THE
AMERICAN JOURNAL OF SCIENCE

[FOURTH SERIES.]

ART. I.—*The American Journal of Science from 1818 to 1918*; by EDWARD S. DANA.

INTRODUCTION.

In July, 1818, one hundred years ago, the first number of the American Journal of Science and Arts was given to the public. This is the only scientific periodical in this country to maintain an uninterrupted existence since that early date, and this honor is shared with hardly more than half a dozen other independent scientific periodicals in the world at large. Similar publications of learned societies for the same period are also very few in number.

It is interesting, on the occasion of this centenary, to glance back at the position of science and scientific literature in the world's intellectual life in the early part of the nineteenth century, and to consider briefly the marvelous record of combined scientific and industrial progress of the hundred years following—subjects to be handled in detail in the succeeding chapters. It is fitting also that we should recall the man who founded this Journal, the conditions under which he worked, and the difficulties he encountered. Finally, we must review, but more briefly, the subsequent history of what has so often been called after its founder, "Silliman's Journal."

The nineteenth century, and particularly the hundred years in which we are now interested, must always stand out in the history of the world as the period which has combined the greatest development in all departments of science with the most extraordinary industrial progress. It was not until this century that scientific investigation

used to their full extent the twin methods of observation and experiment. In cases too numerous to mention they have given us first, a tentative hypothesis; then, through the testing and correcting of the hypothesis by newly acquired data, an accepted theory has been arrived at; finally, by the same means carried further has been established one of nature's laws.

Early Science.—Looking far back into the past, it seems surprising that science should have had so late a growth, but the wonderful record of man's genius in the monuments he erected and in architectural remains shows that the working of the human mind found expression first in art and further man also turned to literature. So far as man's thought was constructive, the early results were systems of philosophy, and explanations of the order of things as seen from within, not as shown by nature herself. We date the real beginning of science with the Greeks, but it was the century that preceded Aristotle that saw the building of the Parthenon and the sculptures of Phidias. Even the great Aristotle himself (384-322 B. C.) though he is sometimes called the "founder of natural history," was justly accused by Lord Bacon many centuries later of having formed his theories first and then to have forced the facts to agree with them.

The bringing together of facts through observation alone began, to be sure, very early, for it was the motion of the sun, moon, and stars and the relation of the earth to them that first excited interest, and, especially in the countries of the East, led to the accumulation of data as to the motion of the planets, of comets and the occurrence of eclipses. But there was no coördination of these facts and they were so involved in man's superstition as to be of little value. In passing, however, it is worthy of mention that the Chinese astronomical data accumulated more than two thousand years before the Christian era have in trained hands yielded results of no small significance.

Doubtless were full knowledge available as to the science existing in the early civilizations, we should rate it higher than we can at present, but it would probably prove even then to have been developed from within, like the philosophies of the Greeks, and with but minor influence from nature herself. It is indeed remarkable

that down to the time with which we are immediately concerned, it was the branches of mathematics, as arithmetic and geometry and later their applications, that were first and most fully developed: in other words those lines of science least closely connected with nature.

Of the importance to science of the Greek school at Alexandria in the second and third centuries B. C., there can be no question. The geometry of Euclid (about 300 B. C.) was marvelous in its completeness as in clearness of logical method. Hipparchus (about 160-125 B. C.) gave the world the elements of trigonometry and developed astronomy so that Ptolemy 260 years later was able to construct a system that was well-developed, though in error in the fundamental idea as to the relative position of the earth. It is interesting to note that the *Almagest* of Ptolemy was thought worthy of republication by the Carnegie Institution only a year or two since. This great astronomical work, by the way, had no successor till that of the Arab Ulugh Bey in the fifteenth century, which within a few months has also been made available by the same Institution.

To the Alexandrian school also belongs Archimedes (287-212 B. C.), who, as every school boy knows, was the founder of mechanics and in fact almost a modern physical experimenter. He invented the water screw for raising water; he discovered the principle of the lever, which appealed so keenly to his imagination that he called for a *πρὸ στῶ*, or fulcrum, on which to place it so as to move the earth itself. He was still nearer to modern physics in his reputed plan of burning up a hostile fleet by converging the sun's rays by a system of great mirrors.

To the Romans, science owes little beyond what is implied in their vast architectural monuments, buildings and aqueducts which were erected at home and in the countries of their conquests. The elder Pliny (23-79 A. D.) most nearly deserved to be called a man of science, but his work on natural history, comprised in thirty-seven volumes, is hardly more than a compilation of fable, fact, and fancy, and is sometimes termed a collection of anecdotes. He lost his life in the "grandest geological event of antiquity," the eruption of Vesuvius, which is vividly described by his nephew, the younger

Pliny, in "one of the most remarkable literary productions in the domain of geology" (Zittel).

With the fall of Rome and the decline of Roman civilization came a period of intellectual darkness, from which the world did not emerge until the revival of learning in the fifteenth and sixteenth centuries. Then the extension of geographical knowledge went hand in hand with the development of art, literature, and the birth of a new science. Copernicus (1473-1543) gave the world at last a sun-controlled solar system; Kepler (1571-1630) formulated the laws governing the motion of the planets; Galileo (1564-1642) with his telescope opened up new vistas of astronomical knowledge and laid the foundations of mechanics; while Leonardo da Vinci (1452-1519), painter, sculptor, architect, engineer, musician and true scientist, studied the laws of falling bodies and solved the riddle of the fossils in the rocks. Still later Newton (1642-1727) established the law of gravitation, developed the calculus, put mechanics upon a solid basis and also worked out the properties of lenses and prisms so that his *Optics* (1704) will always have a prominent place in the history of science.

From the time of the Renaissance on science grew steadily, but it was not till the latter half of the eighteenth century that the foundations in most of the lines recognized to-day were fully laid. Much of what was accomplished then is, at least, outlined in the chapters following.

Our standpoint in the early years of the nineteenth century, just before the *American Journal* had its beginning, may be briefly summarized as follows: A desire for knowledge was almost universal and, therefore, also a general interest in the development of science. Mathematics was firmly established and the mathematical side of astronomy and natural philosophy—as physics was then called—was well developed. Many of the phenomena of heat and their applications, as in the steam engine of Watt, were known and even the true nature of heat had been almost established by our countryman, Count Rumford; but of electricity there were only a few sparks of knowledge. Chemistry had had its foundation firmly laid by Priestley, Lavoisier, and Dalton, while Berzelius was pushing rapidly forward. Geology had also its roots down, chiefly through the work of Hutton and

William Smith, though the earth was as yet essentially an unexplored field. Systematic zoology and botany had been firmly grounded by Buffon, Lamarck and Cuvier, on the one hand, and Linnæus on the other; but of all that is embraced under the biology of the latter half of the nineteenth century the world knew nothing. The statements of Silliman in his Introductory Remarks in the first number, quoted in part on a following page, put the matter still more fully, but they are influenced by the enthusiasm of the time and he could have had little comprehension of what was to be the record of the next one hundred years.

