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ALPHONSE DE CANDOLLE'S *HISTOIRE DES SCIENCES ET DES SAVANTS DEPUIS DEUX SIÈCLES* AND ITS HISTORIC SIGNIFICANCE *

Books like men have their fate, sometimes lucky, sometimes miserable, often complicated with many ups and downs. There are books becoming famous at once and actively living in science for a long time afterwards. There are other ones which pass unnoticed or quickly vanish from the memory of history. It happens also that books which initially were not appraised at their true worth come into light many years later.

And it is most curious that often the fate of the book does not correspond to its real scientific value.

One can hardly find a biologist who has never heard of Alphonse de Candolle. He is not so famous as his father, Augustin-Pyramus de Candolle, but every encyclopaedia, putting aside books on the history of botany, supplies a piece of information about him. He is yet spoken of almost everywhere as an eminent botanist among those who laid foundations of scientific geography of plants and of the theory of the origin of cultivated plants.

De Candolle's views on darwinism draw less attention and are but mentioned in literature on the history of science. However, his works and his correspondence show that as early as 1855 he was trying to prove the idea of historical succession of species and that after 1859 he became propagator of darwinism, having accepted this theory earlier than almost any other botanist. His works supply us with valuable data as to understanding the process of reception and development of Darwin's theory in the decades following the publication of the *Origin of Species*. It is rather strange that historians practically miss this very vivid page in the history of the evolution theory. [1]

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[1] We have tried to make up for this gap in the paper making part of the collection *Iz istorii biologii*, Wypusk 4, Moscow, 1973.

Alphonse de Candolle's book *Histoire des sciences et des savants depuis deux siècles* is still less known. This year is the centenary of its being published. Nonetheless neither the idea of the book nor many questions considered therein have lost their scientific meaning. They have rather acquired a still more vital importance.

And again literature on the history of science has paid no attention to this outstanding work written by an eminent biologist. In this paper we try to fill up this gap and to explain the reasons of such a deficiency.

I

One cannot say that de Candolle's book had passed unnoticed and was later completely forgotten. Ch. Darwin had great interest for it and appreciated it highly. So did also the eminent English scientist F. Galton and many others. The mention of the book is easily to be found in his biographies. But just a mention, favourable, almost always with epithets like "remarkable" etc., but throwing little light on its contents. A. Engler, a well-known German botanist, called de Candolle's book "very interesting and remarkable", but restricted himself to just one quotation from it, considering that further account of it would lead him too far. [2] Only a short mention can we find also in vast obituaries written by Geneva botanists Micheli and Christ. [3] Almost the same can be said about editions from the field of history of science. For example, voluminous and as yet the most complete American *Dictionary of Scientific Biography* quotes on this work only the following: "Besides his interest in politics, Candolle was passionately devoted to the history of science and in 1873 published a remarkable book, *Histoire des sciences et des savants depuis deux siècles*. The book displays both the naturalist's objectivity and the jurist's clarity. Darwin had just published his own works when Candolle wrote the *Histoire:* and Candolle was enthusiastic over the thesis of natural selection, which he applied with keen intelligence to the moral and intellectual characteristics of man and of human societies." [4] We should notice that the last phrase has no relation to the "*Histoire des sciences...*" except for the fact that de Candolle's article on the role of selection in human society had been placed in the same volume with his "*Histoire des sciences...*"

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[2] A. Engler, *Alphonse de Candolle. Nekrolog*, Sonderadruck, Berlin, 1893, p. 15.

[3] M. Micheli, "Alphonse de Candolle et son oeuvre scientifique", *Archives des sciences physiques et naturelles*, Genève, Troisième période, vol. 30, 1893, pp. 513–69; H. Christ, "Notice biographique sur A. de Candolle", Bull. l'herbier Boissier, vol. I, No. 4, Genève, 1893, pp. 203–34.

[4] *Dictionary of Scientific Biography*, vol. III, 1971, p. 42.

In 1911 the German translation of the de Candolle's book was published by W. Ostwald who also wrote an introduction appreciating the work very highly. But then Ostwald had just published his book "*Great Men*" (first edition 1909, second edition 1910) and was still considering the questions which were tackled there. So his attention was drawn only to one and not the main aspect of de Candolle's investigation, and to this aspect he reduced practically the whole contents of the book which, according to his opinion, gave foundations to a new science, namely, "geniology", or "science about geniuses".

We shall see that this appraisal is not at all adequate as far as the subject and direction of de Candolle's studies are concerned. He did not set the task of founding some science about geniuses. His research dealt not with geniuses, but with conditions and factors favouring the shaping of scientists and the development of science. We must acknowledge the merit of Ostwald who reminded of de Candolle's book as an outstanding phenomenon. Virtually it was Ostwald who first made a serious attempt to draw attention to this work. But the estimation of its contents by K. A. Timiryazev is considerably more precise. In a paper written for the encyclopaedia *Granat* Timiryazev says, after characterizing de Candolle as botanist: "His work is also of great interest in an altogether different field". Namely, his "*Histoire des sciences et des savants depuis deux siècles*" (1873) presents a curious attempt at determining statistically the natural and social conditions which favour or handicap the development of talents in science".[5] In another work Timiryazev, having in sight the same book of de Candolle, named him among such scientists as Galilei, Boyle, Descartes, Newton, Laplace, Faraday, Helmholtz, Berthelot, Cl. Bernard, Huxley, J.J.Thomson which had thrown light upon methodological problems of scientific thinking.[6]

K. Pearson has gathered an ample and very valuable material concerning de Candolle in the monography *The Life, Letters and Labours of Francis Galton.*[7] But here Pearson like Ostwald, takes into consideration only one question from among those touched by de Candolle's study, that is the question of influence of the heredity on intellectual capacities. Pearson neither considers other questions broached by de Candolle, nor the subject and meaning of his book as a whole.

Statistical data concerning the influence of religion on science were used in 1938 by one of the leading contemporary American sociologists, Robert Merton. His conclusions as to the difference between the Protestant and Catholic impact on science coincide with de Candolle's deduc-

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[5] K. A. Timiriazev, *Socz.*, vol. VIII, Moscow, 1939, p. 392.
[6] Ibid., p. 14.
[7] K. Pearson, *The Life, Letters and Labours of Francis Galton,* vols. I–III, Cambridge, 1914–1930.

tions.[8] The views of the latter on this question were acutely discussed also by S. Lilley, a notable English historian of science and technology.[9]

The correspondence of Alphonse de Candolle with Ch. Darwin is of exceptional interest. It was published by Ch. Baehni, a scientist from Geneva. It touches, among other questions, de Candolle's book.[10]

II

Alphonse de Candolle was born on October 27, 1806 in Paris. He spent his childhood in Montpellier where his father Augustin-Pyramus de Candolle, since 1807, was a professor in the university.

