role of autopsy

In anatomy, Leibniz sees another field of intense future research. He stresses its importance and proposes firstly to largely increase the number of autopsies, and secondly to improve their quality.<sup>19</sup> In his view, it would be best if the majority of the deceased were examined post-mortem. At the very least there should be an autopsy every time a patient dies in hospital, upon which all affected body parts are examined. To avoid errors resulting from artefacts, the autopsies are to be carried out in different ways (as was demonstrated by Niels Stensen in his *Anatomy of the Brain*<sup>20</sup>). The “natural history” of the deceased has to be written down, and to be correlated with the autopsy results, too. The body liquids are to be analyzed: Do they react acidly? How salty are they? How do they react with certain dyes as *lignum nephriticum*? ... And so on.

<sup>18</sup> In regard to chiromancy, Leibniz refers to Philipp May, *Chiromantia medica. Mitt einem anhang von den zeichen auff den Nägeln der Finger. Nebens einem Tractätlein Von der Physiognomia Medica*, The Hague 1667.

<sup>19</sup> E.g. by following the embalment method of Dutch anatomist Louis de Bils. De Bils never disclosed his method; nevertheless, it was highly estimated by his contemporaries. See e.g. Burchardus Wittenbergius, *La nouvelle dissection sans effusion de sang, et l'embaumement de Monsr. Louys de Bils*, Bruges 1675.

<sup>20</sup> See Niels Stensen, *De cerebri anatome*, Leyden 1671, p. 51–58.

It is crucial that a method can be developed to make the blood coagulate in a way so that it does not hinder autopsy. Likewise it is necessary to find a liquid that digests the flesh without destroying the ducts and vessels. The overall aim is to create a perfect model of the human body.

But this is not enough: Leibniz demands for, as he puts it, “uncountable autopsies of animals — dead as well as alive” Here, the main goal is the study of pathology. As, according to Niels Stensen, modern anatomy derived a good deal of its knowledge from the example of animals, the study of animal diseases will give much insight into the nature of human pathology. Animals have a decisive advantage: “We can cut animals open and examine them when and where we like to.” What is more, drugs and therapeutic methods can be assayed in experiments conducted on animals, and it is possible to draw conclusions from these that might be important in the treatment of human beings. Of course, the animal owners will get compensation by the Republic...

## **(8) Medicine as an experimental science**

These animal experiments show that Leibniz’s concept of medical research goes far beyond mere experience and data raising: He calls for an experimental basis of medicine. In the text, he uses some standard beginnings meaning “one has to test” — they all indicate that there is a problem that can only be solved by applying experimental methods.

Experiments are necessary to verify old knowledge as well as to generate new knowledge, especially to develop new methods. Again, Leibniz demands that all existing knowledge should be collected: All medical experimentations have to be written down, brought in an order depending on their probability, and finally to be verified. There are experiments that can be conducted whenever one wants to. Other experiments — for example those concerning the effect of drugs against certain diseases — are depending on opportunities. That is why there should be a register of all patients and their health problems in every district: This way, no opportunity will be left out. When there are precise descriptions of every single step, the therapeutic experiments can be sensibly conducted. Of course, those tests must be harmless.

Experiments should also be conducted in the field of physiology. E.g., it has to be examined why and how liquids get to the bladder so quickly; nature and movement of digestion gas have to be checked by pressing air into the intestines; and means of prolongation of the life span are to be verified. But Leibniz proposes nutrition experiments as well: What happens to persons that are nourished exclusively by milk products or water and bread? He suggests such simple diets could be helpful in prolonging the life span.

## **(9) Finding ways into the body: Intrusive medicine**

Finally, Leibniz is very much interested in methods of intrusion into the human body. In this field he thinks a good deal of experimental research is necessary, too. He mentions the injection of fluids as well as of solid material into the human body, but he is also dealing with the problem of getting into the body by ways of surgery. Beyond the known methods — injections via clysters into the throat, into the anus, into the genitalia — he suggests a new method of introducing fluids to the blood by means of cupping. Just as promising in his eyes is the bath as a way of infusion (he calls it *infusio per poros* — infusion through the pores).