Now, leaving this hasty and incomplete retrospect and coming down to 1918, we find the contrast between to-day and 1818 perhaps most strikingly brought out, on the material side, if we consider the ability of man, in the early part of the nineteenth century, to meet the demands upon him in the matter of transportation of himself and his property. In 1800, he had hardly advanced beyond his ancestor of the earliest civilization; on the contrary, he was still dependent for transportation on land upon the muscular efforts of himself and domesticated animals, while at sea he had only the use of sails in addition. The first application of the steam engine with commercial success was made by Fulton when, in 1807, the steamboat "Clermont" made its famous trip on the Hudson River. Since then, step by step, transportation has been made more and more rapid, economical and convenient, both on land and water. This has come first through the perfection of the steam engine; later through the agency of electricity, and still further and more universally by the use of gasoline motors. Finally, in these early years of the twentieth century, what seemed once a wild dream of the imagination has been realized, and man has gained the conquest of the air; while the perfection of the submarine is as wonderful as its work can be deadly.

Hardly less marvelous is the practical annihilation of space and time in the electric transmission of human thought and speech by wire and by ether waves. While, still further, the same electrical current now gives man his artificial illumination and serves him in a thousand ways besides.

But the limitations of space have also been conquered, during the same period, by the spectroscope which brings

a knowledge of the material nature of the sun and the fixed stars and of their motion in the line of sight; while spectrum analysis has revealed the existence of many new elements and opened up vistas as to the nature of matter.

The chemist and the physicist, often working together in the investigation of the problems lying between their two departments, have accumulated a staggering array of new facts from which the principles of their sciences have been deduced. Many new elements have been discovered, in fact nearly all called for by the periodic law; the so-called fixed gases have been liquefied, and now air in liquid form is almost a plaything; the absolute zero has been nearly reached in the boiling point of helium; physical measurements in great precision have been carried out in both directions for temperatures far beyond any scale that was early conceived possible; the atom, once supposed to be indivisible, has been shown to be made up of the much smaller electrons, while its disintegration in radium and its derivatives has been traced out and with consequences only as yet partly understood but certainly having far-reaching consequences; at one point we seem to be brought near to the transmutation of the elements which was so long the dream of the alchemist. Still again photography has been discovered and perfected and with the use of X-rays it gives a picture of the structure of bodies totally opaque to the eye; the same X-rays seem likely to locate and determine the atoms in the crystal.

Here and at many other points we are reaching out to a knowledge of the ultimate nature of matter.

In geology, vast progress has been made in the knowledge of the earth, not only as to its features now exhibited at or near the surface, but also as to its history in past ages, of the development of its structure, the minute history of its life, the phenomena of its earthquakes, volcanoes, etc. Geological surveys in all civilized countries have been carried to a high degree of perfection.

In biology, itself a word which though used by Lamarck did not come into use till taken up by Huxley, and then by Herbert Spencer in the middle of the century, the progress is no less remarkable as is well developed in a later chapter of this number.

Although not falling within our sphere, it would be wrong, too, not to recognize also the growth of medicine, especially through the knowledge of bacteria and their functions, and of disease germs and the methods of combating them. The world can never forget the debt it owes to Pasteur and Lister and many later investigators in this field.

To follow out this subject further would be to encroach upon the field of the chapters following, but, more important and fundamental still than all the facts discovered and the phenomena investigated has been the establishment of certain broad scientific principles which have revolutionized modern thought and shown the relation between sciences seemingly independent. The law of conservation of energy in the physical world and the principle of material and organic evolution may well be said to be the greatest generalizations of the human mind. Although suggestions in regard to them, particularly the latter, are to be found in the writings of early authors, the establishment and general acceptance of these principles belong properly to the middle of the nineteenth century. They stand as the crowning achievement of the scientific thought of the period in which we are interested.

Any mere enumeration of the vast fund of knowledge accumulated by the efforts of man through observation and experiment in the period in which we are interested would be a dry summary, and yet would give some measure of what this marvelous period has accomplished. As in geography, man's energy has in recent years removed the reproach of a "Dark Continent," of "unexplored" central Asia and the once "inaccessible polar regions," so in the different departments of science, he has opened up many unknown fields and accumulated vast stores of knowledge. It might even seem as if the limit of the unknown were being approached. There remains, however, this difference in the analogy, that in science the fundamental relations—as, for example, the nature of gravitation, of matter, of energy, of electricity; the actual nature and source of life—the solution of these and other similar problems still lies in the future. What the result of continued research may be no one can predict, but even with these possibilities before us, it is hardly rash to say that so great a combined progress of

pure and applied science as that of the past hundred years is not likely to be again realized.

SCIENTIFIC PERIODICAL LITERATURE IN 1818.

The contrast in scientific activity between 1818 and 1918 is nowhere more strikingly shown than in the amount of scientific periodical literature of the two periods. Of the thousands of scientific journals and regular publications by scientific societies and academies to-day, but a very small number have carried on a continuous and practically unbroken existence since 1818. This small amount of periodical scientific literature in the early part of the last century is significant as giving a fair indication of the very limited extent to which scientific investigation appealed to the intellectual life of the time. Some definite facts in regard to the scientific publications of those early days seem to be called for.

Learned societies and academies, devoted to literature and science, were formed very early but at first for occasional meetings only and regular publications were in most cases not begun till a very much later date. Some of the earliest—not to go back of the Renaissance—are the following:

- 1560. Naples, *Accademia Secretorum Naturæ*.
- 1603. Rome, *Accademia dei Lincei*.
- 1651. Leipzig, *Accademia Naturæ Curiosum*.
- 1657. Florence, *Accademia del Cimento*.
- 1662. London, *Royal Society*.
- 1666. Paris, *Académie des Sciences*.
- 1690. Bologna, *Accademia delle Scienze*.
- 1700. Berlin, *Societas Regia Scientiarum*. This was the forerunner of the K. preuss. Akad. d. Wissenschaften.

The Royal Society of London, whose existence dates from 1645, though not definitely chartered until 1662, began the publication of its "Philosophical Transactions" in 1665 and has continued it practically unbroken to the present time; this is a unique record. Following this, other early—but in most cases not continuous—publications were those of Paris (1699); Berlin (1710); Upsala (1720); Petrograd, 1728; Stockholm (1739); and Copenhagen (1743).

