

Some college trained engineers who desire or need a life in the great outdoors will use their training and knowledge in the discovery of ore bodies, where untrained men would not be likely to find them, or would pass them by. Other trained engineers will explore these ore bodies and if found to be sufficiently rich or large, will pass them on again to others, who will develop them into producing and paying mines.

Your universities as well as ours can assist in the development of Canada by giving a thorough training in mining and geology, with all the collaterals that these sciences imply, to all three classes of engineers mentioned above, and also to directors or prospective directors of mining companies so that they also may understand and appreciate the work done by their several engineers. With such assistance the Canadian Mining industry would increase and develop at an even more rapid rate than it has done in the past.

J. B. TYRRELL

THE SCIENTIFIC RESOURCES OF FRANCE

To those who harbor an impulse which keeps them, throughout life, arduously laboring in scientific fields, the great cultural institutions of France appeal with peculiar power. Some of my French friends remark, "Yes, the Frenchman invents, creates and embellishes and then ceases to interest himself in the creatures of his mind." A surgeon whose name is internationally honored said, when the purpose of this paper was explained and his aid sought in the collection of material, "C'est très important! En France, nous créons des grandes organisations, et après, nous nous en moquons trop!" In a sense it may be true that the intellectual wines of Europe need no bush, yet descriptions of the educational resources of the Old World never fail to be eagerly scanned by the American scientific public and what may be termed our general student body. Novel light on the ancient beaten paths which all students must tread, pointing again the rough, unroyal highway in which the world's best workers have bruised their hearts and cudgelled their brains, seems ever welcome. It reminds present pilgrims of

the beautiful democracy of ideas, or aristocracy of ideas, if you will, which has placed marvelous forces within reach of every human mind which would seek to employ and direct them. And, besides an undertaking for my own countrymen, the present paper constitutes a labor of love and humble tribute devoted to the genius of France. Probably there have never been as many American students in attendance at French institutions as now. There is every indication that their number will be continually swelled. The old wells of knowledge still flow and the strata of fact ever accumulate in the world's huge centers. The flood of inquiring spirits surges about the doors of hoary institutions and threatens to submerge and block their portals, yet is somehow sluiced away, leaving ample room for perpetually rising tides.

The undergraduate institutions, such as the Sorbonne, University of Paris, and provincial universities like those of Lille, Lyon, Strasbourg, Bordeaux, Montpellier, Grenoble and many others possess libraries, laboratories and museums which may be utilized by post-graduate students. In fact, the special student may find that his particular needs will require a visit to one or more of the schools outside Paris. For French students living far from Paris, the local university and its attributes are highly important. The foreign student naturally first interests himself in Paris.

At Paris, the Institut de France, Académie de Médecine, Collège de France, Institut National Agronomique, Académie d'Agriculture, Institut Pasteur and, especially, the libraries, are supremely interesting. In addition, the Observatories, Radium Institute, various museums, the Polytechnic School, Institute of the Arts et Métiers and other special colleges, laboratories and manifold sources of information are available to the special worker.

All these organizations are separate and independent. Sometimes a loosely common tie is constituted by direction by the same ministry, such as that of the Public Instruction, Agriculture, etc. However, the faculties, officers and members are not officially inter-related. The institutions have originated differently and developed, each by itself, through centuries of changing and often troublous history. In a

paper of this kind, scarcely more than mere mention can be made of the very numerous educational resources centering in Paris alone. However, something of a sketch will be attempted. And, in this endeavor, the institut has been selected, first, because it constitutes the summit of French intellectual achievement and second, because it is a type generally representing the learned bodies of France. It is here concerned mainly on account of a single one of its five constituent Academies, the Académie des Sciences. In justice to the institut, this state monument of surpassing interest to all liberal minds, a review is indispensable. The principal chronology may be tabulated in the following scheme:

