have spent two summers in this kind of work and have found it most profitable.

Examine the serpent in the embryo first. One easily defines four long lines thus:

1———————
2———————
3———————
4———————

The first is a white line of nerve flesh, the second a livid line of muscular flesh, the third a red line of vascular flesh, and the fourth a yellow line of glandular flesh.

In the adult these four radical elements appear also in long lines, and one forgets to look for details of organs and functions, for he sees before him a grand generalization made by nature herself. Here is the long white line of nerve, the flesh of excitation, next a gross elongate contractile mass, say three feet in length, the motor flesh, two long tubes, one alimentary the other sanguiniferous, nutritive tubing, constructive flesh, and finally a chain of elongate soft masses, each serpent-shaped, lung, liver, kidney, ovary, constituting the effusive or productive flesh.

Each of these being reduced to impalpable powder, if made into extracts, we would have serpent neurine, musculine, vasculine, glanduline.

Presumably we must take it for granted that the flesh of the serpent is not appropriate for human veins, as we do not put it into the human stomach, though we do that of the turtle, but the simplicity of the organism makes it a most delightful subject for the man of science to contemplate. Along that white nervous line lies the brain, the soul, the spirit of the creature, the power of excitement; by theory injected into the veins of other creatures it ought to raise the spirits and the power of excitement. Along the livid contractile line lies the muscular power. In the third, or vascular line, we find the heart and the vitality. Injection of this flesh should increase vitality, the power of living and growing,—a serpent, like a cat, dies hard. The heart and intestines of felines also offer a subject for investigation. In the fourth line, finally, that of the soft and melting flesh, we see the force of effusion and efflorescence, or productivity. Forced feeding of the veins or lacteals with this flesh ought to raise the effusive and productive power.

For purposes of experiment the rabbit would in many places be a more convenient animal than the guinea pig of Brown-Séquard. A number of these animals being provided, the brain and nerves are thrown into the first pile, so to speak, as spirit flesh, the muscles into the second as motor flesh, the heart, veins, arteries and intestines into the third as vital or vigor flesh, and the lungs, liver, kidney, ovaries, testes and mammary glands into the fourth as productive flesh.

These four radical parts being treated by Brown-Séquard's method would produce nerve juice, muscle juice, vessel juice and gland juice. Being treated by Dr. Hammond's process with boric acid, glycerine, and absolute alcohol, the result would be four radical or elementary extracts, neurine, musculine, vasculine, glanduline, calculated respectively to raise the spirits, the energies, the vigor or vitality, and the effusive power.

Each of the grand divisions of the little kingdom of man has its capital or seat wherein each special kind of force is concentrated. The nervous centre is the cerebrum, or highest pair of nerve ganglia; the muscular centre, somewhat less marked in man, is clearly to be distinguished in the breast of wild birds, and in the rump of the cervidæ; the heart is the vascular centre, the seat of vitality and vigor, the culmination of nutritive force; while the germ or sperm glands, or generative flesh, may be regarded as the glandular culmination of the organism.

In these organs, then, brain, breast (of birds), heart and ovaries or testes, we have special concentrations of life's radical forces, excitatory, motor, constructive and generative, and thus, if instead of taking the whole of the flesh for the manufacture of carneous extracts, one selects the concentrated parts, using these alone, he will, in place of making neurine, musculine, vasculine and glanduline, produce cerebrine, pectine, cardine, testine, which thus ought to be a higher essence of the flesh. For these specialized flesh masses in nature present to us the highest examples of force excitant, energetic, constructive and generative.

How to grasp and bottle these forces and with them perform the scientific miracle of transubstantiation, is the question for those who seek an elixir of life, making these flesh masses by means of extracts the vehicles through which to transfer these forces from animals to man.

The ancient Romans were convinced of the truth of the dictum that each part nourishes a part. As an example the udders of cows were eaten by them as emotional food. The science of sarcology and the new way opened up by Brown-Séquard and Dr. Hammond suggest higher possibilities. Who knows but some day we may inject into our veins the breasts of birds and the heart of the lion, as modes of raising human spirits and energies.

HISTORY OF SCIENCE IN AMERICA.

BY JOHN READE, MONTREAL, CANADA.

THE period between 1876 and 1889—the centennial period, it might be called—was the occasion of many retrospects, touching the development of letters, law, the constitution and various branches of science within the Republic. Long before the later limit of this period had been reached, the eyes of students had begun to contemplate, with admiration, an anniversary of still more pregnant suggestiveness, and surveys covering the interval between the Columbian discovery and the present have begun to appear. In an age of specialists, such as ours, comprehensive records of progress, like those of Drs. Whewell and Draper, are going out of fashion. Where they survive, they mostly take the cyclopedic form, each contributor dealing with a special department of knowledge. If we were to have a history of scientific progress in the new world during the last four centuries, it would probably be the product of such collaboration.

