(1) CIRRUS (Ci.).—Isolated feathery clouds of fine fibrous texture, generally of a white colour. Frequently arranged in bands which spread like the meridians on a celestial globe over a part of the sky, and converge in perspective towards one or two opposite points of the horizon. (In the formation of such bands, Ci. S. and Ci. Cu. often take part.)

(2) CIRRO-STRATUS (Ci. S.).—Fine whitish veil, sometimes quite diffuse, giving a whitish appearance to the sky, and called by many cirrus haze, sometimes of more or less distinct structure, exhibiting confused fibres. The veil often produces halos around the sun and moon.

(3) CIRRO-CUMULUS (Ci. Cu.).—Fleecy cloud. Small white balls and wisps without shadows, or with very faint shadows, which are arranged in groups and often in rows.

(4) ALTO-CUMULUS (A. Cu.).—Dense fleecy cloud. Larger whitish or greyish balls with shaded portions, grouped in flocks or rows, frequently so close together that their edges meet. The different balls are generally larger and more compact (passing into S. Cu.) towards the centre of the group, and more delicate and wispy (passing into Ci. Cu.) on its edges. They are very frequently arranged in stripes in one or two directions.

(The term cumulo-cirrus is given up as causing confusion.)

(5) ALTO STRATUS (A. S.).—Thick veil of a grey or bluish colour, exhibiting in the vicinity of the sun and moon a brighter portion, and which, without causing halos, may produce coronæ. This form shows gradual transitions to cirro-stratus, but, according to the measurements made at Upsala, has only half the altitude.

(The term stratus-cirrus is abandoned as giving rise to confusion.)

(6) STRATO CUMULUS (S. Cu.).—Large balls or rolls of dark cloud which frequently cover the whole sky, especially in winter, and give it at times a wave-like appearance. The stratum of strato-cumulus is usually not very thick, and blue sky often appears in the breaks through it. Between this form and the alto-cumulus, all possible graduations are found. They are distinguished from nimbus by the ball-like or rolled form, and because they do not tend to bring rain.

(7) NIMBUS (N.).—Rain clouds. Dense masses of dark formless clouds with ragged edges, from which generally continuous rain or snow is falling. Through the breaks in these clouds there is almost always seen a high sheet of cirro-stratus or alto-stratus. If the mass of nimbus is torn up into smaller patches, or if smaller clouds are floating very much below a great nimbus, the former may be called Fracto-nimbus ("Scud" of the sailors).

(8) CUMULUS (Cu.).—Piled clouds. Thick clouds whose summits are domes with protuberances, but whose bases are flat. These clouds appear to form in a diurnal ascensional movement which is almost always apparent. When the cloud is opposite the sun, the surfaces which are usually seen by the observer are more brilliant than the edges of the protuberances. When the illumination comes from the side, this cloud shows a strong actual shadow; on the sunny side of the sky, however, it appears dark with bright edges. The true cumulus shows a sharp border above and below. It is often torn by strong winds, and the detached parts (Fracto-cumulus) present continual changes.

(9) CUMULO-NIMBUS (Cu. N.).—Thunder cloud; shower cloud. Heavy masses of clouds, rising like mountains, towers, or anvils, generally surrounded at the top by a veil or screen of fibrous texture ("false cirrus"), and below by nimbus-like masses of cloud. From their base generally fall local showers of rain or snow, and sometimes hail or sleet. The upper edges are either of compact cumulus-like outline, and form immense summits, surrounded by delicate false cirrus, or the edges themselves are drawn out like cirrus. This last form is most common in "spring squalls." The front of storm clouds of great extent sometimes shows a great arch stretching across a portion of the sky, which is uniformly lighter in colour.

(10) STRATUS (S.).—Lifted fog in a horizontal stratum. When this stratum is torn by the wind or by mountain summits into irregular fragments, they may be called Fracto-stratus.

INSTRUCTIONS FOR OBSERVING CLOUDS.

At each observation there are to be recorded:—

(1) *The Kind of Cloud*, designated by the international letters of the cloud name, which may be more exactly defined by giving the number of the picture of the Atlas most nearly representing the observed form.