- 1635. Richelieu interests himself in an existing literary society, whose meetings are held with one of the members, Conrart. Becoming the protector of this society, Richelieu lays the foundation for the future Académie Française.
- 1648-71. Royal Academy of painting and sculpture, and Royal Academy of architecture, aided by Mazarin and Colbert.
- 1663. Royal Academy of Inscriptions et Belles Lettres organized by Colbert.
- 1666. First meeting, December 22, of the Royal Académie des Sciences.
- 1793. Suppression of all intellectual organizations by the revolutionary National Convention.
- 1795. True birthday and foundation of the Institut, October 25 (Brumaire 3, Year IV), under the title "Institut National des Sciences et des Arts." The new Institut was not related to the preexisting Academies, except in so far as the fact that some of their members became members of the Institut. The Institut was composed of three classes, namely, of the physical and mathematical sciences, moral and political sciences, and French literature and fine arts.
- 1803. Reorganization by Napoleon's Consular Decree of January 23 (Pluviôse 3, Year XI), with abrogation of the class of moral and political sciences and formation of the four classes of the physical and mathematical sciences, French literature and language, ancient history and literature, and fine arts.
- 1816. Interesting principally because the term "Académies" was substituted for that of "Classes."
- 1832. Royal decree restoring the class (called Académie) of moral and political sciences.

This skeleton calendar suggests the present composition of the Institut. The latter is autonomous, consists of five Academies and is maintained by funds provided by the French government and bestowed by private individuals. In the order of their usual ranking, the constituent Academies are the Académie Française, Académie des Inscriptions et Belles Lettres, Académie des Sciences, Académie des Beaux Arts and Académie des Sciences Morales et Politiques. The president of one of the academies automatically rotates to the presidency of the Institut. Each academy is represented in the presidency of the Institut for a year. The chief of the Académie Française, the only officer styled "Director," is elected every three months, presidents of the four other academies being elected annually. Accordingly, in years when the presidency of the Institut is represented by the Académie Française, the Institut has four presidents, each serving for three months. This condition chances to exist in 1922, the present president of the Institut being Monsieur Henri Regnier, director of the Académie Française. The secretary is Monsieur Frédéric Masson.

The secretaries of the academies are perpetual and elected for life. They constitute the real directors, since they thus remain in contact with permanent policies. In association with two members delegated to the central administrative committee described further on, they administer the academies' finances. They also designate the programs of the weekly meetings and supervise publications. Perpetual secretaries are practically always great savants. Among those who have so served are Joseph Bertrand, Darboux, Cuvier, Arago and Pasteur. After becoming ill and unable to continue active secretarial duty, Pasteur was made perpetual honorary secretary in the Académie des Sciences.

As shown by the chronological table, the Institut dates from 1795. Before this date, the various academies, which had been created and developed under Louis XIII and Louis XIV, were entirely separate and independent. Liberal thought had begun to flourish actively by the time when its exaggerations, combined with France's difficulties, had precipitated the Revolution. The dominant spirit in the Na-

tional Convention feared free thought and opposed it. Saron, Bailly and Lavoisier were guillotined, while Condorcet preferred suicide. These men were destroyed because of their political activities and, so to speak, in spite of, and not by reason of, their scientific accomplishments. The royal decree of 1832 fully restored all the elements suppressed by Napoleon and launched the Institut on a course which has been practically uninterrupted since that time.

The governmental funds allotted to the Institut are apportioned as follows:

Académie Française	150,000 francs
des Inscriptions et Belles	
Lettres	79,000
des Sciences.....	175,600
des Beaux Arts.....	97,400
des Sciences Morales et	
Politiques	87,400
Library	15,600
General	81,400
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Total	688,400

Obviously, the library fund is utterly insufficient. At the present rate of exchange, it is equivalent to about \$1,500, or to about \$3,000 only, were exchange at the prewar rate. The library is encyclopedic, containing valuable works on all the subjects in which the several academies are interested. On account of the paucity of this library fund, and especially in view of the fact that the government will be unable to supplement it for a long time because of the grave post-war financial conditions, the Library of the Institut would be most grateful could it receive, free, the important bulletins and other valuable publications issued by the United States government and by the several states. An appeal of this kind is hereby made to the federal bureaus and to the numerous educational, scientific and other liberal agencies existing in all our states. National, state, university and other publications may be sent to the Conservateur de la Bibliothèque de l'Institut, 23 Quai de Conti, Paris. Perhaps in no way can our country so effectively aid the country which so materially secured to us our victory in the days when our independence was darkly and gravely uncertain. With us, it must be remembered that the question of this sort of assistance is scarcely one of material

cost, for free publications by the bushel, of which one copy each would be gratefully cherished by the Institut library, are unceremoniously dumped into American wastebaskets.