For the latter half of the eighteenth century, when the foundations of our modern science were being rapidly

laid, a considerable list might be given of early publications of similar scientific bodies. Some of the prominent ones are: Göttingen (1750), Munich (1759), Brussels (1769), Prague (1775), Turin (1784), Dublin (1788), etc. The early years of the nineteenth century saw the beginnings of many others, particularly in northern Italy. It is to be noted that, as stated, only rarely were the publications of these learned societies even approximately continuous. In the majority of cases the issue of transactions or proceedings was highly irregular and often interrupted.

In this country the earliest scientific bodies are the following:

Philadelphia. American Philosophical Society, founded in 1743. Transactions were published 1771-1809; then interrupted until 1818 *et seq.*

Boston. American Academy of Arts and Sciences, founded in 1780. Memoirs, 1785-1821; and then 1833 *et seq.*

New Haven. Connecticut Academy of Arts and Sciences, begun in 1799. Memoirs, vol. 1, 1810-16; Transactions, 1866 *et seq.*

Philadelphia. Academy of Natural Sciences, begun in 1812. Journal, 1817-1842; and from 1847 *et seq.*

New York. Lyceum of Natural History, 1817; later (1876) became the New York Academy of Sciences. Annals from 1823; Proceedings from 1870.

The situation is somewhat similar as to independent scientific journals. A list of the names of those started only to find an early death would be a very long one, but interesting only historically and as showing a spasmodic but unsustained striving after scientific growth.

It seems worth while, however, to give here the names of the periodicals embracing one or more of the subjects of the *American Journal*, which began at a very early date and most of which have maintained an uninterrupted existence down to 1915. It should be added that certain medical journals, not listed here, have also had a long and continued existence.¹

¹ The statements given are necessarily much condensed, without an attempt to follow all changes of title; furthermore, the dates of actual publication for the academies given above are often somewhat vaguely recorded. For fuller information see Seudder's "Catalogue of Scientific Serials, 1633-1876," Cambridge, 1876; also H. Carrington Bolton's "Catalogue of Scientific and Technical Periodicals, 1665-1882" (Smithsonian Institution, 1885). The writer is much indebted to Mr. C. J. Barr of the Yale University for his valuable assistance in this connection.

Early Scientific Journals.

1771-1823. *Journal de Physique*, Paris; title changed several times.

1787-. *Botanical Magazine*. (For a time known as *Curtis's Journal*.)

1789-1816. *Annales de Chimie*, Paris. Continued from 1817 on as the *Annales de Chimie et de Physique*.

1790. *Journal der Physik*, Halle (by Gren); from 1799 on became the *Annalen der Physik (und Chemie)*, Halle, Leipzig. The title has been somewhat changed from time to time though publication has been continuous. Often referred to by the name of the editor-in-chief, as Gren, Gilbert, Poggendorff, Wiedemann, etc.

1795-1815. *Journal des Mines*, Paris, continued from 1816 as the *Annales des Mines*.

1796-1815. *Bibliothèque Britannique*, Geneva. From 1816-1840, *Bibliothèque Universelle*, etc. 1846-1857, *Archives des Sci. phys. nat.* Since 1858 generally known as the *Bibliothèque Universelle*.

1797. *Journal of Natural Philosophy, Chemistry and the Arts (Nicholson's Journal)* London; united in 1814 with the *Philosophical Magazine (Tilloch's Journal)*.

1798-. *The Philosophical Magazine* (originally by Tilloch). This absorbed *Nicholson's Journal* (above) in 1814; also the *Annals of Philosophy* (Thomson, Phillips) in 1827 and *Brewsters' Edinburgh Journal of Science* in 1832.

1798-1803. *Allgemeines Journal de Chemie* (Scherer's *Journal*). 1803-1806; continued as *Neues Allg. J.* etc. (Gehlen's *Journal*.) Later title repeatedly changed and finally (1834 *et seq.*) *Journal für praktische Chemie*.

1816-18. *Journal of Science and the Arts*, London. 1819-30, *Quarterly J.* etc. 1830-31, *Journal of the Royal Institution of Great Britain*.

1818. *American Journal of Science and Arts* until 1880, when "the Arts" was dropped, New Haven, Conn. First Series, 1-50, 1818-1845; Second Series, 1-50, 1846-1870; Third Series, 1-50, 1871-1895; Fourth Series, 1-45, 1896-June, 1918.

1820-1867. *London Journal of Arts and Sciences* (after 1855, *Newton's Journal*).

1824-. *Annales des sciences naturelles*. Paris.

1826-. *Linnæa*, Berlin, Halle; from 1882 united with *Jahrb. d. K. botan. Gartens*.

1828-1840. *Magazine of Natural History*, London; united 1838 with the *Annals of Natural History*, and known since 1841 as the *Annals and Magazine of Natural History*.

1828-. Journal of the Franklin Institute, Philadelphia, from 1826; earlier (1825) the American Mechanics Magazine.

1832-. Annalen der Chemie (und Pharmacie) often known as Liebig's Annalen. Leipzig, Lemgo.

THE FOUNDER OF THE AMERICAN JOURNAL OF SCIENCE.

The establishment of a scientific journal in this country in 1818 was a pioneer undertaking, requiring of its founder a rare degree of energy, courage, and confidence in the future. It was necessary, not only to obtain the material to fill its pages and the money to carry on the enterprise, but, before the latter end could be accomplished, an audience must be found among those who had hitherto felt little or no interest in the sciences. This great work was accomplished by Benjamin Silliman, "the guardian of American Science," whose influence was second to none in the early development of science in this country. Before speaking in some detail of the early years of this Journal and of its subsequent history, it is proper that some words should be given to its founder.

Benjamin Silliman, son of a general prominent in the Revolutionary War, was born in Trumbull, Connecticut, on August 8, 1779. He was a graduate of Yale College of the class of 1796. Though at first a student of law and accepted for the bar in Connecticut, he was called in 1802 by President Timothy Dwight—a man of rare breadth of mind—to occupy the newly-made chair of chemistry, mineralogy (and later geology) in Yale College at New Haven. To fit himself for the work before him he carried on extensive studies at home and in Philadelphia and spent the year 1805 in travels and study at London and Edinburgh, and also on the Continent. His active duties began in 1806 and from this time on he was in the service of Yale College until his resignation in 1853. From the first, Silliman met with remarkable success as a teacher and public lecturer in arousing an interest in science. His breadth of knowledge, his enthusiasm for his chosen subjects and power of clear presentation, combined with his fine presence and attractive personality, made him a great leader in the science of the country and gave him a unique position in the history of its development.