(2) *The Direction from which the Clouds come.*—If the observer remains completely at rest during a few seconds, the motion of the clouds may be easily observed relatively to a steeple or mast erected in an open space. If the motion of the cloud is very slow, the head must be supported. Clouds should be observed in this way only near the zenith, for if they are too far away from it the perspective may cause errors. In this case nephoscopes should be used, and the rules followed which apply to the particular instrument employed.

(3) *Radiant Point of the Upper Clouds.*—These clouds often appear in the form of fine parallel bands, which, by an effect of perspective, seem to come from one point of the horizon. The radiant point is that point where these bands, or their direction prolonged, meet the horizon. The position of this point on the horizon should be recorded in the same way as the wind direction, north, north-north-east, &c.

(4) *Undulatory Clouds.*—It often happens that the clouds show regular, parallel, and equidistant streaks, like the waves on the surface of water. This is the case for the greater part of the cirro-cumulus, strato cumulus (roll-cumulus), &c. It is important to note the direction of these streaks. When there are apparently two distinct systems, as is to be seen in clouds separated into balls by streaks in two directions, the directions of the two systems should be noted. As far as possible, observations should be made on streaks near the zenith to avoid effects of perspective.

(5) *Density and Position of Cirrus Banks.*—The upper clouds frequently take the form of felt or of a more or less dense veil, which, rising above the horizon, resembles a thin white or greyish bank. As this cloud form has an intimate relation to barometric depressions, it is important to note:—

(*a*) The density—

0 meaning very thin and irregular.
1 meaning thin but regular.
2 meaning rather dense.
3 meaning dense.
4 meaning very dense and of dark colour.

(*b*) The direction in which the veil or bank appears densest.

Remarks.—All interesting details should be noted, for example:

(1) On summer days all low clouds generally assume particular forms resembling cumulus more or less. In this case, there should be put under *Remarks*, "Stratus or Nimbus Cumuliformis."

(2) It sometimes happens that a cumulus has a mammillated lower surface. This appearance should be described by the name of "Mammato-cumulus."

(3) It should always be noted whether the clouds appear stationary, or whether they have a very great velocity.

The text of the Atlas is to be in French, English, and German.

ENDOWMENT FOR SCIENTIFIC RESEARCH AND PUBLICATION.[1]

II.

IMMEDIATELY connected with our colleges and universities is another field, in which additional endowments are greatly needed, viz. for fellowships in science for post-graduate studies.

Upon the post-graduate workers the future of science, and the recruits for future teachers and professors, must necessarily depend. In that view the importance of post-graduate endowments in science can scarcely be magnified. The great majority of the young men from whom all the new recruits must be drawn have little or no pecuniary means. After graduating, often through many difficulties, they must face the question of their future calling. They must consider what promise of a reasonable and comfortable support a life devoted to science affords. If this risk should not deter them, still there are many with talents of a high order who would be absolutely unable to proceed further in the advanced scientific studies necessary to qualify them to enter upon remunerative scientific

[1] Address delivered by Mr. Addison Brown, at a meeting of the Scientific Alliance of New York. Reprinted from Smithsonian Report, 1892.

(Continued from page 167.)

work, or to obtain situations as professors or assistants, except by the aid of substantial endowments for their support, during the three or four years more of necessary assiduous study.

In the stress of modern life, and in the allurements towards more certain pecuniary results, nothing but such endowments can avert the withdrawal from scientific pursuits of many young men of high promise, whose genius and tastes and ambition strongly incline them to science, and who would be secured to it if this temporary support were afforded.

The endowments of our colleges and universities in aid of post-graduate work in science are much less, I suppose, than is commonly imagined. I find no such support for post-graduate work in science, either at Cornell University, at the University of the City of New York, at Brown University, at Amherst, or even at the Johns Hopkins University. No statement of the endowments of the new Clark University at Worcester has as yet been published. Princeton, though having a hundred under-graduate scholarships, has but one post-graduate fellowship for science; Yale but two—the Silliman and the Sloane Fellowships.

Columbia College has two fellowships expressly restricted to science, viz. the Tyndall Fellowship of 648 dols. annually, and the Barnard Fellowship, before referred to, of about 500 dols. annually. Besides these, however, twenty-four general university fellowships have been established, of 500 dols. each, for post-graduate study, of which eighteen are in present operation. About one-third of these are assigned to science; making now eight for science at Columbia, with probably two more in 1893 or 1894. In architecture, moreover, there are three additional noble post-graduate fellowships at Columbia—the Schermerhorn of 1300 dols. annually, and the two McKim Fellowships of 1000 dols each, to support study in foreign travel. In the Medical Department, also, there are five valuable prizes for proficiency.