De Candolle's ancestors were Huguenots who had emigrated to Geneva from Provence, escaping religious persecution.

At the end of the 18th century, when Geneva was annexed by France, Alphonse de Candolle's father came to Paris. The French botanists soon took heed of him, and he was charged with issuing the third edition of Lamarck's *Flora of France*. In the preface de Candolle set forth his classification of plants which made him famous. But after Geneva regained independence in 1814, Augustin—Pyramus de Candolle returned with his family to his homeland where he obtained his professorship. From that time on, the life of Alphonse de Candolle was closely connected with Geneva.

Initially he studied law. But after obtaining in 1822 the degree of bachelor in law he began with zeal to study philosophy, natural history and physics. In consequence, he was awarded the degree of Bachelor of Science in 1825.

Since childhood he was devoted to botany, studying under the quidance of his father. His first published work, in 1824, was about fungi. Nonetheless he did not abandon his studies in law and was granted a doctorate in 1829 for the dissertation *Sur le droit de grâce*. Later he entirely devoted himself to botany. As early as 1831 the Geneva Academy granted him the title of honorary professor, and he began lecturing botany. In 1835, his father handed him over his chair, and till 1850 he lectured botany at the Geneva Academy and ran the Botanical Garden. By 1850 he gave up teaching to concentrate on scientific research.

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[3] R. Merton had first quoted de Candolle's book, including data on the percentage of scientists with Protestant and Catholics background, in his well-known work "Science, Technology and Society in Seventeenth-Century England" published in 1938 in the magazine *Osiris* (vol. IV, No. 2, pp. 360–632). In 1970 this work was published in New York as a separate volume under the same title. These data were quoted by Merton also in his paper "Puritanism, Pietism and Science", published in: B. Barber and W. Hirsch (eds.), *The Sociology of Science*, 1962.

[9] S. Lilley, "Social Aspects of the History of Science", *Archives internationales d'histoire des sciences*, vol. II, No. 6, 1949.

[10] Ch. Baehni, "Correspondance de Charles Darwin et d'Alphonse de Candolle", *Gesnerus*, vol. 12, 1955, pp. 109–56.

De Candolle was many times elected to the constitutional body of Geneva, and in 1862—1866 he was a member of the Grand Conseil of the republic. He took an active part in the work of Genevan scientific societies, playing an important role in the life of the republic.

De Candolle was in correspondence with many botanists from many countries. He exchanged letters and botanical materials with St. Petersburg botanists — A. A. Bunge, E. L. Regel, F. I. Ruprecht — and with Ch. I. Steven, director of Nikitski botanical garden in Crimea.

Alphonse de Candolle completed the work begun by his father, *Prodromus systematis naturalis regni vegetabilis* (Paris, 1824-1873). From volume VII, this work was edited by Alphonse de Candolle, the last XVII volume being published in 1873. One can imagine the enormity of the effort when one realises that the work contains a description of 58, 975 species. That is why the work written with the aid of many collaborators took 50 years. Personally, Alphonse de Candolle is responsible for 1, 387 pages.

Monographies of many plant families, in particular, Campanulaceae (1830), Myrsinaceae (1834), Apocynaceae (1843), etc., were prepared by him.

In 1835 de Candolle published two volumes of his *Introduction à l'étude de la botanique* which was translated into Russian (1837) and German (1838).

In 1855 he published *Géographie botanique raisonnée*, also a two-volume edition, which had a decisive influence on turning plant geography to a science. Acute observer, de Candolle describes there the struggle for existence and the competition between species. Widely-distributed species have a tendency to spread yet wider and, in consequence, extinguish some from among other species. In this process they usually derive varieties. He wrote: "Énoncer clairement ses opinions sur la nature de l'espèce est pour un naturaliste l'épreuve la plus redoutable de toutes. Il sait que chaque mot sera pesé, que toute idée nouvelle pourra être taxée d'hérésie, et que des notions fausses sur cette base des sciences naturelles jettent ses travaux de descriptions dans un dicrédit merité." [11] In spite of this, he expressed the conviction that the more species the science was getting to know, the less definite their limits. The majority of species had arisen earlier than it is thought usually, and they underwent considerable changes under the influence of geological and climatic factors. But de Candolle was troubled with the question about how could deviations preserve themselves under conditions of free crossing. That is why his conclusions in 1855 were only of limited character. The same problem was the greatest difficulty for him, four years later, after the appearance of Darwin's theory.

[11] A. de Candolle, *Géographie botanique*, Paris, Genève, vol. 2, p. 1068.

Ch. Darwin esteemed very highly this work of de Candolle, considering him one of the greatest authorities in the study of the origin and distribution of plants. We may notice that in his book *The variation of animals and plants under domestication* Darwin had, on different occasions, referred to *Géographie botanique* 25 times, and 16 times in *Origin of species.*

As we have already mentioned, the basic principles of the theory of Darwin were soon after its publication accepted by de Candolle, though with hesitation. We can learn it also from their correspondence. [12]

In November, 1862, de Candolle expressed his opinion concerning the great idea of darwinism in a special work dealing with the family of Fagaceae. [13] Studying this family, de Candolle displayed the discrepancy of the species immutability concept with facts. He strived to demonstrate that things formerly vague and unintelligible could be completly explained with the help of Darwin's theory.

In the letter dated January 14, 1863, Darwin wrote to de Candolle about the impression his book had made upon him. He wrote: "I thank you most sincerely for sending me your memoir. I have read it with the liveliest interest,... you have the art of making subjects, which might be dry, run easily. I have been fairly astonished at the amount of individual variability in the oaks. I never saw before the subject in any department of nature worked out so carefully." [14]

In 1873 *Histoire des sciences* ... was published. We shall discuss this work later. Here we should only notice that in the introduction to this book de Candolle, without underestimating the difficulties arising before Darwin's theory, decidedly became its partisan.