Much might be said of the man and his work, but, the

best tribute is that of James Dwight Dana, given in his inaugural address upon the occasion of his beginning his duties as Silliman professor of geology in Yale College. This was delivered on February 18, 1856, in what was then known as the "Cabinet Building." Dana says in part:

"In entering upon the duties of this place, my thoughts turn rather to the past than to the subject of the present hour. I feel that it is an honored place, honored by the labors of one who has been the guardian of American Science from its childhood; who here first opened to the country the wonderful records of geology; whose words of eloquence and earnest truth were but the overflow of a soul full of noble sentiments and warm sympathies, the whole throwing a peculiar charm over his learning, and rendering his name beloved as well as illustrious. Just fifty years since, Professor Silliman took his station at the head of chemical and geological science in this college. Geology was then hardly known by name in the land, out of these walls. Two years before, previous to his tour in Europe, the whole cabinet of Yale was a half-bushel of unlabelled stones. On visiting England he found even in London no school public or private, for geological instruction, and the science was not named in the English universities. To the mines, quarries, and cliffs of England, the crags of Scotland, and the meadows of Holland he looked for knowledge, and from these and the teachings of Murray, Jameson, Hall, Hope, and Playfair, at Edinburgh, Professor Silliman returned, equipped for duty,—albeit a great duty,—that of laying the foundation, and creating almost out of nothing a department not before recognized in any institution in America.

He began his work in 1806. The science was without books—and, too, without system, except such as its few cultivators had each for himself in his conceptions. It was the age of the first beginnings of geology, when Wernerians and Huttonians were arrayed in a contest. . . . Professor Silliman when at Edinburgh witnessed the strife, and while, as he says, his earliest predilections were for the more peaceful mode of rock-making, these soon yielded to the accumulating evidence, and both views became combined in his mind in one harmonious whole. The science, thus evolved, grew with him and by him; for his own labors contributed to its extension. Every year was a year of expansion and onward development, and the grandeur of the opening views found in him a ready and appreciative response.

And while the sciences and truth have thus made progress here, through these labors of fifty years, the means of study in the institution have no less increased. Instead of that half-

bushel of stones, which once went to Philadelphia for names, in a candle-box, you see above the largest mineral cabinet in the country, which but for Professor Silliman, his attractions and his personal exertions together, would never have been one of the glories of old Yale. . . .

Moreover, the *American Journal of Science*,—now in its thirty-seventh year and seventieth volume [1856],—projected and long-sustained solely by Professor Silliman, while ever distributing truth, has also been ever gathering honors, and is one of the laurels of Yale.

We rejoice that in laying aside his studies, after so many years of labor, there is still no abated vigor. . . . He retires as one whose right it is to throw the burden on others. Long may he be with us, to enjoy the good he has done, and cheer us by his noble and benign presence."

In addition to these words of Dana, much of vital interest in regard to Silliman and his work will be gathered from what is given in the pages immediately following, quoted from his personal statements in the early volumes of the *Journal*.

THE EARLY YEARS OF THE JOURNAL.

In no direction did Silliman's enthusiastic activities in science produce a more enduring result than in the founding and carrying on of this *Journal*. The first suggestion in regard to the enterprise was made to Silliman by his friend, Colonel George Gibbs, from whom the famous Gibbs collection of minerals was bought by Yale College in 1825. Silliman says (25, 215, 1834):

"Col. Gibbs was the person who first suggested to the Editor the project of this *Journal*, and he urged the topic with so much zeal and with such cogent arguments, as prevailed to induce the effort in a case then viewed as of very dubious success. The subject was thus started in November, 1817; proposals for the *Journal* were issued in January, 1818, and the first number appeared in July of that year."

He adds further (50, p. iii, 1847) that the conversation here recorded took place "on an accidental meeting on board the steamboat *Fulton* in Long Island Sound." This was some ten years after Robert Fulton's steamboat, the *Clermont*, made its pioneer trip on the Hudson river, already alluded to. The incident is not without significance in this connection. The deck of the "*Ful-*

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AND THE
ORNAMENTAL AS WELL AS USEFUL
ARTS.

—
CONDUCTED BY
BENJAMIN SILLIMAN,
PROFESSOR OF CHEMISTRY, MINERALOGY, ETC. IN YALE COLLEGE, AUTHOR OF
TRAVELS IN ENGLAND, SCOTLAND, AND HOLLAND, ETC

—
VOL. I....NO. I.
—

ENGRAVING IN THE PRESENT NO.
New apparatus for the combustion of TAR, &c. by the vapour of
water.

—
New-York:
PUBLISHED BY J. EASTBURN AND CO. LITERARY ROOMS, BROADWAY,
AND BY HOWE AND SPALDING, NEW-HAVEN.

—
Abraham Paul, printer,

.....
1818.

ton'' was not an inappropriate place for the inauguration of an enterprise also great in its results for the country.

In the preface to the concluding volume of the First Series (*loc. cit.*) Silliman adds the following remarks which show his natural modesty at the thought of undertaking so serious a work. He says:

Although a different selection of an editor would have been much preferred, and many reasons, public and personal, concurred to produce diffidence of success, the arguments of Col. Gibbs, whose views on subjects of science were entitled to the most respectful consideration, and had justly great weight, being pressed with zeal and ability, induced a reluctant assent; and accordingly, after due consultation with many competent judges, the proposals were issued early in 1818, embracing the whole range of physical science and its applications. The Editor in entering on the duty, regarded it as an affair for life, and the thirty years of experience which he has now had. have proved that his views of the exigencies of the service were not erroneous.

The plan with which the editor began his work and the lines laid down by him at the outset can only be made clear by quoting entire the "Plan of the Work" which opens the first number. It seems desirable also to give this in its original form as to paragraphs and typography. The first page of the cover of the opening number has also been reproduced here. It will be seen that the plan of the young editor was as wide as the entire range of science and its applications and extended out to music and the fine arts. This seems strange to-day, but it must be remembered how few were the organs of publication open to contributors at the time. If the plan was unreasonably extended, that fact is to be taken not only as an expression of the enthusiasm of the editor, as yet inexperienced in his work, but also of the time when the sciences were still in their infancy.

He says (1, pp. v, vi):

"PLAN OF THE WORK.

This Journal is intended to embrace the circle of THE PHYSICAL SCIENCES, with their application to THE ARTS, and to every useful purpose.

It is designed as a deposit for *original American communications*; but will contain also occasional selections from Foreign Journals, and notices of the progress of science in other countries. Within its plan are embraced

NATURAL HISTORY, in its three great departments of MINERALOGY, BOTANY, and ZOOLOGY;

CHEMISTRY and NATURAL PHILOSOPHY, in their various branches: and MATHEMATICS, pure and mixed.

It will be a leading object to illustrate AMERICAN NATURAL HISTORY, and especially our MINERALOGY and GEOLOGY.

The APPLICATIONS of these sciences are obviously as numerous as *physical arts*, and *physical wants*; for no one of these arts or wants can be named which is not connected with them.

While SCIENCE will be cherished *for its own sake*, and with a due respect for its own *inherent* dignity; it will also be employed as the *handmaid to the Arts*. Its numerous applications to AGRICULTURE, the earliest and most important of them; to our MANUFACTURES, both mechanical and chemical; and to our DOMESTIC ECONOMY, will be carefully sought out, and faithfully made.