The University of Pennsylvania has the Tyndall Fellowship, before referred to; and, in the Department of Hygiene, an admirable laboratory fitted up by Mr. Henry C. Lea, with a fellowship of 10,000 dols. endowed by Mr. Thomas A. Scott, at present applied to original research in bacteriology.

At Harvard, besides the three Bullard Fellowships of 5000 dols. each, established in 1891, to promote original research in the medical school, there are two post-graduate fellowships restricted to science exclusively, namely, the Tyndall Fellowship of about 500 dols. annually, and the income of the recently established Joseph Lovering Fund, the principal of which is now about 8000 dols. There are also eleven other general fellowships, viz. the Parker, the Kirkland, and the Morgan Fellowships, available for promising graduate students in any branch, of which about five have been usually assigned to science. These fellowships give an income of from 450 dols. to 700 dols. a year. Harvard has also forty-six scholarships available for graduate students, varying in income from 150 dols. to 300 dols. each, of which about seventeen are assigned to science. During the last year, according to the report of Prof. Pierce, the Dean, there were 193 applications for those post-graduate fellowships and scholarships, seventy-one of which were in science. Only one-third of the applicants could receive the aid. The Dean adds:

"The number of appointments is still *very insufficient* to meet demands of promising students who wish to enter the graduate school, and are unable to do so without assistance." (Report Harvard Coll. 1891, p. 92.) The tables published by him indicate that a considerable number of those not aided withdrew from science; and that many others who were entered for the first year in the graduate school would, if not aided, afterwards leave. It is gratifying to observe the further fact, so encouraging also for the young graduates who wish, if possible, to enter upon a scientific career, that all who had enjoyed these fellowships for the full term of three years, and did not continue their studies further abroad, at once received honourable positions.

From the above synopsis it appears that in all these colleges (and I know of no other similar fellowships elsewhere) there are only about twenty-six adequately endowed post-graduate fellowships in science. As these should be continued for at least three years, there is provision altogether for only about nine per year—not one fourth the number required to supply the annual loss in our 150 colleges, to say nothing of the increasing demand through the growth and improvements in the colleges themselves. As it is from such specially trained students that the great professors of the future must be drawn, the need of much greater endowments for new recruits is apparent.

In England the aids afforded by fellowships in their universities are familiar to all. Sir Isaac Newton, who is to modern science what Shakespeare is in literature, was sustained from his student days successively in a scholarship, a fellowship, and as professor at Trinity College at Cambridge. Besides those aids, the Royal Commissioners of the Exhibition of 1851 instituted in 1891 "Exhibition Science scholarships" for advanced students, to which 25,000 dols. yearly is to be applied in sums of 750 dols. each. In the first year sixteen appointments were made, to be held for two, and probably for three, years by students who show capacity, and "who advance science by experimental work." [1]

On this subject a most interesting discussion took place last year in the French Academy of Sciences. On April 27, 1891, the Secretary read the following extracts from the will of the late M. Cahours, a deceased member of the Academy:

"I have frequently had the opportunity of observing, in the course of my scientific career, that many young men distinguished and endowed with real talent for science, found themselves obliged to abandon it, because before beginning they had no efficacious help which provided them with the first necessities of life, and allowed them to devote themselves exclusively to scientific studies.

"With the object of encouraging such young workers, who for want of sufficient resources find themselves powerless to finish works in course of execution, . . . I bequeath to the Academy of Sciences . . . 100,000 francs, . . . the interest to be distributed yearly by way of encouragement to any young men who have made themselves known by some interesting works, and more particularly by chemical researches; . . . as far as possible to young men without fortune, not having salaried offices, and who, from want of a sufficient situation, would find themselves without the possibility of following up their researches. These pecuniary encouragements ought to be given for several years to the same young men, if the Commissioner thinks their productions have sufficient value; . . . to cease when they shall have other sufficiently remunerative positions."