In 1882, when he was 76, de Candolle published his new fundamental work *Origine des plantes cultivées* (Paris, 1882), which confirmed his fame as an outstanding botanist. This work laid stable foundations for the further development of this important branch of botany and enriched the science with an enormous quantity of valuable data. It excited such an interest that already on the next year a second edition became necessary to publish, and in 1886 a third. In 1883 it was translated into Italian, in 1884 into English and German, in 1885 into Russian. We may judge about the appraisal of this work by the botanists from the fact that N. I. Vavilov dedicated his classical work *Centres of origin of the cultivated plants* (1926) in memory of Alphonse de Candolle.

The general list of works published by de Candolle exceeds 235, testifying his baffling productivity. This efficiency may be explained only

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[12] Ch. Baehni, *op. cit.*, pp. 109–56.

[13] A. de Candolle, "Étude sur l'espèce à l'occasion d'une révision de la famille des Cupulifères", *Archives des sciences*, vol. 15, No. 59 (20 novembre 1862), pp. 211–37; No. 60 (20 décembre 1862), pp. 326–65.

[14] Ch. Baehni, *op. cit.*, p. 120.

by the combination of his natural endowments with exceptional diligence and the ability to work hard during many years. His aptitude for establishing and maintaining relations with specialists from many countries and even from different continents, for obtaining from them indispensable information and plant samples, also played a role. In this relation he can probably be compared, among his contemporaries, only with Ch. Darwin. Of course, de Candolle made use also of his skill in co-operation for working out special questions as well as of the colossal herbarium and library inherited from his father.

De Candolle was a corresponding member of the Academy of Sciences in Paris, a foreign member of the London Royal Society as well as of Academies of Sciences in Rome, Stockholm, Madrid, Boston, etc. In December 1858 he was elected a corresponding member of the Petersburg Academy of Sciences, by presentation of the academicians A. A. Bunge, N. I. Zhelesnov, A. F. Middendorf and F. I. Ruprecht. [15]

De Candolle did not cease to work creatively till his death. One may say he let the pen slip out of his hand only with the last pulsation of his heart. In January 1893 his last paper was published, and on April 4th he died at the age of 87.

III

We have said that de Candolle's work *Histoire des sciences et des savants depuis deux siècles* (Genève-Bâle-Lyon, 1863) was published in 1873. It is written in French and contains 482 pages, of which *Histoire des sciences* ... constitutes 285 pages and the rest is a *Supplement* comprising seven papers on different questions. [16] The second somewhat reviewed edition of this book was published, also in French, in 1885. It covered 594 pages, of which the *Histoire* ... proper covers 324. The changes consisted mainly in abridging the Introduction and completing the book by some new sections, such as "Women and Scientific Progress", "Studies on Certain Scientists from the Aspect of Their Heredity and Education", "The Influence of Scientific Societies (on the Development of Science)", "The Influence of Special Inclinations", "Review of the Contemporary Situation of Mathematical, Physical and Natural Sciences in Different

[15] Leningrad section of the Archives of the Academy of Sciences, USSR, collection 2, inventory No. 17, sheets 98, 99, 115, also the backs of the sheets 98 and 115.

[16] (1) "Keenness of Observation and School Education"; (2) "The Advantages for Science in Using the Dominating Language and What Language Will Dominate in XXth Century"; (3) "The Influence of Heredity, Variability and Selection on the Human Species and Its Future"; (4) "On the Question of Disease Intensity and Preventive Measures Like Vaccination etc."; (5) "Different Meanings of the Word 'Nature' and Consequently of the Words 'Natural', 'Supernatural' etc."; (6) "Statistics and the Freedom of Will"; (7) "Transformation of Movement in the Organic Beings".

Countries". The amount of factual material was increased, conclusions were amplified. The *Supplement* also was extended by a report entitled "The Observation of Social Phenomena". Some headings are changed, for instance, "Statistics and Freedom of Will" are substituted in the second edition by "Statistics as the Means for Systematic Observation", the latter report being besides somewhat extended.

The book of de Candolle differred in its character from most works on history of science, which had preceded or even followed it. The author begins it with noting that there were many works on the subject, some of them very praiseworthy. But they concentrated, according to him, mainly on the study of biographies and schools, or dealt only with some particular branch of science or with the history of science in a given country. The whole of science was not considered, except perhaps in the general context of the culture progress. [17] As to de Candolle, his book was not concerned at all with the development of scientific ideas, problems and theories. He aimed at studying science as a whole and its dependence upon social, political and economic conditions, upon social-psychological attitudes of the environment, upon the situation of a given country on a geographical and cultural scale, upon all the factors creating public opinion and a personality with all its interests and education.

De Candolle investigated in detail all these factors with reference to their influence on the development of science. He recognized (see his letter to F. Galton, January 2, 1873) that their role might change according to geographical and historical circumstances. Therefore, he tried to analyse not only their general role but also their local peculiarities in Europe and in USA, as well as Brazil and other Latin-American countries.

It is just natural that his characteristics of local historical condition were brief and far from precise. But an attempt to analyse the conditions of development of science in particular countries, with their history, traditions and social situation taken into consideration, is of great interest, the more so as de Candolle aimed not only at describing facts but also at attaining general conclusions as to the decisive effect of social and cultural-historic conditions.

It must, however, be noticed that de Candolle's understanding of social conditions was rather limited. His analysis concentrated, mainly, on the development of personal gifts and interests, social conditions being considered only to the extent of their favouring or handicapping scientific work and, respectively, the orientation of the personality. A deeper interaction of science and social-economic conditions and the influence of the mode of production and of economic demands of the society, re-

[17] A. de Candolle, *Histoire des sciences et des savants depuis deux siècles*, Genève–Bâle, 1885, p. 209.

mained outside de Candolle's field of view, although the meaning of these factors had been at that time revealed by Marxism. The essential difference between de Candolle's studies and previous works on the history of science is nonetheless evident. Limited as it was, de Candolle's research had much in common with problems of science development, raised by Marxism and by modern trends of history and sociology of science, stressing the necessity of studying the dependence of science upon social conditions.