In Leibniz’s view, the experiments concerning blood transfusion should be continued — at least those with animals. The blood that will be transfused can be modified by mixing it with different liquors or by adding drugs to it.

Leibniz is convinced that fluids can be found which are capable of dissolving bladder or kidney stones. This has to be tested by introducing the fluids via syringe or clysters into the genitals.

But there is need of further new methods to get into the inner of the living human body. One of these is cutting it open. Its prerequisite is finding a way of sending the patient into a deep, harmless and pain-free sleep; a second one is a means of awakening him without problems. But first of all, the art of cutting has to be improved so that only parts that heal well are affected.

## (10) Conclusion: The place of medicine in Leibniz's overall concept

All in all, the following conclusion can be drawn. Leibniz's *Directiones ad rem medicam pertinentes* develop a consistent and comprehensive concept of medicine as an empirical and experimental science.

But where is their position in the work of Leibniz as a whole?<sup>21</sup> Are they no more than a margin in the work of a great philosopher and mathematician? To give an answer to this question, it is helpful to have a look at two different papers Leibniz wrote in the same phase. Not only did Leibniz actually deal with his "Instructions Regarding Medicine" in 1671, he also developed plans regarding the foundation of a German Academy for Art and the Sciences. Those plans he explained in two memoranda, one of them titled "Aide-mémoire on the Erection of an Academy or Society in Germany Containing the Arts and Sciences".<sup>22</sup> In these memoranda, he dealt with all sort of sciences and the arts — among them, of course, medicine.

Strikingly, a number of ideas regarding medicine appeared in the memoranda as well as in the *Directiones*. But what is more: the wording of several among them was quite similar in either source. While Leibniz demanded in the *Directiones* for "uncountable autopsies of animals — alive as well as dead", in one of the memoranda, he stressed the necessity of "uncountable autopsies of animals as well as of humans — and never missing an opportunity for it." The correspondence between these two passages is a good dating help; together with the fact that the most recent literature Leibniz used was printed in 1671, it demonstrates that the *Directiones* were written more or less at the same time.

But there is an even more important aspect: These memoranda give the wider context of the *Directiones*, thus showing the position Leibniz assigned to medicine. In the memoranda, Leibniz sketched a concept of empirical sciences that is not confined to the exact, so-called "hard sciences". In his view, the less exact, "softer" life sciences were as relevant as e.g. mechanics. All empirical sciences — including medicine — were to be unified in a *scientia generalis*. And the foundation of a German Academy was to serve one huge goal: to support the development of this General Science.

To cut a long story short: In Leibniz's overall concept, medicine was indeed as important as physics.

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<sup>21</sup> To this question see the meritorious pioneer work of Hartmann and Krüger, *Directiones*, p. 40–46; as well as Duchesneau, *Leibniz's Model*, p. 380f.

<sup>22</sup> "Bedenken Von aufrichtung einer Academie oder Societät in Teutschland, zu Aufnehmen der Künste und Wißenschafften". An edited version of this document is printed in: Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe*, Series IV: *Politische Schriften*, edited by the Prussian Academy of Sciences, First Volume: 1667–1676, Darmstadt 1931, Document 44, p. 543–552. The second memorandum, "Grundriß eines Bedenkens von aufrichtung einer Societät in Teutschland zu auffnehmen der Künste und Wißenschafften" (i.e. "Outlines of an Aide-mémoire on the Erection of a Society in Germany Containing the Arts and Sciences"), is to be found *ibid.*, Doc. 43, p. 530–543. Like all other volumes of Leibniz Edition Series IV and several volumes of Series I, II, III, and VII, there is an Internet version as well (in Portable Document Format, 'pdf').