M. Janssen, then addressing the Academy, said:

"This affords an example to all who hereafter may desire to encourage the sciences by their liberality. M. Cahours, who knew the urgent necessities of science, had, like most of us, become convinced of the need of introducing a new form of scientific recompenses.

"Our prizes will always continue to meet a great and noble necessity. Their value, the difficulty of obtaining them, and the *éclat* they take from the illustriousness of the body that grants them, will always make them the highest and most valuable of recompenses. But the value also of the works it is necessary to produce in order to lay claim to them forbids them to beginners. It is a field only accessible to matured talents. But there are many young men endowed with precious aptitudes, inclined to pure science, but turned very often from this envied career by the difficulties of existence, and taking with regret a direction towards more immediate results. And yet many among them possess talents which, if well cultivated, might do honour and good to science. . . . These difficulties are increased every day by the marked advance of the exigencies of life.

"We must find a prompt remedy for this state of things, if we do not wish to see an end of the recruitment of science. This truth is beginning to be generally felt. The Government has already created institutions, scholarships, and encouragements, which partly meet the necessity. Some generous donors are also working in this manner. I will mention specially the noble foundation of Mdlle. Dosne, in accordance with whose instructions a hall is at this moment being built, where young men, having shown distinguished aptitudes for high administration, for the bar, or for history, will receive for three years all the means of carrying on high and peaceful studies. Let us say, then, plainly (and in speaking thus we only feebly echo the words of the most illustrious members of the Academy), that it is by following the way so nobly opened by Cahours that the interests and prospects of science will be most efficaciously served." [2]

Huxley is said to have once stated that "any country would find it to its interest to spend 100,000 dols. in first *finding* a Faraday, and then putting him in a position where he could do

[1] Sir William Thomson, *Proceedings, Royal Society*, 1891, vol. l. p. 225.

[2] NATURE, May 7, 1891 (vol. xliv. p. 17).

the greatest amount of work." It is the post-graduate endowments that must first find and retain to science the Faradays of the future.

A notable instance of the need and value of such aid is found in the recently-appointed head of a great university, who, by such endowments alone, here and abroad, it is said, was enabled to prosecute his studies for ten years successively, reaching thereby the front rank in his chosen department of philosophy.

III.

Another department in great need of pecuniary support is that of the learned and scientific societies. In these England is pre-eminent. Our own societies have endeavoured to follow, as far as they could, their English models. The English societies have rendered to science invaluable service in three main lines:

1. In providing ample means for the publication of scientific papers, showing the progress and the results of their scientific work. In this every society has taken part.

2. In the direct maintenance of original research, in which the Royal Institution has been most conspicuous.

3. In the award of prizes for scientific distinction; but still more important, in the distribution of pecuniary aid, for the prosecution of special scientific researches.

(1) Of these, I regard publication as, perhaps, the most important; not only because it puts the world in possession of what has been done by investigators, but because the very fact that there are means of publication, is one of the greatest incitements to complete and thorough original scientific work.

Of the English societies the Royal Society is the oldest, having been chartered in 1662. It has published 181 volumes of *Transactions* and about 50 volumes of *Proceedings*. For these purposes, in 1881 the expenditure was between 11,000 dols. and 12,000 dols. It has property to the value of about two-thirds of a million of dollars, more than half of which is in trust funds, held for scientific uses. The income on the trust funds in 1891 was about 17,500 dols. (*Proceedings*, 1891, vol. l. p. 235.) In 1828 Dr. Wollaston, in giving it 10,000 dols. in 3 per cent. Consols "to promote scientific researches," charged upon the Society "not to hoard the income parsimoniously, but to expend it liberally for the objects named."

The Royal Institution of Great Britain was founded in 1779, largely through our countryman James Thompson, of Rumford, Vt., afterwards Count Rumford. In 1888 it had property and invested funds for general purposes to the amount of 350,000 dols., and about 40,000 dols. of invested funds for the maintenance of its three professors. In 1887 it expended about 2000 dols. in publications, and it has issued about forty volumes. (*Report*, 1888, p. 13.)