De Candolle determined the reasons of his investigation into history of science in the following way:

„La question de l'origine des caractères individuels des savants n'est pourtant pas ce qui m'a le plus occupé. J'ai eu essentiellement en vue, de chercher comment les influences extérieures propres à divers pays, à des époques successives, depuis deux siècles, ont influé sur le développement des sciences par celui des hommes les plus éminents. C'est l'adaptation aux recherches scientifiques de quelques individus, en raison surtout des circonstances, qui a produit le remarquable essor des sciences dont nous sommes témoins aujourd'hui, et il est intéressant de savoir dans quels pays et sous quelles conditions ces hommes distingués se sont manifestés et ont réussi. Les causes sociales qui les ont gênés ou favorisés sont d'un intérêt très vif pour l'histoire, non seulement des sciences, mais de la civilisation en général. J'espère avoir jeté quelque jour sur cette question ..." [18]

De Candolle's merit is not only reduced to the extension of the scope of traditional history of science but it is owed, besides, to the enrichment of the methods of its exposure. Aiming at objectivity, clarity and expressiveness in the interpretation of the history of science, he decided to apply statistical methods in his study. [19] But it is known that an idea, even a very good and important one, cannot suffice itself for the success of an investigation. It is necessary to find the ways of applying it, i.e. of working out an appropriate technique. Therefore, de Candolle had to find quantitative data characterizing the growth of science, its differentiation, the impact of religion, local political and cultural-historic conditions, etc.. He decided to analyze and to process statistically lists of members of the Royal Society of London, of the Paris and Berlin academies. But this would limit the number of countries and, consequently, of the data on the development of science. Besides he wanted to make sure that he had treated with data concerning really eminent scientists. To overcome these difficulties, de Candolle assumed, as a basis, the data about foreign members and corresponding members, considering that it were scientific merits and not other circumstances which served mainly as a criterion of their election. In consequence his calculation covered

[18] A. de Candolle, *Histoire des sciences...*, p. 208.

[19] It was probably the first attempt of applying statistical methods to the analysis of the development of science, though we may not assert it categorically. In any case de Candolle wrote that he had chosen an "earlier not applied" method, *Histoire des sciences...*, p. 209. K. Pearson disputed this opinion and gave priority to F. Galton, what does not seem to have sufficient reasons.

scientists not only from England, France and Germany, but from all over the world. He analysed lists of foreign members of the Paris Academy from 1666 to 1883, of the Royal Society of London from 1750 do 1869 and of the Berlin Academy of Sciences from 1750 to 1869. He took into consideration the speciality, the social origin and the nationality of elected members. He ascertained the participation of the representatives of different countries in these academies as well as its changes up to 1750, 1829 and 1869, the percentage of elected members per million people of their native country, the dynamics of the correlation of scientists of different branches of knowledge, and the shift in the correlation of scientists originating from (as he called it) "the three classes", i.e. the nobility by birth, the bourgeoisie and, finally peasants, handicraftsmen, soldiers and other rank-and-file men.

Applying the statistical technique to analysing history of science, de Candolle did not consider this technique as something perfect and emphasized the necessity of its coupling with the study of the subject of phenomena investigated. He wrote: "... Les chiffres employés dans la méthode statistique ne sont qu'une manière de grouper des faits, dans le but d'estimer mieux la valeur et les causes qui les ont produits ... Le bon sens d'un homme impartial doit dominer toute la recherche; autrement vous n'avez qu'une de ces statistiques apparentes et sans vraie signification qui encombrent les journaux" [20] He wrote further that one had to classify, to compare and to count just for getting to understand little known facts and their causes. He wrote that one could carry this out even without using numbers, if only one had an intellect clear enough, but be collecting and classifying quantitative parameters we subdivide a problem into its elements and make our reasoning more convincing and more reliable (p. 304).

After exposing methods and main facts, de Candolle passes on to the next section of his work titled "Analyse des faits et recherche des causes qui favorisent ou entravent le développement des sciences" (pp. 259—487). He examines here: (1) the dynamics of the distribution of scientists in different branches of science during two centuries; (2) the growing specialization; (3) the role of women in the progress of science; (4) distribution of scientists according to their social origin; (5) the factors influencing the orientation, success and number of people promoting science. Among these factors de Candolle mentions heredity, special gifts, education, means of subsistence, religion, family tradition, public opinion, political and governmental system, scientific societies, language, dimensions of country, geographical situation, climate and race. De Candolle also investigates the geography of science as well as the state of mathematical, physical and natural science in different countries at his time.

[20] A. de Candolle, *Histoire des sciences...*, p. 303–4.

In the sixth part, he compares the development of humanities with the development of natural and mathematical sciences.

De Candolle starts his analysis of factors of the development of science by investigating its intrinsic structure, the differentiation and specialization during the last two centuries. His review of the specialization beginning from antiquity and gradually progressing is short but very expressive. The main obstacle hindering this process according to him is the fact that the work of a scientist is and, probably, will remain for ever unpaid, therefore scientists must spend time merely to support their living. Formerly, celebrated scientists often happened to be doctors, i.e. physicians, not only as honorary title, but in reality. Newton supervised the muntage and coinage, Pristley was a unitarian priest, astronomers used to be sailors and war geometricians. De Candolle states that even in his days many scientists were bound to divide their time between work in the chosen field of science and the making of their living. He says that the force of the general course of events leads, nonetheless, to a rapid growth of specialization. Now, among scientists we find botanists, geologists, agriculturists, physicians, mining engineers. A more and more accentuated division appears between collectors and descriptionists, between the scientists promoting theoretical science and those applying its results, between experimentators, observers and calculators, finally, between research workers and teachers. De Candolle admits that, in the near future, most scientists will not be engaged in teaching, and this will probably restrict their interest and cause that they forget what they have learnt in universities. Then, the statement that a scientist is a man who knows things that nobody knows except him, but does not know things that evarybody knows, would come true.

De Candolle's conclusions as to the necessary conditions for the development of science are of great social and theoretical importance. He divided them into two groups: (1) conclusions concerning heredity and other personal data, and (2) those concerning social circumstances in a given country at a given period. The most important thing, according to de Candolle, is not to give preference to the first or to the second group of factors and not to consider them as something absolute. The scientific success of a personality depends on the interaction of inner and outer causes, of personal data and social conditions.

These conclusions led to a discussion between de Candolle and F. Galton (1822-1911), cousin of Darwin. F. Galton was a richly endowed English scientist, and their debate is of great historic and scientific interest.

In 1869 Galton published his "*Hereditary Genius, Its Laws and Consequences*". In this book he tried to show the hereditary transfer of intellectual gifts. His views were based on the analysis of family trees of eminent statesmen, writers, actors, partly also scientists, etc. De Candolle knew Galton's book but (as he wrote) he began writing his already

in the thirties and had come to his conclusions and to using statistics quite on his own, independently of Galton.