It is also within the design of this Journal to receive communications on MUSIC, SCULPTURE, ENGRAVING, PAINTING, and generally on the fine and liberal, as well as useful arts;

On Military and Civil Engineering, and the art of Navigation.

Notices, Reviews, and Analyses of new scientific works, and of new Inventions, and Specifications of Patents;

Biographical and Obituary Notices of scientific men; essays on COMPARATIVE ANATOMY and PHYSIOLOGY, and generally on such other branches of medicine as depend on scientific principles;

Meteorological Registers, and Reports of Agricultural Experiments: and we would leave room also for interesting miscellaneous things, not perhaps exactly included under either of the above heads.

Communications are respectfully solicited from men of science, and *from men versed in the practical arts*.

Learned Societies are invited to make this Journal, occasionally, the vehicle of their communications to the Public.

The editor will not hold himself responsible for the sentiments and opinions advanced by his correspondents; but he will consider it as an allowed liberty to make slight *verbal alterations*, where errors may be presumed to have arisen from inadvertency."

In the "Advertisement" which precedes the above statement in the first number, the editor remarks somewhat naïvely that he "does not pledge himself that all the subjects shall be touched upon in every number. This is plainly impossible unless every article should be very short and imperfect. . ."

The whole subject is discussed in all its relations in the "Introductory Remarks" which open the first vol-

ume. No apology is needed for quoting at considerable length, for only in this way can the situation be made clear, as seen by the editor in 1818. Further we gain here a picture of the intellectual life of the times and, not less interesting, of the mind and personality of the writer. With a frank kindliness, eminently characteristic of the man, as will be seen, he takes the public fully into his confidence. In the remarks made in subsequent volumes,—also extensively quoted—the vicissitudes in the conduct of the enterprise are brought out and when success was no longer doubtful, there is a tone of quiet satisfaction which was also characteristic and which the circumstances fully justified.

The INTRODUCTORY REMARKS begin as follows:

The age in which we live is not less distinguished by a vigorous and successful cultivation of physical science, than by its numerous and important applications to the practical arts, and to the common purposes of life.

In every enlightened country, men illustrious for talent, worth and knowledge, are ardently engaged in enlarging the boundaries of natural science; and the history of their labors and discoveries is communicated to the world chiefly through the medium of scientific journals. The utility of such journals has thus become generally evident; they are the heralds of science; they proclaim its toils and its achievements; they demonstrate its intimate connection as well with the comfort, as with the intellectual and moral improvement of our species; and they often procure for it enviable honors and substantial rewards.

Mention is then made of the journals existing in England and France in 1818 “which have long enjoyed a high and deserved reputation.” He then continues:

From these sources our country reaps and will long continue to reap, an abundant harvest of information: and if the light of science, as well as of day, springs from the East, we will welcome the rays of both; nor should national pride induce us to reject so rich an offering.

But can we do nothing in return?

In a general diffusion of useful information through the various classes of society, in activity of intellect and fertility of resource and invention, producing a highly intelligent population, we have no reason to shrink from a comparison with any country. But the devoted cultivators of science in the United States are comparatively few: they are, however, rapidly increasing in number. Among them are persons distinguished for their capacity and attainments, and, notwithstanding the

local feelings nourished by our state sovereignties, and the rival claims of several of our larger cities, there is evidently a predisposition towards a concentration of effort, from which we may hope for the happiest results, with regard to the advancement of both the science and reputation of our country.

Is it not, therefore, desirable to furnish some rallying point, some object sufficiently interesting to be nurtured by common efforts, and thus to become the basis of an enduring, common interest? To produce these efforts, and to excite this interest, nothing, perhaps, bids fairer than a SCIENTIFIC JOURNAL.

The valuable work already accomplished by various medical journals is then spoken of and particularly that of the first scientific periodical in the United States, Bruce's Mineralogical Journal. This, as Silliman says (1, p. 3, 1818), although "both in this country and in Europe received in a very flattering manner," did not survive the death of its founder, and only a single volume of 270 pages appeared (1810-1813).

Silliman continues:

No one, it is presumed, will doubt that a journal devoted to science, and embracing a sphere sufficiently extensive to allure to its support the principal scientific men of our country, is greatly needed; if cordially supported, it will be successful, and if successful, it will be a great public benefit.

Even a failure, in so good a cause, (unless it should arise from incapacity or unfaithfulness,) cannot be regarded as dishonourable. It may prove only that the attempt was premature, and that our country is not yet ripe for such an undertaking; for without the efficient support of talent, knowledge, and money, it cannot long proceed. No editor can hope to carry forward such a work without the active aid of scientific and practical men; but, at the same time, the public have a right to expect that he will not be sparing of his own labour, and that his work shall be generally marked by the impress of his own hand. To this extent the editor cheerfully acknowledges his obligations to the public; and it will be his endeavour faithfully to redeem his pledge.

Most of the periodical works of our country have been short-lived. This, also, may perish in its infancy; and if any degree of confidence is cherished that it will attain a maturer age, it is derived from the obvious and intrinsic importance of the undertaking; from its being built upon permanent and momentous national interests; from the evidence of a decided approbation of the design, on the part of gentlemen of the first eminence, obtained in the progress of an extensive correspondence; from assurance of support, in the way of contributions, from men of

ability in many sections of the union; and from the existence of such a crisis in the affairs of this country and of the world, as appears peculiarly auspicious to the success of every wise and good undertaking.

An interesting discussion follows (pp. 5-8) as to the claims of the different branches of science, and the extent to which they and their applications had been already developed, also the spheres still open to discovery.

The Introductory Remarks close, as follows:

In a word, the whole circle of physical science is directly applicable to human wants and constantly holds out a light to the practical arts; it thus polishes and benefits society and everywhere demonstrates both supreme intelligence and harmony and beneficence of design in the Creator.

The science of mathematics, both pure and mixed, can never cease to be interesting and important to man, as long as the relations of quantity shall exist, as long as ships shall traverse the ocean, as long as man shall measure the surface or heights of the earth on which he lives, or calculate the distances and examine the relations of the planets and stars; and as long as the *iron reign of war* shall demand the discharge of projectiles, or the construction of complicated defences.

The closing part of the paragraph shows the influence exerted upon the mind of the editor by the serious wars of the years preceding 1818, a subject alluded to again at the close of this chapter.

In February, 1822, with the completion of the fourth volume, the editor reviews the situation which, though encouraging is by no means fully assuring. He says (preface to vol. 4, dated Feb. 15, 1822):

Two years and a half have elapsed, since the publication of the first volume of this Journal, and one year and ten months since the Editor assumed the pecuniary responsibility. . . .