The Linnean Society, now furnished by the Government with permanent accommodation in Burlington House, free of rent, was founded by Sir James E. Smith in 1788, and is devoted to botany and zoology. Its property amounts to about 32,000 dols., but it has no endowed funds for scientific investigation. For some years past its receipts, mainly from contributions, have been about 10,000 dols. a year, of which one-half, about 5000 dols., is spent on its publications, which now number nearly fifty volumes of *Transactions* in quarto, and as many more of its *Journal*. In 1888 7000 dols. were expended in publication. (*Proceedings* [May 4, 1888], 1890, pp. 15, 45.)

Next in order of time is the British Association for the Advancement of Science, founded in 1831. It is sustained chiefly by yearly contributions. Its invested funds amount to about 62,000 dols. Its income and contributions are about 10,000 dols. annually, out of which it appropriates from 6000 dols. to 7000 dols. per annum for the encouragement of scientific investigations, and about 1800 dols. annually for its yearly volume of *Proceedings*. Its publications now number twenty-five volumes. (*Report*, 1891, pp. lxxxvii. to c. 76.)

The Ray Society was founded in 1844. It was named after the Rev. John Ray, who lived from 1628 until 1705. Haller, himself one of the greatest men of science of his time, writing in 1771, in the full light of Linnæus' fame, calls Ray "the greatest botanist within the memory of man." (*Bibliotheca Botanica.*) The society has published about fifty volumes of scientific works of the highest importance. I have not seen any statistics concerning its means or acquisitions; nor have I found any financial report of the scientific societies of Edinburgh or Dublin.

(2) Of these societies, only the Royal Institution directly supports professors for scientific research. It has two laboratories, one chemical and one physical. These were rebuilt in 1872, "in order that original discovery might be more effectively carried on." The society was founded for the declared purpose of "promoting scientific and literary research." It has three professors—one in chemistry, one in physics, and one in physiology. Davy, Faraday, Tyndall, and others who have spent their lives there, have made its annals immortal.

(3) In stimulating research by the appropriation of moneys for specific objects, the Royal Society and the British Association are the chief agencies. Besides some of its own funds, the Royal Society distributes annually £4000, or 20,000 dols., granted by the Government "for the advancement of science." This has been done by applying it to numerous purposes; in 1891, for fifty-seven different scientific objects, in sums ranging from 25 dols. to 3000 dols. each; not confined to natural science alone, but including ethnology and magnetic surveys. Most of the grants were in sums of about 350 dols. or less. (*Proceedings*, 1891, vol. l. p. 242)

The British Association has disbursed annually for the last forty years from 6000 dols. to 7000 dols. per annum, upon the same system of dividing it up for numerous specific purposes; usually from thirty to forty objects yearly, the grants being in sums ranging from 25 dols. to 1000 dols. The grants are called for and expended for the specific purpose named, and under the direction of some prominent scientific man. Men of science like Sir William Thomson, and others of like renown, have had the administration of many of these grants. These have included for the last six years (save in 1890) the appropriation of 500 dols. per year for a table in the Naples Marine Laboratory. (*Report*, 1890, p. 90.)

We have no single society in this country, save the Smithsonian, that can rival in importance those that I have named in England. And the Smithsonian is not a society, but an institution, established by one man, and he an Englishman. This institution, based upon the bequest of James Smithson, was founded by act of Congress of August 10, 1846. I doubt whether in any country or in any age the bequest of half a million of dollars has ever been followed by such beneficent results, or has ever so profoundly affected the life of science in any country as the Smithsonian Institution has done in America during the last forty-four years of its existence. This has been owing (1) to the wisdom and the profound scientific insight of Prof. Henry, its first secretary and director; and (2) to the corps of able assistants and successors whom his spirit and policy have inspired. Its publications number 26 quarto volumes of "Contributions to Knowledge," 40 volumes of "Miscellaneous Collections," and 44 volumes of "Annual Reports." Its "Contributions to Knowledge" rival, if they do not excel, in rarity and importance, the publications of any other society during the same period. Its expenditure in publications is about 12,500 dols. a year. Under Prof. Henry a good deal was done in research. Under Prof. Langley, the present director, astro-physical research is carried on. Besides the direct scientific work of the Institution, however, its influence has been very great, especially in its relations with the other departments at Washington, and as a medium for the prosecution of other scientific enterprises under authority of Congress. Many of the appropriations of Congress for scientific expeditions for researches in ethnology, palæontology, chemistry, and physics have been due to the presence and co-operation of the Smithsonian Institution. For ethnologic researches alone during the last twelve years, under the administration of the Smithsonian, Congress has appropriated 400,000 dols.; to palæontologic researches within the last three years, 160,000 dols.; to chemical and physical research, 68,000 dols.; and to astro-physical research, 10,000 dols. Besides these, there have been for many years appropriations for maintaining the important investigations of the Coast and Geodetic Survey, and of the Weather Bureau in Meteorology; and for the great scientific work of the Naval Observatory, and of the various scientific divisions of the Agricultural Department and of the Geological Survey. Our Government has been by no means inactive in science.