De Candolle disagreed with Galton's cathegorical statement about the leading role of the heredity. In 1873 in the first edition of his book, de Candolle, emphasizing the importance of natural (hereditary) gifts for being successful in science, accused Galton of exaggerating the role of heredity. "Le titre même et la première phrase de son livre" ("I propose to show in this book that a man's natural abilities are derived by inheritance, under exactly the same limitations as are the form and physical features of the whole organic world") montrent qu'il la regarde comme la cause dominante. Je ne vois pas cependant qu'il en ait donné la preuve, ni qu'il ait scruté cette question d'une manière assez spéciale ... quant aux faits, nous allons être complètement d'accord. C'est dans l'interprétation des faits, en d'autres termes, dans la recherche des causes, qu'on remarquera une assez grande différence entre nos deux opinions." [21]

De Candolle gathered information about the participation of leading scientist's sons among the foreign members of the three Academies and about the number of eminent scientists among eminent scientist's sons. Analysis of this information lead him to write: "Je conclus dans un sens plutôt contraire à l'action de l'hérédité proprement dite. Elle me paraît avoir eu peu d'effet, excepté dans les sciences mathématiques. Ce seraient nt les influences d'éducation, d'exemple, de conseils donnés, etc., qui auraient été prépondérantes." [22]

The book out of print, de Candolle sent its copies to Ch. Darwin and F. Galton. Darwin answered de Candolle on November 2, 1872 [23] acknowledging receipt of the book and anticipating the pleasure of reading it. [24] On November 11 of the same year, Darwin wrote to de Candolle: "I began reading your new book sooner than I intended, and when I once began, I could not stop; and now you must allow me to thank you for the very great pleasure which it has given me. I have hardly ever read any thing more original and interesting than your treatment of the causes which favour the development of scientific men. The whole was quite new to me, and most curious. When I began your essay I was afraid that you were going to attack the principle of inheritance in

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[21] A. de Candolle, *Histoire des sciences...*, Genève–Bâle–Lyon, 1873, pp. 93–4.
[22] *Ibid.*
[23] One can be embarassed with this date, for the year of publishing standing on the title-page is considered to be 1873. Still the dating of Darwin's letter was no slip of the pen. The next letter where Darwin shared with de Candolle impressions evoked by the book was also dated 1872. Even if we assume that Darwin had again been mistaken, it is altogether improbable that the same mistake was repeated by Galton whose letter to de Candolle was also dated 1872. One may conclude that the edition, at least a part of it, had been out of print by 1872, although the title-page is marked 1873.
[24] Ch. Baehni, *op. cit.*, p. 135.

relation to mind; but I soon found myself fully content to follow you and accept your limitations." [25]

De Candolle's answer being essential for understanding his views, we might be excused in quoting here a considerable part of it, especially as the letter is little known. De Candolle wrote on January 14, 1873:

„Mon cher Monsieur, Vous avez été bien bon de me communiquer vos impressions sur la plupart des articles de mon dernier ouvrage et je vois fort heureusement qu'elles ont été approbatives. Comme nous cherchons tous les deux sincèrement et prudemment la vérité, je suis toujours heureux de me rencontrer avec vous. Si j'ai quelquefois restreint les conclusions auxquelles on semblait arriver par la variabilité et la sélection, je les eu aussi étendues dans d'autres cas, et j'estime être resté fidèle à vos principes en montrant, pour l'espèce humaine, que souvent le jeu des phénomènes produit des effets opposés qui se neutralisent plus ou moins et rendent les modifications extrêmement lentes ou peu importantes ...

... M. Galton a été moins content que vous de ce que j'ai dit sur l'hérédité intellectuelle. Il m'a adressé une longue et amicale lettre d'observations, à laquelle j'ai répondu dans le même esprit. Je crois voir entre nous des différences dans les conclusions et non des oppositions. La tendance générale de M. Galton et le titre de son livre l'indique, est de montrer l'hérédité comme cause unique ou principale de la succession d'hommes distingués dans une famille. S'il parle des autres influences d'éducation, exemples, traditions, etc., c'est accessoirement. J'ai cherché à établir que ces autres causes sont souvent prépondérantes et me suis efforcé de préciser leur part dans plusieurs cas. Ainsi nous sommes d'accord quand il faut démontrer par des faits que l'hérédité intellectuelle existe, mais nous différons dans l'estimation des résultats de cette cause combinée avec d'autres.

A vrai dire, je n'estime pas avoir été contraire à M. Galton, mais venant après lui, je crois avoir complété son travail en tirant de faits semblables des conclusions plus variées et plus complètes. Il se sera rendu, j'espère, à cette façon d'envisager nos travaux et il sait d'ailleurs à quel point j'ai rendu justice à ses recherches." [26]

In his comments to this letter Sh. Baehni regrets of the correspondence between de Candole and Galton being lost, for it would throw light on the divergence of their opinions. But actually this correspondence is not lost and was published by K. Pearson. [27]

In the letter of December 27, 1872 Galton wrote to de Candolle:

"Dear Sir, I thank you much for your volume which I received about a fortnight since and which I have read and re-read with care and with great instruction to myself. Allow me to congratulate you on the happy idea of accepting the nominations of the French Academy and similar bodies as reliable diplomas of scientific eminence, and on thus obtaining a solid basis for your reasoning. I must, however, express no small surprise at the contrast between your judgement on my theories and your own conclusion. You say and imply that my views on hereditary genius are wrong and that you are going to correct them; well, I read on, and find to my astonishment that so far from correcting them you re-enunciate them. I am

[25] *Ibid.*, p. 136.
[26] Ch. Baehni, *op. cit.*, p. 138–40.
[27] K. Pearson, *The Life, Letters and Labours of Francis Galton*, vol. II, Cambridge, 1924.

perfectly unable to discover on what particulars, speaking broadly, your conclusions have invalidated mine. They have largely supplemented them, by thoroughly working out a branch of the inquiry into which I never professed to enter, but I literally cannot see that your conclusions, so far as heredity is concerned, differ in any marked way from mine. You say that race is all-important (p. 253 etc.) — that families of the same race differ from each other more widely than the races themselves (p. 268) — that physical form is certainly hereditary and that intellect is dependent on structure and must therefore be inherited (p. 326) — that for success, an individual must both 'vouloir et *pouvoir*' (p. 92) — that the natural faculties must be above mediocrity (p. 106) and very many other similar remarks. I never said, nor thought, that special aptitudes were inherited so strongly as to be irresistible, which seems to be a dogma you are pleased to ascribe to me and then to repudiate. My whole book, including the genealogical tables, shows that ability — the '*pouvoir*' — may manifest itself in many ways. I feel the injustice you have done to me strongly, and one reason that I did not write earlier was that I might first hear the independent verdict of some scientific man who had read both books. This I have now done, having seen Mr. Darwin whose opinion confirms mine in every particular ...