In compiling such a history, it would be necessary at the outset to draw a line of partition between such scientific research as, though conducted on this side of the Atlantic, was due to European initiative. In geography, for instance, the services of Columbus belong, in the main, to Europe, and of European countries, Spain has the best claim to the honor of them. But where, after his primal discovery of cis-Atlantic land, he chose fresh starting points for exploration and thus enlarged his knowledge by its growth on American soil, America may at least share in the distinction. Again, whatever additions to geographical knowledge or natural history were made under the auspices of viceroys or governors after the settlement and political organization of the West Indies and of South, Central and North America, may fairly be set down to the credit of American science. What is not American is Spanish, French or English, or less frequently, Portuguese, Dutch or Scandinavian.

The gathered facts which, after due sifting, amendment and classification, might be accepted as of scientific value, relate to geography, geology and mineralogy, meteorology, botany, anthropology, philology, mythology and folk-lore. Some of these terms were not in use in the early generations of American settlement; nor of science, in our modern sense, was there, apart from pure mathematics, and

its applications, a great deal that was worthy of the name. The germs, however, were there, and the scientific method of to-day sometimes makes them fructify in ways that the authors never dreamed of.

The materials for a history of the sciences in America are ample enough. If we have regard to any one of the three main divisions of the twofold continent as occupied by Europeans—New Spain, New England and New France—we happily find that, in every instance, among the pioneers, there were educated observers who, although their mental horizon was contracted by prejudices characteristic of their time, country, creed or party, or all conjoined, were able to express their thoughts in intelligible and often in vigorous language. In some cases these scribes, priests for the most part, though sometimes laymen, have given us their impressions of the aborigines with whom they came in contact. A few of these latter—or at least half-castes—had also learned the accomplishments of the new-comers and have left us what purport to be traditions of their race. It is also of importance, for the subject under consideration, that the most learned and enlightened of the conquerors won the sympathy of the natives, and, although their treatment of them was not always such as science would approve, they nevertheless elicited from them information that science can turn to advantage. If we seek to know where the materials for the history of scientific progress in America may be found, it is enough to mention Mr. Justin Winsor's History. The critical essays on the sources of information in these eight volumes will, if wisely used, guide the inquirer along the path by which science, in all its branches, developed during the first three centuries of civilized life and labor in the new world.

A beginning of such an investigation for the northern part of the continent was made a few years ago simultaneously by two members of the Royal Society of Canada. Singularly enough, though one (Professor Laflamme) is a geologist, and the other (Professor Penhallow) is a botanist, they both chose the same line of inquiry—the progress of botanical research in Canada. Professor Laflamme made a single savant (Michel Sarrazin) the centre of his study, while Professor Penhallow undertook to trace the successive steps by which plant lore was developed in Canada. Although in each case the ground, both biographic and historic, was virtually unoccupied before, each winter succeeded in clearing a considerable tract for the benefit of the historian of science. The scientist trained in the methods of the present meets, in such surveys of the past, with much that makes him smile, much, perhaps, that tries his patience, but occasionally he discovers an anticipation of knowledge long ascribed to later workers. Sarrazin was a pioneer in comparative anatomy as well as botany, and his observations were highly esteemed by the French Academy of Sciences. To-day he is chiefly remembered in connection with the order of polypetalous exogens (*Sarraceniaceæ*) that bears his name. Another botanical name due to a Canadian scientist of the French regime is *Gualtheria.* Again, *Diervilla* was the name given by Tournefort to a species of bush honeysuckle, out of compliment to Dierville, who wrote the "Voyage du Port Royal de l'Acadie." Kalm, whose assiduous services to science in North America are commemorated in *Kalmia,* spent considerable time very pleasantly with one of the most learned of the governors of the old regime, De Galisounière.