The Institut administers various foundations and awards many prizes. Of the government funds, only 22,000 francs are devoted to prizes. The funds of the several academies, and the general and library funds of the Institut, are administered by a committee, the Commission Administrative Centrale, composed of the perpetual secretaries and two members delegated by each academy. Excepting secretaries, each member of the Institut receives 1,200 francs annually. Secretaries receive 8,000 francs.

It must be remembered that the foundations bestowed upon the Institut must be administered according to the specifications of the donors. These specifications are usually precise, thus largely leaving the Institut powerless to convert the funds otherwise, even in the presence of great emergency, such as that confronting the library. Of these foundations, perhaps the most generally useful is the Jean Debrousse Foundation of 1900, consisting of a million francs. From this foundation, various sums are expended in the aid of scientific, historical and other works, and for the maintenance of publications. The Montyon prizes are very important. The most important single prize, the Osiris, of 100,000 francs, is awarded triennially for outstanding contributions to science, letters, art, industry or general public welfare. Roux, who was director of the Pasteur Institute when awarded this prize in 1903, immediately bestowed it upon the Institut Pasteur.

Various museums, chateaux, estates, etc., have been bestowed upon the Institut and constitute important research resources, largely in the fields of history and literature. Among these are the domain of Chantilly (Museum Condé), given by the Duc d'Aumale; the estate at Chaalis and the Museum Jacquemart-André, in the boulevard Haussmann, at Paris, bestowed by Madame Jacquemart-André; the Chateau de Langeais and Hotel de Thiers, at Paris; and the Abbazia Observatory of the Académie des Sciences, situated at Hendaye, on the Spanish frontier near Biarritz.

The library of the Institut, partially discussed above, is private, situated on the premises of the Institut at 23 Quai de Conti, and open on Mondays, Thursdays, Fridays and Saturdays, from noon to 6 P.M. Workers must be introduced by members of the Institut. The Mazarin library (Bibliothèque Mazarine) is also quartered on the site of the Institut. It is public, and chiefly devoted to history and literature. It is quite independent of the Institut library.

The creator of the Académie des Sciences was Colbert, controller of finance under Louis XIV. Among its members have been Lavoisier, Condorcet, Buffon, Lagrange, Laplace, Biot, Ampère, Fresnel, Lamarek, Becquerel, Dupuytren and Magendie. Some of the distinguished perpetual secretaries have been already named. Bonaparte was elected a member in 1797.

The membership comprises a total of 218, of whom two are the perpetual secretaries. The classes of members are titular, or regular (68), free (10), non-resident (6), corresponding (116), foreign associate (12) and include 6 members from the new section on the Application of Science to Industry. Free members are not necessarily great savants, but may be chosen on account of their scientific interests and general relations. They receive no compensation and have no vote in elections. Corresponding members may vary in number and represent various regions of France, the French colonies and foreign countries. Foreign associates are always scientists of the first order.

The members are distributed among 12 working sections, namely, of Geometry, Mechanics, Astronomy, Geography and Navigation, General Physics, Chemistry, Mineralogy, Botany, Rural Economy, Anatomy and Zoology, Medicine and Surgery, and Application of Science to Industry. Meetings, free to the public, are held Monday afternoons. Ladies must have a card of admission, which is readily obtainable. The proceedings, including papers, demonstrations, etc., are reported in the *Comptes rendus hebdomadaires de l'Académie des Sciences*. The academy also publishes *Mémoires des Savants Etrangers* and *mémoires*, or articles, written by the members. In 1878, Edison's phonograph, then not fully completed, was presented at one of the meetings. In order to prove good faith,

the demonstrator was obliged to submit to having his nose held, to eliminate ventriloquism. Gouraud and Janssen gave the final demonstration on April 22, 1889. An annual meeting, open to the public, is held in December.