I regret very much that you did not succeed in working out the genealogies of the scientific discoverers, on whom you rely, and on both sides. However, there is no denying the fact, that as a whole they are specialists, rather than illustrious men, and are therefore somewhat obscure to fame. Man against man, they would be nowhere in competition with a great statesman — but they have owed more to concentration and the narrowing of their faculties then to a general prodigality of their nature. Such men are more easily affected by circumstances than the born geniuses about whom I chiefly busied myself, and are therefore all the more suitable subjects for an inquiry like yours, into the effects of different circumstances.

One of the most striking things to me in your book is the chilling influence on scientific curiosity you prove to result from religious authority. The figures you give seem to me of the highest importance. I am also greatly impressed with the conditions of fortune (funds not land) ... Is not "Protestant" a deceptive word? I fear most of the scientific men would be more truly described as 'infidel' or 'agnostic'.

How remarkable are your conclusions about teaching. I suppose severe teaching sacrifices many original minds but raises the level. We in England are in the throes of educational reform, wanting to know how best to teach 'How to observe'.

In your table XI of the scientific value of a million of different races I note, what appears to me, a serious statistical error. You disregard the fact that some populations increase faster than others and have therefore always a plethora of children and of persons too young to be academicians. Take as sample and not very incorrect figures, that America (U.S.) doubles in 25 years, England in 50 and that France remains stationary. Then your calculation would do about a *four*-fold injustice to America, and a double injustice to England as compared to France, because it is at the age of 50 or thereabouts that people become academicians. The true comparison woul be with the number of persons in the nations *above the age* of 50. This would avoid another great source of error arising from the very different chances of life of a child in different countries ...

I feel, now that I have come to the end of this letter, that I have done little else than find faults, but I beg you to be assured that my general impression of the book is of another kind. I feel the great service you have done in writing it, and I shall do what I can to make it known, as it ought to be, in England." [28]

[28] *Ibid.*, pp. 135–6.

Galton could hardly dissemble his irritation about de Candolle's criticism. He quoted Darwin alleging that the latter entirely held with Galton's view. But we already do know the text of Darwin's letter. One cannot surmise that Darwin wrote something contrary to his genuine opinion. Nothing else is left but to assume that Galton had not understood Darwin. It is noteworthy that Galton was trying to present the whole thing in such a way as if his views were, practically speaking, not very different from the views of de Candolle. But in reality there were great discrepancies between them. To Galton, the biological basis was all. He underestimated the influence of social conditions on the moulding of the personality and its abilities. Having rejected Galton's thesis about hereditarily determined development of the creative personality, de Candolle set the question on a broader scale. He did not turn down the part played by heredity, but he aimed at investigating the whole complex of conditions (including, in particular, the social ones) favouring the emergence of scientists. Owing to that, de Candolle's research even to-day does not cease to be of interest, and his approach retains a practical significance.

De Candolle did not want to broaden the cleavage in regard to their views. But he marched it out in his answer of January 2, 1873:

„Monsieur et honoré collègue, Le volume que j'ai publié vous a causé un mélange d'impressions agréables et désagréables. Je puis en dire autant de votre lettre du 27 Décembre mais avant de discuter certains points, je désire vous faire une déclaration générale. S'il m'échappe dans les 482 pages de mon livre, une phrase, un mot pouvant faire douter de mon respect pour votre impartialité, votre caractère et votre talent d'investigation, ce ne peut être absolument que par erreur et contrairement à mes intentions. Vous avez toujours cherché la vérité. J'ai apprécié beaucoup votre travail et s'il n'était pas inusité de transcrire de nombreux articles d'un auteur je vous aurais cité encore plus souvent.

L'idée de consulter les nominations par les Académies m'est venue il y a 40 ans! j'avais prié un de mes amis de prendre au sécrétariat de l'Institut les listes des Associés étrangers et Correspondants de 1750 à 1789. Les noms modernes sont aisés à trouver ailleurs. J'avais redigé en 1833 un mémoire sur ces listes de Paris et sur celles de la Société Royale. Si je ne l'ai pas publié alors c'est qu'il me semblait un peu présomptueux chez un jeune homme de mesurer ainsi la valeur de savants illustres, parmi lesquels se trouvait son père et quelques hommes distingués à côté de lui. Une fois moi-même sur certaines listes, il me répugnait d'en parler. Enfin, à 66 ans, après une série de travaux spéciaux propres à justifier ma position, le courage m'est venu et j'ai pensé pouvoir m'élever au dessus des considérations personnelles de toute nature.

Ma rédaction était fort avancée quand j'ai connu votre ouvrage. Je l'ai lu avec infiniment de plaisir, comme je viens d'en relire les chapitres les plus importants ...

Je persiste à croire qu'il y a, non pas une opposition mais une *différence* assez sensible dans l'appréciation des causes qui ont influé sur les faits.

Vous faites habituellement ressortir, comme cause principale, l'hérédité. Quand vous parlez, des autres causes elles sont indiquées accessoirement et sans recherches à démêler ce qui tient particulièrement à elles où à chacune d'entre elles. De loin en loin vous mentionnez ces autres causes. Ainsi on

peut lire bien des pages où vous démontrez l'influence de l'hérédité avant de rencontrer une ligne comme au haut de la page 88 sur les *sociales influences*. Le titre même de l'ouvrage implique l'idée de rechercher uniquement sur l'hérédité, ses lois et ses consequences, autrement vous auriez dit: *On the effect of heredity and other circumstances as to genius*. Assurément vous avez rendu un vrai service à la science, mais votre point de vue était essentiellement l'hérédité.

Quant à moi j'ai eu l'avantage de venir après vous. Il ne m'a pas été difficile de confirmer par de nouveaux faits l'influence de l'hérédité, mais je n'ai jamais perdu de vue les autres causes, et la suite de mes recherches m'a convaincu qu'elles ont en général plus d'importace que l'hérédité, du moins parmi les hommes de même race. ... parmi les hommes de nos pays civilisés l'effet des traditions, exemples et conseils dans l'interieur des familles m'a paru exercer plus d'influence que l'hérédité proprement dite. Vient ensuite l'éducation extérieure, l'opinion publique, les institutions etc. Je me suis appliqué à distinguer la part d'influence de toutes ces causes, part qui varie suivant les pays et les époques, et qui favorise ou contraire les effets de l'hérédité. Le but de mes recherches était donc différent du vôtre et les résultats en ont été *différents* sans être opposés." [29]

A radical divergence in de Candolle's and Galton's views is evident. Galton would not admit it, but he could not ignore it. Perhaps he saw it not at once, but he came to see it and in answer to de Candolle's book he did not linger to publish his *English Men of Science. Their Nature and Nurture* (London, 1874).