The principal American scientific associations, omitting those of comparatively recent origin, are the American Philosophical Society of Philadelphia, originally founded in 1744; the American Academy of Arts and Sciences at Boston; the Boston Society of Natural History; the Academy of Natural Sciences; and the Franklin Institute at Philadelphia, the latter

founded in 1824 (see *Journal*, vol. i. pp. 71, 129); the New York Academy of Sciences (a continuation of the Lyceum of Natural History); the National Academy of Science at Washington, founded in 1863; and the American Association for the Advancement of Science. Of these, the Philosophical Society has published 29 volumes of its *Transactions*; the American Academy, 26 volumes of *Transactions* and 9 quarto volumes of *Memoirs*; the Boston Society of Natural History, 25 volumes, at a cost of about 600 dols. per year; the Academy of Natural Science of Philadelphia, 48 volumes of *Proceedings* and 12 quarto volumes of its *Journal*, at an average cost of about 1000 dols. per year; the Franklin Institute, 133 volumes of its *Journal*; the New York Academy and its predecessor, about 30 volumes of *Transactions* and *Annals*; the National Academy, 3 quarto volumes of *Memoirs* and some volumes of *Proceedings*; and the American Association for the Advancement of Science, about 40 volumes of *Proceedings*.

The latter society had in 1891 a "Research Fund" of 5254 dols. (*Proceedings*, 1891, p. 441.) None of the other societies, so far as I can find, has any fund specially devoted to research, or makes any specific appropriations therefor. The National Academy and the Academy of Philadelphia have each some funds for their support, and the latter also the Jessup Fund for students in science, on which the income is about 550 dols. yearly. The Philosophical Society from time to time awards the prize established by John Hyacinth de Magellan in 1786—an oval gold plate "for the most useful discovery or invention in navigation or science." One of the earliest awards of this prize was for painting lightning-rods with black lead.

The American Academy of Arts and Sciences awards a gold and silver medal from a bequest of 5000 dols. made to it by Count Rumford, who in 1796 made a similar bequest to the Royal Society. In 1888 this prize was most worthily awarded to Prof Michelson for his researches in light.[1]

The Boston Society of Natural History has a general fund, of which the income is about 6000 dols. It has also a small Walker prize fund and a grand prize fund, from which in 1884 it awarded a grand prize of 1000 dols. to James Hall, of Albany, "for his distinguished services to science." It also administers the expenditure of about 2700 dols. a year for instruction in laboratory work, drawn from the Boston University, and 1500 dols. from the Lowell Fund for the instruction of teachers.[2]

From this comparison of the voluntary associations, it appears that the property, endowed funds, and equipment of the English societies named are nearly tenfold greater than the American, and their publications double; while for direct original research our societies maintain no laboratories and no professors, as is done by the Royal Institution. The English societies distribute yearly from 25,000 dols. to 30,000 dols. for from sixty to seventy-five different scientific purposes, while ours make no such appropriations, simply because they have no funds. To supply this deficiency there is need of large endowments.