The work has not, even yet, reimbursed its expenses, (we speak not of editorial or of business compensation.) we intend, that it has not paid for the paper, printing and engraving; the proprietors of the first volume being in advance, on those accounts, and the Editor on the same score, with respect to the aggregate expense of the three last volumes. This deficit is, however, no longer increasing, as the receipts, at present, just about cover the expense of the physical materials, and of the manual labour. A reiterated disclosure of this kind is not grateful, and would scarcely be manly, were it not that the public, who alone have the power to remove the difficulty, have

a right to a frank exposition of the state of the case. As the patronage is, however, growing gradually more extensive, it is believed that the work will be eventually sustained, although it may be long before it will command any thing but gratuitous intellectual labour. . . .

These facts, with the obvious one,—that its pages are supplied with contributions from all parts of the Union, and occasionally from Europe, evince that the work is received as a national and not as a local undertaking, and that the community consider it as having no sectional character. Encouraged by this view of the subject, and by the favour of many distinguished men, both at home and abroad, and supported by able contributors, to whom the Editor again tenders his grateful acknowledgments, he will still persevere, in the hope of contributing something to the advancement of our science and arts, and towards the elevation of our national character.

In the autumn of the same year, the editor closes the fifth volume with a more confident tone (Sept. 25, 1822):

A trial of four years has decided the point, that the American Public will support this Journal. Its pecuniary patronage is now such, that although not a lucrative, it is no longer a hazardous enterprise. It is now also decided, that the intellectual resources of the country are sufficient to afford an unfailing supply of valuable original communications and that nothing but perseverance and effort are necessary to give perpetuity to the undertaking.

The decided and uniform expression of public favour which the Journal has received both at home and abroad, affords the Editor such encouragement, that he cannot hesitate to persevere—and he now renews the expression of his thanks to the friends and correspondents of the work, both in Europe and the United States, requesting at the same time a continuance of their friendly influence and efforts.

Still again in the preface to the sixth volume (1823) he takes the reader more fully into his confidence and shows that he regards the enterprise as no longer of doubtful success. He says:

The conclusion of a new volume of a work, involving so much care, labour and responsibility, as are necessarily attached, at the present day, to a Journal of Science and the Arts, naturally produces in the mind, a state of not ungrateful calmness, and a disposition, partaking of social feeling, to say something to those who honour such a production, by giving to it a small share of their money, and of their time. The Editor's first impression was, that the sixth volume should be sent into the

world without an introductory note, but he yields to the impulse already expressed, and to the established usages of respectful courtesy to the public, which a short preface seems to imply. He has now persevered almost five years, in an undertaking, regarded by many of the friends whom he originally consulted, as hazardous, and to which not a few of them prophetically allotted only an ephemeral existence. It has been his fortune to prosecute this work without, (till a very recent period,) returns adequate to its indispensable responsibilities;—under a heavy pressure of professional and private duty; with trying fluctuations of health, and amidst severe and reiterated domestic afflictions. The world are usually indulgent to allusions of this nature, when they have any relation to the discharge of public duty: and in this view, it is with satisfaction, that the Editor adds, that he has now to look on formidable difficulties, only in retrospect, and with something of the feeling of him, who sees a powerful and vanquished foe, slowly retiring, and leaving a field no longer contested.

This Journal which, from the first, was fully supplied with original communications, is now sustained by actual payment, to such an extent, that it may fairly be considered as an established work; its patronage is regularly increasing, and we trust it will no longer justify such remarks as some of the following, from the pen of one of the most eminent scientific men in Europe. "Nothing surprises me more, than the little encouragement which your Journal," ("which I always read with very great interest, and of which I make great use,") "experiences in America—this must surely arise from the present depressed condition of trade, and cannot long continue."

Six years more of uninterrupted editorial work passed by, the sixteenth volume was completed, and the editor was now in a position to review the whole situation up to 1829. This preface (dated July 1, 1829), which is quoted nearly in full, cannot fail to be found particularly interesting and from several standpoints, not the least for the insight it gives into the writer's mind. It is also noteworthy that at this early date it was found possible to pay for original contributions, a privilege far beyond the means of the editor of to-day.

When this Journal was first projected, very few believed that it would succeed.

Among others, Dr. Dorsey wrote to the editor; "I predict a short life for you, although I wish, as the Spaniards say, that you may live a thousand years." The work has not lived a thousand years, but as it has survived more than the hundredth part of that period, no reason is apparent why it may not con-

tinue to exist. To the contributors, disinterested and arduous as have been their exertions, the editor's warmest thanks are due; and they are equally rendered to numerous personal friends for their unwavering support: nor ought those subscribers to be forgotten who, occupied in the common pursuits of life, have aided, by their money, in sustaining the hazardous novelty of an *American Journal of Science*. A general approbation, sufficiently decided to encourage effort, where there was no other reward, has supported the editor; but he has not been inattentive to the voice of criticism, whether it has reached him in the tones of candor and kindness, or in those of severity. We must not look to our friends for the full picture of our faults. He is unwise who neglects the maxim—

—fas est ab hoste doceri,

and we may be sure, that those are quite in earnest, whose pleasure it is, to place faults in a strong light and bold relief; and to throw excellencies into the shadow of total eclipse. Minds at once enlightened and amiable, viewing both in their proper proportions, will however render the equitable verdict;

Non ego paucis offendar maculis,—

It is not pretended that this *Journal* has been faultless: there may be communications in it which had been better omitted, and it is not doubted that the power to command intellectual effort, by suitable pecuniary reward, would add to its purity, as a record of science, and to its richness, as a repository of discoveries in the arts.

But the editor, even now, offers payment, at the rate adopted by the literary *Journals*, for able original communications, containing especially important facts, investigations and discoveries in science, and practical inventions in the useful and ornamental Arts.

As however his means are insufficient to pay for all the copy, it is earnestly requested, that those gentlemen, who, from other motives, are still willing to write for this *Journal*, should continue to favor it with their communications. That the period when satisfactory compensation can be made to all writers whose pieces are inserted, and to whom payment will be acceptable, is not distant, may perhaps be hoped, from the spontaneous expression of the following opinion, by the distinguished editor of one of our principal literary journals, whose letter is now before me. "The character of the *American Journal* is strictly national, and it is the only vehicle of communication in which an inquirer may be sure to find what is most interesting in the wide range of topics, which its design embraces. It has become in short, not more identified with the science than the literature of the country." It is believed that a strict examination of its contents will prove that its character has been decidedly

scientific; and the opinion is often expressed to the editor, that in common with the journals of our Academies, it is a work of reference, indispensable to him who would examine the progress of American science during the period which it covers. That it might not be too repulsive to the general reader, some miscellaneous pieces have occasionally occupied its pages; but in smaller proportion, than is common with several of the most distinguished British Journals of Science.