Galton admitted that de Candolle's analysis of social factors producing scientists was instructive. But he did not give up his view on the decisive importance of heredity and of creating an elite through selection, on natural gifts (and not social conditions) causing the divisions among people. For his part de Candolle in the second edition had, in several places, changed his wordings as to the role of heredity to somewhat more cautious ones. But the main result of this discussion was not so much the mutual rapprochement of the views of de Candolle and Galton but the deepening, in general, of the problem. To make his conclusions on the influence of social conditions more persuasive, de Candolle reaffirmed in the second edition (going even further than in the first one) his invariable belief in the role of natural (inherited) gifts for careers in science. But he emphasized that this role was not a decisive one, and besides it was the influence of social factors and environment, not of the heredity, which interested him most. Thereby he managed to isolate two interlinked but distinct facets of the problem, each of them being a research problem per se. De Candolle went on showing that the disregard of social conditions had led Galton to drawing his conclusions from rather mixed up material, for it was difficult to define to what extent mental faculties were innate and to what extent they were acquired in the course of education, etc.

De Candolle wrote illustrating his opinion: "Si le talent naturel, si le

[29] Quoted from: K. Pearson, *ibid.*, pp. 136–7.

goût prononcé pour des recherches scientifiques étaient le seules causes qui déterminent la carrière et le succès des hommes de science, il y aurait eu infiniment plus de savants de familles pauvres que de savants d'une origine différente — surtout le nombre des savants de familles riches aurait été minîme relativement aux autres — ce qui n'est pas arrivé." [30]

To find out which strata of society had given most outstanding scientists, de Candolle ascertained exact numerical correlations between scientists representing various social groups. From one hundred foreign members of the Paris Academy nobility and the rich (by birth) were 41%, middle class 52%, and the class of peasants and handicraftsmen, totalling up to 3/4 of the population, gave only 7%. To ascertain the social composition of French scientific estate, de Candolle took samples from the lists of foreign members of the Royal Society of London and the Berlin Academy. For the 18th century de Candolle received the following distribution: nobility and the rich — 46%, middle classes — 33%, handicraftsmen and peasants — 21%, for the 19th century correspondingly 28%, 47%, 25%. He explained such a distribution exclusively by means of social conditions, e.g. various opportunity of getting education and concentrating on scientific activity. Especially did he note the post-revolutionary shifts in France at the end of the 18th century.

De Candolle thought that domestic education and family influence bore upon the emergence of scientists more than other factors. All the discoveries are produced by curiosity. If a child is asked questions at home and at school or if it is stimulated to ask questions itself, its curiosity gets stirred. When, on the contrary, it is incessantly prevented from doing such and such things, from being curious, from inquiring into things unintelligible, then the impulses of curiosity become repressed and gradually the mind grows nonchalant and timid. "Le pire, à mon avis, est celui qui représente la science comme faite", [31] wrote de Candolle.

It was also the development of the personality which interested de Candolle most in his studies on the influence of religion. Seeing that every religion is something contrary to science, he wrote:

„Il existe, je le reconnais, dans le but poursuivi de part et d'autre et dans les méthodes, des différences très réelles. L'homme de science ne cherche absolument que la vérité en elle-même, sans s'occuper des conséquences possibles ou probables. L'homme attaché d'une manière particulière à une religion est persuadé qu'il tient la vérité. Il n'aime pas qu'on la discute. Il lui répugne d'en voir contester certaines déductions. Il redoute aussi les découvertes qui pourraient entamer ce qui lui semble plus important que tout le reste. L'homme de science repousse absolument le principe d'autorité ... Il tient beaucoup à n'admettre que des choses prouvées, et comme il en existe fort peu qui le soient mathématiquement, il s'attache

[30] A. de Candolle, *Histoire des sciences...*, 1885, pp. 280–81.
[31] *Ibid.*, pp. 323–4.

à des probabilités, qu'il pèse dans son esprit et qu'il doit toujours être prêt à abandonner quand d'autres lui semblent prévaloir. L'homme essentiellement religieux ne redoute pas le principe d'autorité. Il l'admet sous plusieurs formes, ou verbales ou écrites, et même pour des choses qu'il ne comprend pas ... Ce sont là de grands contrastes mais en même temps il y a de véritables analogies. Ni les hommes de science, ni les hommes religieux ne sacrifient leurs opinions à des intérêts matériels, à la politique ou au plaisir. Quand cela leur arrive, ils sortent de leur catégorie et perdent l'estime du public." [32]

De Candolle thought that the influence of religion upon the science was exerted primarily through the direct or indirect ascendancy of the clergy over education, customs and ideas of the society. As to the religious tenets themselves, de Candolle considered them of little consequence. By far more important is the spread of an authoritative spirit arising from the compulsion to recognize religious dogmas, whether understood or not.

De Candolle did not utter atheistic ideas and, as one can judge from his works, was not an atheist. The limitations of his understanding of social development affected also his comprehension of the reciprocity of religion and society. Just as in his interpretation of many social problems, he often alternated interesting ideas with erroneous theses. For instance, the fact that greatest success of science during the last centuries occurred mainly in Christian countries led him to the thesis of the affinity between Christianity and the scientific movement. He did not realize that there was no causal relationship here, for transmutations and forms assumed by the religion in the Christian world were caused by the same social-economic factors which called forth the scientific progress in Europe since the 15th century. At the same time de Candolle had phrased some observations valuable for his epoch directed against prevailing church principles, against subjecting of the science to the religion.

As far as we know, it was de Candolle who first made close a study of the different impact of protestantism and catholicism on science. He counted up that from 1666 to 1870, 18 foreign members of Paris Academy were catholic, 80 protestant, 1 orthodox and 2 unidentified, while the population of all Europe, France excluded, totalled 107 milion catholics and only 68 milion protestants. Thus, protestant families of Europe gave four times as many outstanding scientists as catholic families did, while the proportion of protestant and catholic inhabitants of Europe was 1 to 1.5, France being excluded. To generalize for the whole of Europe, de Candolle counted also the number of the elected French foreign members of the London Royal Society and ascertained that in 1829 half of them were protestants. In 1869 protestants had somewhat outnumbered catholics, although in the whole of Europe catholics amounted to 139.5 million and protestants — to 44 million.