If we begin with the "Voyages de Decouverte" of Jacques Cartier, recording impressions made on an explorer of the days of Francis the First, and follow the course of settlement, organization and research down to the time of Kalm's visit, soon after the publication of Charlevoix's history, we are not likely to miss frequent indications helpful to the historian of scientific progress. Sir William Dawson's "Fossil Men" is based on the discovery of remains on the site of the Indian village of Hochelaga, which, after an interval of nearly three centuries and a half, confirmed the truth of Cartier's hitherto unsupported story. A few years later the astrolabe of Champlain was found in the track of his journey to the *Mer Douce,* not far from the banks of the upper Ottawa, a prize for more than the antiquary. Faulty as he is, when judged by the rigorous standard of modern science, Champlain has left us, in his writings, a rich mine for the student who would compare things old with things new. In his rough, practical way, he was a watchful observer, and if his handling of the pencil is clumsy, he uses his pen for the most part with clearness and point. In the very year of his death, just a century after Jacques Cartier's visit to Hochelaga, there was published at Paris a book entitled *Canadensium Plantarum Aliarumque non dum Editarum Historia,* by Jacobus Cornutus (Jacques Cornut), whose share in the development of the knowledge of new-world botany is the subject of a paper read by Professor Laflamme before the Royal Society at Ottawa last May and now in course of publication. Creuxius (Du Creux), who wrote his history of Canada in Latin, pays some attention to its natural history and enumerates *"arbores plantasque cujuscunque generis quas edere terra sponte solet."*

To the Jesuits' *Relation,* the *Voyages* of La Houtan, Lafitau's *Moeurs des Sauvages Ameriquains Comparees aux Moeurs des Premiers Temps,* the anthropologist and folklorist may go as to sources of knowledge not to be found elsewhere. Lafitau is, indeed, for North America, the father of comparative mythology. He wrote when opportunities of observing the manners and customs, ceremonies and habits of thought and belief of the wild tribes of Canada were still abundant, and he has dealt learnedly and, so far as was possible in his day, liberally, with his themes. His two volumes are still well worth a careful study. Besides his own experience of savage life, he had derived great benefit from the gathered knowledge of Père Garnier, who had spent no less than sixty years among the Indians, and knew the languages of several Algonquin tribes, the Huron and the five dialects of the Iroquis. Lafitau found that if the study of ancient authors threw light on the usages of the Indians, the latter also enabled him to understand a great deal touching the barbarous races of antiquity, to which he must otherwise have remained a stranger. Charlevoix, besides describing and illustrating a considerable number of new-world plants, gives fruitful attention to American ethnology and the customs of the aborigines. The reports of some of the Intendants, the histories of Boucher, Sagard, Le Clerc, Dollier de Carson and other contemporary records of the old regime contain hints that the student of scientific development may turn to account. Nor would it be wise to ignore the records, both French and English, of far-northern and far-western exploration, missionary, military or commercial, during the same period. The story of the La Verendoye family, with its romance and its tragedy, and those persistent Hudson Bay Co. voyages in search of a northwest passage, with the instructions ever ending in prayer for successful discovery and safe return, have also their scientific significance for those who do not despise the day of small things. Some of the worthiest heroes of science were those who moved in the long, slow march, which, in our more fortunate generation, was to be so wondrously quickened. And the grandest triumphs, from the moral standpoint, belonged to some of those who persevered in the face of failure, knowing that not to them, but to their successors, was the victory destined to fall. The records of scientific progress in America abound in such heroism, and the

rescue from oblivion of some of its forgotten heroes would be not the least reward of the patient inquirer in these unfrequented paths. If what Jules Verne calls *la decouverte de la terre*, that is, the gradual ascertainment of the physical features, extent and habitability of the globe, be worthy of being classed as science (and in what scientific society is not geography recognized?), then what the old regime has contributed to the opening up and civilization of this continent is no scanty share. No less than ten states of the Union, and every province in Canada, save British Columbia, were first occupied by French pioneers, first described by French writers. And in this record of exploration and colonization, extending from 1534 to 1764, we find such names as Cartier, Champlain, La Salle, Duluth, Iberville, Joliette, Marquette, La Mothe, Cadillac and those of many another to whom mankind is deeply indebted. This is the merest outline of what, if a history of science in the new world were undertaken, the inquirer would find helpful and more or less valuable in the records of the northern dominion. On another occasion I hope to give some details from these records as indications of their scientific worth.

BRITISH STONE CIRCLES—IV. SOMERSETSHIRE AND DORSETSHIRE CIRCLES.*

BY A. L. LEWIS, PRESIDENT SHORTHAND SOCIETY, LONDON, ENGLAND.