Still, the editor has been frequently solicited, both in public and private, to make it more miscellaneous, that it might be more acceptable to the intelligent and well educated man, who does not cultivate science; but he has never lost sight of his great object, which was to produce and concentrate original American effort in science, and thus he has foregone pecuniary returns, which by pursuing the other course, might have been rendered important. Others would not have him admit any thing that is not strictly and technically scientific; and would make this journal for mere professors and amateurs; especially in regard to those numerous details in natural history, which although important to be registered, (and which, when presented, have always been recorded in the *American Journal*,) can never exclusively occupy the pages of any such work without repelling the majority of readers.

If this is true even in Great Britain it is still more so in this country; and our savants, unless they would be, not only the exclusive admirers, but the sole purchasers of their own works, must permit a little of the graceful drapery of general literature to flow around the cold statues of science. The editor of this Journal, strongly inclined, both from opinion and habit, to gratify the cultivators of science, will still do everything in his power to promote its high interests, and as he hopes in a better manner than heretofore: but these respectable gentlemen will have the courtesy, to yield something to the reading literary, as well as scientific public, and will not, we trust, be disgusted, if now and then an *Oasis* relieves the eye, and a living stream refreshes the traveller. Not being inclined to renew the abortive experiment, to please every body, which has been so long renowned in fable; the editor will endeavor to pursue, the even tenor of his way; altogether inclined to be courteous and useful to his fellow travellers, and hoping for their kindness and services in return.

THE CLOSE OF THE FIRST SERIES.

The "First Series," as it was henceforth to be known, closed with the fiftieth volume (1847, pp. xx + 347). This final volume is devoted to an exhaustive index to the forty-nine volumes preceding. In the preface (dated April 19, 1847) the elder Silliman, now the senior editor,

reviews the work that had been accomplished with a frank expression of his feeling of satisfaction in the victory won against great obstacles; with this every reader must sympathize. He quotes here at length (but in slightly altered form) the matter from the first volume (1818), which has been already reproduced almost entire, and then goes on as follows (pp. xi *et seq.*):

Such was the pledge which, on entering upon our editorial labors in 1818, we gave to the public, and such were the views which we then entertained, regarding science and the arts as connected with the interests and honor of our country and of mankind. In the retrospect, we realize a sober but grateful feeling of satisfaction, in having, to the extent of our power, discharged these self-imposed obligations; this feeling is chastened also by a deep sense of gratitude, first to God for life and power continued for so high a purpose; and next, to our noble band of contributors, whose labors are recorded in half a century of volumes, and in more than a quarter of a century of years. We need not conceal our conviction, that the views expressed in these "Introductory Remarks," have been fully sustained by our fellow laborers.

Should we appear to take higher ground than becomes us, we find our vindication in the fact, that we have heralded chiefly the doings and the fame of others. The work has indeed borne throughout "the impress" of editorial unity of design, and much that has flowed from one pen, and not a little from the pens of others, has been without a name. The materials for the pile, have however been selected and brought in, chiefly by other hands, and if the monument which has been reared should prove to be "*aere perennius*," the honor is not the sole property of the architect; those who have quarried, hewn and polished the granite and the marble, are fully entitled to the enduring record of their names already deeply cut into the massy blocks, which themselves have furnished.

If a retrospective survey of the labors of thirty years on this occasion has rekindled a degree of enthusiasm, it is a natural result of an examination of all our volumes from the contents of which we have endeavored to make out a summary both of the laborers and their works. . . .

The series of volumes must ever form a work of permanent interest on account of its exhibiting the progress of American science during the long period which it covers. Comparing 1817 with 1847, we mark on this subject a very gratifying change. The cultivators of science in the United States were then few—now they are numerous. Societies and associations of various names, for the cultivation of natural history, have been instituted in very many of our cities and towns, and several of them

have been active and efficient in making original observations and forming collections.

A summary follows presenting some facts as to the growth of scientific societies and scientific collections in this country during the period involved: Then the striking contrast between 1818 and 1847 in the matter of organized effort toward scientific exploration is discussed, as follows (pp. xvi *et seq.*):

When we began our Journal, not one of the States had been surveyed in relation to its geology and natural history; now those that have not been explored are few in number. State collections and a United States Museum hold forth many allurements to the young naturalist, as well as to the archæologist and the student of his own race. The late Exploring Expedition [Wilkes] with the National Institute, has enriched the capital with treasures rarely equalled in any country, and the Smithsonian Institution recently organized at Washington, is about to begin its labors for the increase and diffusion of knowledge among men.

It must not be forgotten that the American Association of Geologists and Naturalists—composed of individuals assembled from widely separate portions of the Union—by the seven sessions which it has held, and by its rich volume of reports, has produced a concentration and harmony of effort which promise happy results, especially as, like the British Association, it visits different towns and cities in its annual progress.

Astronomy now lifts its exploring tubes from the observatories of many of our institutions. Even the Ohio, which within the memory of the oldest living men, rolled along its dark waters through interminable forests, or received the stains of blood from deadly Indian warfare, now beholds on one of its most beautiful hills, and near its splendid city, a permanent observatory with a noble telescope sweeping the heavens, by the hand of a zealous and gifted observer. At Washington also, under the powerful patronage of the general government, an excellent observatory has been established, and is furnished with superior instruments, under the direction of a vigilant and well instructed astronomer—seconded by able and zealous assistants.

Here also (in Yale College) successful observations have been made with good instruments, although no permanent building has been erected for an Observatory.

We only give single examples by way of illustration, for the history of the progress of science in the United States, and of institutions for its promotion, during the present generation, would demand a volume. It is enough for our purpose that science is understood and valued, and the right methods of prosecuting it are known, and the time is at hand when its moral

and intellectual use will be as obvious as its physical applications. Nor is it to be forgotten that we have awakened an European interest in our researches: general science has been illustrated by treasures of facts drawn from this country, and our discoveries are eagerly sought for and published abroad.

While with our co-workers in many parts of our broad land, we rejoice in this auspicious change, we are far from arrogating it to ourselves. Multiplied labors of many hands have produced the great results. In the place which we have occupied, we have persevered despite of all discouragements, and may, with our numerous coadjutors, claim some share in the honors of the day. We do not say that our work might not have been better done—but we may declare with truth that we have done all in our power, and it is something to have excited many others to effort and to have chronicled their deeds in our annals. Let those that follow us labor with like zeal and perseverance, and the good cause will continue to advance and prosper. It is the cause of truth—science is only embodied and sympathized truth and in the beautiful conception of our noble Agassiz—"it tells the thought of God."

The preface closes with some personal remarks:

In tracing back the associations of many gone-by years, a host of thoughts rush in, and pensive remembrance of the dead who have labored with us casts deep shadows into the vista through which we view the past.