[32] *Ibid.*, pp. 354–5.

De Candolle noted that these data did not permit definitive conclusions, for the difference in political, climatic, etc. conditions could be more important for the development of science than any religious beliefs. Therefore he considered it necessary to establish the religious affiliation of scientists in Switzerland where catholics and protestants were separated only by canton boundaries, while both natural and political conditions were very similar. He ascertained that there was not one catholic among the 13 Swiss scientists elected to foreign academies, while catholics were rather numerous in Switzerland (their proportion to the protestants is 1:1.5), Meanwhile, all the Swiss breathed the same, air, the republic administration existed in all the cantons, among which the catholic and the protestant ones were equally free in their domestic affairs. [33]

What was the reason of such great a difference in the number of scientists from protestant and catholic families? De Candolle explained it first of all by the fact that the protestant church exerted less pressure on minds than the Greek or Roman one. He thought that even the first appearance of protestantism as a rebelion against official tenets gave a stimulus to the struggle against authorities. [34] As an example of the authoritative pressure de Candolle mentioned his homeland. He wrote:

„L'histoire de la petite république de Genève est curieuse comme démonstration des effets (on the science — Auth.) de l'autorité. Pendant près de deux siècles (1535 à 1725), les principes absolus des premiers réformateurs ont régné complètement chez les laïques et les ecclésiastiques. L'instruction était imposée par la religion. Presque tous les citoyens passaient par le collège et beaucoup d'entre eux suivaient plus tard les cours spéciaux de l'Académie; mais pendant toute cette période aucun Genevois ne s'est distingué dans les sciences. De 1720 à 1730, le principe calviniste d'autorité vint à faiblir; l'éducation et les moeurs changèrent dans un sens libéral, et depuis 1739, date de la première élection d'un Genevois à une société étrangère importante, celle de Londres, Genève n'a pas cessé de produire des mathématiciens, des physiciens et des naturalistes, dans une proportion remarquable pour sa faible population." [35]

Thus, de Candolle speaking about the advantages of protestantism in comparison with catholicism did not mean that he had tied science with the spirit of protestantism. He realized the radical difference between science and any form of religion.

De Candolle's conclusions concerning the situation in the Geneva republic help to understand his views on the influence, not only of the church, but also of the state, social system and form of government. His conviction is that wherever freedom of thought and research is repressed, the development of science slows down. But all his discourses on the influence of the social system upon science are very superficial.

[33] *Ibid.*, p. 331. In 1938 these data were used by Merton (see above), whose view on the role of protestantism was similar to de Candolle's opinion.
[34] *Ibid.*, p. 335.
[35] *Ibid.*, pp. 335–6.

He does not understand the interaction of science and state otherwise than in the form of relations between the state and an individual scientist. As a result many and the most essential facets of the interaction between science and social system escaped his research. No wonder that he attached a disproportional importance to the influence of public opinion, family tradition, education, etc.

Of course, these factors have a more immediate effect on an individual scientist, and their influence on his career is easier to discern than the impact of a social system or economics. But this does yet not mean that they determine also the development of science as a whole. We may attach to them very much importance, but there remains always the question as to what determines them. The idea of tenor of life, public opinion, education, moral and manners being a consequence of social-economic conditions remained unknown to or misunderstood by de Candolle. In the light of this idea the question of social or family and educational conditions having more influence on a youth is not of so great an importance as de Candolle thinks it to be. It is much more important to understand what were the social and economic causes of the domestic tenor, customs, education, etc., caracteristic for the definite social strata of a given country in a given period. If we understand it, we will not ask what is more important for the development of science: family tradition, education, public opinion, customs, or the social system and economics. But one must not oversimplify the problem in explaining the first group of factors by the second group. This view is to some extent supported by the data of de Candolle himself when he counted the number of foreign members of the Paris, London and Berlin academies who were descendants of protestant emigrants. It turned out that they were 44 in all the three academies, 35 from this number being Swiss, though French protestants had emigrated to Germany, Netherlands or England not less than to Switzerland. This fact led de Candolle to the conclusion that "Si l'hérédité déterminait les aptitudes aux différents branches des connaissances humaines, et si la religion seule avait dirigé les protestants vers les sciences, on aurait vu les descendants de réfugiés se distinguer, en tous pays, et dès l'origine, dans les mêmes catégories de travaux." [36] But we see the contrary to be true, this being explained (according to de Candolle's conclusion) by the conditions of the country which received the emigrants. It was no answer, but at least a certain approach to it. As to the development of personal caracteristics of a scientist, here the analysis is of great importance, and de Candolle's ideas on this occasion retain their great interest even to-day.

It is to be noted that de Candolle did not restrict himself to the scrutiny of factors influencing science, but formulated 20 (in the first

[36] *Ibid.*, p. 345.

edition 18) conditions favouring its development, having summarized his research in practical, normative conclusions. Among these conditions he emphasized the spread of material well-being among people; the long-standing culture of mind and perception, particularly of the perception of external realities; the well-organized system of primary and espencially of high and university education stimulating research and the devotion of young people and professors to science; the rich and well-organized basis of research (libraries, observatories, laboratories, collections); the freedom of scientific opinions and of selection of any profession; the public opinion, favourable to sciences; the widely-spread knowledge of foreign languages; the independence of small countries and of their federations; the proximity to the developed countries; the numerous academies and scientific societies; the habit of travelling especially abroad.

IV

In conclusion, we cannot but wonder, how could it happen that the original, highly interesting research of de Candolle had attracted so little attention? But it was natural. The problems reised in his work were alien to most botanists. As to the historians of science, they knew and admitted, up to recent days, practically only two genres, biography and history of scientific problems or ideas. De Candolle advanced a new type of work on history of science which might be considered as a prototype for modern science of science. Such a type of investigation exceeded traditional limits of the literature on history of science. Finally, the ways of development of science in de Candolle's time and still long afterwards did not excite such a live interest as they did in the few last decades. The social need in investigating this problems, the rise of the science of science lead to a new reading of the scientific heritage of the past. It is probable that many things should be revealed there, earlier not having drawn attention but useful in solving actual problems of to-day. Every epoch treats its fore-runners in its own way, from the point of view of its notions and ideas.