Fifty foundations are administered by the Académie des Sciences. Six Montyon prizes provide a total of 44,845 francs for award. The Guzman prize offers 100,000 francs for proved communication with any heavenly body excepting Mars. Scientific thought is still further stimulated by the Caze prizes, each of 10,000 francs, in physiology and physics; the Caze and Jecher prizes of 10,000 francs each, in general and organic chemistry; the Plumey prize of 4,000 francs, in steam navigation; and by a number of prizes in botany, geography, mathematics, exploration, mineralogy and various other subjects. Moreover, the prizes, medals and other honors bestowed by the Institut are not all limited to the French. Many are freely at the disposal of every race and people, within the limits of merit only.

The conditions of award, prize-lists and other information may be obtained by addressing the Secrétaire Perpetuel de l'Académie des Sciences, Secrétariat de l'Institut, 23 Quai de Conti, Paris. Competing manuscripts should be received at this address by December 31 of the year preceding that in which the competition will be judged. Prizes are awarded at periods varying from one to five years. Scientific works competing for award must be written in French and three copies, with a letter, must be filed with the Secrétariat.

The present president of the Académie des Sciences is Monsieur Emile Bertin. The two perpetual secretaries are Messieurs Emile Picard and Alfred Lacroix. Some of the members are Painlevé, Appell, Roux, Deslondres, d'Arsonval, Admiral Fournier, Haller, Richet, Quénu, Widal and Moureu. Marshal Foch and Prince Roland Bonaparte are free members. The late Prince of Monaco was a foreign associate. Other members not American include Sir Edwin Ray Lankester, Pavlov, Cajal, Yersin, Depage, Wright, Bordet and Bruce. How can one select luminaries from such a firmament?

Members of the Académie Française must be

French. Not so with the other academies. A total American membership of about twenty is distributed among the four other academies of the Institut. American foreign associates of the Académie des Sciences are Dickson, Brown, Campbell, Davis, Loeb, Hale, Waddell, Michelson and Walcott.

The Académie de Médecine, 16 rue Bonaparte, succeeded, by a royal decree dated December 20, 1820, the ancient Académie Royale de Chirurgie and the Société Royale de Médecine. Like most other institutions, it is independent. Its eleven sections are those of anatomy and physiology, medical pathology, surgical pathology, therapeutics and natural medical history, operative medicine, pathological anatomy, obstetrics, public hygiene, legal medicine and medical policing (the last three in one section), veterinary medicine, medical physics and chemistry, and pharmacy.

The members are titular (100), free associates (10), national associates (20), foreign associates (20), national correspondents (100) and foreign correspondents (50). The proceedings are published in the weekly *Bulletin de l'Académie de Médecine*. The private library is freely at the disposal of physicians and surgeons, pharmacists and others interested in medical subjects. Recommendations made to the government by committees of the academy are always seriously considered, and frequently adopted, by the public powers. Many of the great sanitary and hygienic reforms of France are due to the labors of responsible committees appointed by the academy. The membership embraces many of the well-known French medical and surgical authorities. Madame Curie, recently elected, is the first and only woman member.

Naturally of kindred interest with the Académie de Médecine is the Institut Pasteur, 25 rue Dutot. The Institut Pasteur is composed of three sections, on microbiology, serotherapy and biological chemistry. The rabies service falls in the first section. The animals required for the serum service are kept at Garches. The laboratories are those of physiology, fermentation, agricultural chemistry, therapeutic chemistry, physical chemistry, biological chemistry and serotherapy. The Institut also possesses laboratories of exotic pathology, protozoology

and entomology, situated at 96 rue Falguière. The present director is Dr. Calmette. Among the laboratory chiefs are Bertrand, Levaditi, Mouton, Fernbach, Marie, Besredka and Nicolle.

Foreign students are welcomed. Free theoretical courses in bacteriology are given. For a small, selected class of postgraduate students, practical courses are given in naval and military medicine, public health, and preparation of vaccines, serums, culture media, etc. The free rabies service discharges a service dignified far beyond the measure of human praise. A beautiful isolation hospital, attached to the Institut, lies just across the street. The Institut library, now emerging from its chaotic war period, may be readily consulted by qualified students. Every visitor should see the crypt and tomb of Pasteur. Affiliated Instituts Pasteur are situated at Lille, Algiers, Tangier, Tunis, Brazzaville (Congo region) and at Nha-Trang and Saigon in Indo-China.