ONE of the most interesting groups of circles in England is situated at Stanton Drew, about seven miles south from Bristol. It comprises the remains of three separate circles, two of which have short avenues, a cove, or group of three stones, like those at Abery and Arbelow, a large single stone to the northeast, like the "Friar's Heel" at Stonehenge, and two other stones at a greater distance; and, that these were all parts of one great whole, and were not constructed without reference to each other, is shown by the facts that a line from the "cove" in a direction fifty-four degrees east of north will pass almost exactly through the centre of the great circle to the centre of the smaller circle to the northeast of it, while a line from the centre of the southernmost circle in a direction about twenty degrees east of north will pass almost exactly through the centre of the great circle to an outlying stone called "Hauteville's Quoit."

This latter stone is the first which is encountered on the road from Bristol, and soon after passing it the remains of the great central circle and of the smaller northeastern circle, with the short avenues attached to them, will be seen in a meadow on the other side of the little river Chew, which is crossed by a bridge near by. The northeastern circle is ninety-seven feet in diameter, and consists of nine stones, and there are, besides fragments, eight other stones in the short avenue which goes from it in a direction a little south of east. On the south of this avenue, but not connected with it, another avenue, of which only five stones remain, leads in a southwesterly direction to the great circle, which was about 368 feet in diameter, and of which only twenty-four stones remain; these are, necessarily, a considerable distance from each other, so that it requires a little care to follow the circumference of this circle. The nearest part of the southern circle is 460 feet from the outside of the great circle, and its diameter is 145 feet (which is also about the distance between the circumference of the great circle and that of the northeastern circle); twelve stones of the southern circle remain, but all fallen, and it is cut through by fences, and is, consequently, more difficult to find, and to trace when found, than either of the others. The "cove" is 470 feet, eight degrees north of west, from the circumference of the southern circle, and is not far from the church; it consists of three stones, two upright and one fallen, which form three sides of a square, like the coves of Abery and Arbelow, but it differs from them in facing southeast instead of northeast. Some have thought these stones to have been part of a sepulchral chamber, but they are too thin in proportion to the height of the tallest one (ten feet), and could only have been covered by a very large mound, of which no traces remain; this, however, is a question respecting which the visitor can form his own opinion. If not covered they might have formed a sanctuary open to the rising sun in winter, while the circles were devoted to his worship in summer.

The northeastern circle is better preserved, and is formed of larger stones than the rest of the group, some of the stones composing it being nine feet high, and broad and thick in proportion.

The measurements and compass bearings (true, not magnetic) given here are mostly taken from the beautiful plan made by Mr. Dymond, C.E., F.S.A., and published some years ago in the Journal of the British Archæological Association.

It has been suggested that the avenues are remains of a number of circles concentric with and surrounding the northeastern circle. Mr. Dymond shows pretty conclusively that they were avenues and nothing else, but the visitor may investigate this point for himself.

At Wellow, seven miles south from Bath, and about ten east from Stanton Drew, there is a large tumulus with a long gallery and six small side chambers, built and vaulted with small stones uncemented.

In passing from Somerset to Dorset we find no stone monuments equal to those just described. At Winterbourne Abbas, four or five miles from Dorchester, is a small circle called the "Nine stones," twenty-eight or thirty feet in diameter (not in height as stated, by the Post Office directory), six stones only remain, two of which are six feet high, the others half that size or less. Warne, in his "Ancient Dorset," mentions "a tenth stone which the eye detects just peeping through the long grass on the northeast side."

At Gorwell, on Tennant's Hill, four or five miles beyond Winterbourne Abbas, and about ten southwest from Dorchester, is a ring consisting of eighteen stones or fragments, all prostrate, the largest being eight feet long; the figure which would touch most of them, so far as they are at present uncovered, would be an oval, of which the diameters would respectively be eighty-seven and seventy-eight feet, but they are much overgrown with turf, and, if cleared, it might be found that a circle of from eighty to eighty-two feet in diameter would touch most of their original positions. I was not able to find any outlying stone or other remarkable feature to the northeast of this circle, but there is a thick plantation on that side, which shuts out the view of the surrounding hills, and within which a stone or stones may be buried; there are, however, two outlying stones about 140 feet south from the circle.

At Gorwell, about half a mile southeast from the circle just described, are the remains of a sepulchral chamber and tumulus, with three other stones called the "Grey Mare and Colts," and at Portisham, two miles from Gorwell, is a dolmen called the "Hellstone," which appears to have been inaccurately "restored." There are also remains of a circle or circles at Poswell, six miles southeast from Dorchester, and earthworks nearer that town, known as "Maiden Castle" (a very fine camp), "Poundbury" and "Mammbury Ring."

*I. Abury appeared in No. 529, March 24.
II. Stonehenge appeared in No. 537, May 19.
III. Derbyshire Circles appeared in No. 545, July 14.