The publications of our societies are valuable; the papers have often been of a high character, rivalling those published abroad. But the funds available for publication are insufficient; it is always a question of means. There are a press and surplus of valuable scientific matter, which either is not printed at all, or only gets printed by special subscriptions for the purpose. This ought not to be. After valuable original matter has been produced with great pains and without hope of pecuniary reward, nothing is more discouraging to future research than that even publication can only be had as a charity. This I know, from repeated personal applications, is the condition of things in New York at this moment. It is not creditable that, in a State and country like ours, there should be practically nowhere adequate provision for even the publication of the researches of those who work for nothing but their love of science and its progress. There is very great need of a considerable publication fund, in the hands of some scientific body, through which every valuable contribution to science, not otherwise provided for, might be ensured a speedy publication, after it has been found worthy, as in the practice of the Linnæan Society, first by a critical expert in the particular department, and then by the council of publication.[3]

The stimulus, moreover, to scientific research that would be imparted by the distribution of comparatively small sums, such as are given by the Royal Society and by the British Association, would also be very great; nor is there any reason why the founding of professorships for the express purpose of prosecuting original research in our scientific societies, after the model of the Royal Institution, should not in time be followed by results equally brilliant, and equally beneficial to mankind.

I have endeavoured to point out three main directions in which there is urgent need in this country of pecuniary endowments.

(1) In relief of professors during the transition of the colleges from the schoolmaster system to the university system, whereby all professors in science shall become actively enlisted in the prosecution of original discovery as a part of their duties.

(2) In providing for the future recruits in science, by more endowments for post-graduate study.

(3) By endowments of our scientific associations, both directly to promote original research, and especially also to supply larger means of publication.

It is gratifying to perceive what beginnings have been recently made in response to the needs of science. Only a short time since, in 1885, Mrs. Elizabeth Thompson, of Stamford, Conn., gave 25,000 dols. to a board of trustees of which Dr. Bowditch, of Boston, is president, for the "advancement of scientific research in its broadest sense." The income is annually distributed in sums of from two hundred to five hundred dollars.

Mr. Hodgkins, of Setauket, Long Island, has bequeathed to the Smithsonian Institution 200,000 dols., the income of one-half of which is to be devoted to research into the properties of atmospheric air.

Columbia College has, during the year 1891, received from Mr. Da Costa's estate, before referred to, 100,000 dols. for biology; Harvard, the Joseph Lovering Fund, above stated; 10,000 dols. from Henry Draper for the photography of stellar spectra; the endowments in archæology, above named; and some smaller gifts for various scientific purposes. The University of Chicago and some other institutions have also received important gifts, not to mention those yet to be realised to other colleges from the estate of Mr. Fairweather.

By a bequest of Charles Lenning, the Academy of Sciences of Philadelphia will, in time, receive 20,000 dols.; while half a million of dollars will go to the University of Pennsylvania in aid of instruction in theoretical and practical mechanics, and 200,000 dols. to maintain scholarships. At this University, also, a superb structure for the "Wistar Institute of Anatomy" is now building by General Isaac J. Wistar, at a cost of about 200,000 dols., including endowments designed for original research.[1]

Our reliance in this country must be mainly upon private endowments and the intelligent appreciation of the needs of science. The national Government has done, and is doing, much in certain directions. But aside from the dispositions of legislators, it is restricted by the provisions of the Federal Constitution, and by debated questions of constitutional right. State aid is not thus hampered; but State aid is difficult to obtain, to any adequate degree, on account of the previous habits, prejudices, and political training of the people. No doubt this ought not so to be. The State of New York ought, abstractly considered, to maintain one university of the first class equal in every department to any in the world. But the multiplication of institutions already existing, local jealousies, and aversion to State taxation, make this now probably impracticable.

The remedy is with the people, and through their own voluntary methods. It is the people who have made our Government, its institutions, its methods, and the great aggregate, whatsoever it is, such as we see it to-day. Wealth is rapidly accumulating; much of it in the hands of those who, springing from the people, bear the love of the community in their hearts; and when they and the people at large shall come to see that the cause of scientific advance and the discovery of all new truth are in the deepest sense their cause, responses will, I believe, come to every urgent need; until the work of the people, by its own methods, shall, even in science, be able to confront, without shame, the best work of the monarchies of the Old World.

[1] President Lovering's Address, *Proceedings*, vol. xxiv. p. 380.
[2] *Proceedings*, vol. xxiv. p. 14
[3] President Carruthers, *Proceedings*, *Lin. Soc.*, May 1890, p. 39.

[1] Since the above was written an additional million of dollars has been given by Mr. John D. Rockefeller to the University of Chicago, making 3,600,000 dols. given by him alone to that institution within less than three years, a munificence hitherto unexampled in private endowments, some portions of which, it is hoped, will be available for the maintenance of original scientific research.