The Collège de France was founded by François I. No fees are asked, except for laboratory work, and no diplomas given. About forty professors compose a faculty lecturing on languages, history, literature, etc., and in some twenty-five branches of science. Arrangements to attend lectures or work in the laboratories should be made in September or October with the appropriate lecturers. The address of the Collège de France is Place Marcellin-Berthelot, Paris. Special laboratories are situated at the Parc des Princes, Avenue Victor Hugo, Boulogne-sur-Seine and at Meudon. The Institut d'Hydrologie et de Climatologie, a part of the Collège, possesses laboratories of physics, chemistry, hygiene and hydrology. A group of museums is situated at the Jardin des Plantes, founded in 1636. Many courses are given at the Jardin, among which are those on annelids, mollusks, zoophytes and zoology (birds and mammals). A School of Botany is also conducted at the Jardin and a course in paleontology given at the Museum of Paleontology.

The Institut National Agronomique, 16 rue Claude Bernard, is directed by the Ministry of Agriculture. It possesses various laboratories. It has an experimental farm at Noisy-le-Roy. The Académie d'Agriculture, 18 rue

de Bellechasse, is devoted primarily to the preparation of information utilized in guiding agricultural legislation. Like the Institut Agronomique, it is attached to the Ministry of Agriculture, but has no connection with the Institut Agronomique. It includes nine sections, has seventy-two titular members and various correspondents and associates, offers a number of prizes and publishes the *Comptes rendus des Séances de l'Académie d'Agriculture*. Among noted members have been Buffon, Calonne, the King of Siam, Edward VII and George V of England, Jussieu, Malesherbes, Pasteur, Roux, Turgot and Vicq-d'Azyr. David B. Warden represented America in 1834, L. O. Howard is now a foreign member and George Washington was a foreign associate from 1789 to 1793. In 1793, the Académie d'Agriculture shared the common fate of dissolution by the Convention.

The limits of this paper are approaching. No discussion can be given at present of the observatories, Sorbonne, hospital clinics, the marine laboratories of Cette, Roscoff, Banyuls, etc., the Radium Institute, Oceanographic Institute and Museum, Bureau of Longitudes and many another cultural organization.

Libraries are attached to all the institutions discussed. Many of the Paris libraries are devoted largely to history, art and literature. The Bibliothèque Nationale, at 58 rue de Richelieu, is the most important public library in France. It grants opportunities for research on permission obtained in writing from the Secretariat. This library is of especial interest to all students, since it is the official depositary for all scientific and other works published. Next in importance among general libraries ranks the library of St. Geneviève, close to the Panthéon. It is open daily until 10 P.M. The library of the Faculté de Médecine, at 12 rue de l'Ecole de Médecine, is large and useful, and contains many current journals.

The "Ressources du Travail Intellectuel en France" (see bibliography) constitutes an invaluable summary of French educational institutions, including libraries. Card catalogs as we know them are not generally used in European libraries, partly because valuable works and historical documents, composing much of

the material, can not well be placed freely at the disposal of the merely casual reader. It is usually very easy to obtain any books, manuscripts, etc., desired.

Were I the arbiter *elegantiarum scientiæ*, I should suggest undergraduate study for the first two years in Europe, the last two in America, one or two postgraduate years in America, then for a year or two back to Europe, and so on alternately as long as the consequent intellectual labor might be practicable. By this outline I do not mean mere passive travel in ways blazed by others, but the supplementing of one's own fruitful accomplishments with study of the gifts in similar fields bestowed upon humanity by one's peers and fellows.

In closing, I wish to express especial acknowledgment of kindnesses for which I am indebted to Dr. Tuffier, and particularly to M. Henri Dehérain, curator of the Library of the Institut de France, who reviewed the manuscript and made many invaluable suggestions.

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PARIS, 10 BIS RUE HERRAN,

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