Anticipation of the hour of discharge, when our summons shall arrive, gives sobriety to thought and checks the confidence which health and continued power to act might naturally inspire, were we not reprov'd, almost every day, by the death of some co-eval, co-worker, companion, friend or patron. This very hour is saddened by such an event,—but we will continue to labor on, and strive to be found at our post of duty, until there is nothing more for us to do; trusting our hopes for a future life in the hands of Him who placed us in the midst of the splendid garniture of this lower world, and who has made not less ample provision for another and a better.

Editorial and financial.—The editorial labors on the Journal were carried by the elder Silliman alone for twenty years from 1818 to 1838. As has been clearly shown in his statements, already quoted, he was, after the first beginning, personally responsible also for the financial side of the enterprise. With volume 34 (1838) the name of Benjamin Silliman, Jr., is added as co-editor on the title page. He was graduated from Yale College the year preceding and at this date was only twenty-one years old. His aid was unquestionably of much service

from the beginning and increased rapidly with years and experience. The elder Silliman introduces him in the preface to vol. **34** (1838) and comes back to the subject again in the preface to vol. **50** (1847). The whole editorial situation is here presented as follows:

“During twenty years from the inception of this Journal, the editor labored alone, although overtures for editorial co-operation had been made to him by gentlemen commanding his confidence and esteem, and who would personally have been very acceptable. It was, however, his opinion that the unity of purpose and action so essential to the success of such a work were best secured by individuality; but he made every effort, and not without success, to conciliate the good will and to secure the assistance of gentlemen eminent in particular departments of knowledge. On the title page of No. 1, vol. **34**, published in July, 1838, a new name is introduced: the individual to whom it belongs having been for several years more or less concerned in the management of the Journal, and from his education, position, pursuits and taste, as well as from affinity, being almost identified with the editor, he seemed to be quite a natural ally, and his adoption into the editorship was scarcely a violation of individual unity. His assistance has proved to be very important:—his near relation to the senior editor prevents him from saying more, while justice does not permit him to say less.”

As is distinctly intimated in the preceding paragraph the elder Silliman was fortunate in obtaining the assistance in his editorial labors of numerous gentlemen interested in the enterprise. Their coöperation provided many of the scientific notices, book reviews and the like contained in the Miscellany with which each number closed. It is impossible, at this date, to render the credit due to Silliman's helpers or even to mention them by name. Very early Asa Gray was one of these as occasional notes are signed by his initials. Dr. Levi Ives of New Haven was another. Prof. J. Griscom of Paris also sent numerous contributions even as early as 1825 (see **9**, 154, 1825; **22**, 192, 1832; **24**, 342, 1833, and others).

Some statements have already been quoted from the early volumes as to the business part of Silliman's enterprise. The subject is taken up more fully in the preface to volume **50** (1847). No one can fail to marvel at the energy and optimism required to push the Journal forward when conditions must have been so difficult and encouragement so scanty. He says (pp. iii, iv):

This Journal first appeared in July, 1818, and in June, 1819, the first volume of four numbers and 448 pages was completed. This scale of publication, originally deemed sufficient, was found inadequate to receive all the communications, and as the receipts proved insufficient to sustain the expenses, the work, having but three hundred and fifty subscribers, was, at the end of the year, abandoned by the publishers.

An unprofitable enterprise not being attractive to the trade, ten months elapsed before another arrangement could be carried into effect, and, therefore, No. 1 of vol. 2 was not published until April, 1820. The new arrangement was one of mutual responsibility for the expenses, but the Editor was constrained nevertheless to pledge his own personal credit to obtain from a bank the funds necessary to begin again, and from this responsibility he was, for a series of years, seldom released. The single volume per annum being found insufficient for the communications, two volumes a year were afterward published, commencing with the second volume.

The publishers whose names appear on the title page of the four numbers of the first volume are "J. Eastburn & Co., Literary Rooms, Broadway, New York" and Howe & Spalding, New Haven." For the second volume and those immediately following the corresponding statement "printed and published by S. Converse [New Haven] for the Editor."

Silliman adds (p. iv):

At the conclusion of vol. 10, in February, 1826, the work was again left upon the hands of its Editor; all its receipts had been absorbed by the expenses, and it became necessary now to pay a heavy sum to the retiring publisher, as an equivalent for his copies of previous volumes, as it was deemed necessary either to control the work entirely or to abandon it. The Editor was not willing to think of the latter, especially as he was encouraged by public approbation, and was cheered onward in his labors by eminent men both at home and abroad, and he saw distinctly that the Journal was rendering service not only to science and the arts, but to the reputation of his country. He reflected, moreover, that in almost every valuable enterprise perseverance in effort is necessary to success. He being now sole proprietor, a new arrangement was made for a single year, the publishers being at liberty, at the end of that time, to retire, and the Editor to resume the Journal should he prefer that course.

The latter alternative he adopted, taking upon himself the entire concern, including both the business and the editorial duties, and of course, all the correspondence and accounts. From that time the work has proceeded without interruption, two volumes per annum having been published for the last

twenty years; and its pecuniary claims ceased to be onerous, although its means have never been large. . . .

Later in the same preface he adds (p. xiv):

It may be interesting to our readers to know something of the patronage of the Journal. It has never reached one thousand paying subscribers, and has rarely exceeded seven or eight hundred—for many years it fluctuated between six and seven hundred.

It has been far from paying a reasonable editorial compensation; often it has paid nothing, and at present it does little more than pay its bills. The number of engravings and the extra labor in printer's composition, cause it to be an expensive work, while its patronage is limited.

It is difficult at this date to give any adequate statement of the amount of encouragement and active assistance given to Silliman by his scientific colleagues in New Haven and elsewhere—a subject earlier alluded to. It is fortunately possible, however, to acknowledge the generous aid received by the Journal in the early days from a source near at hand. It has already been noted in another place that the dawning activity of science at New Haven was recognized by the founding of the "Connecticut Academy of Arts and Sciences," formally established at New Haven in 1799 and the third scientific body to be organized in this country. From the beginning of the Journal in 1818, the Connecticut Academy freely gave its support both in papers for publication and at least on one occasion later it gave important financial aid. Upon the occasion of the celebration of the centennial anniversary of the Academy on October 11, 1899, Professor, later Governor, Baldwin, the president of the Academy, discusses this subject in some detail. He says in part:

To support his [Silliman's] undertaking, a vote had been passed in February [1818], "that the Committee of Publication may allow such of the Academy's papers as they think proper, to be published in Mr. Silliman's Scientific Journal."

Free use was made of this authority, and a large part of the contents of the Journal was for many years drawn from this source. In some cases this fact was noted in publication;² but in most it was not. . . .

² The following footnote accompanies the opening article of the first volume of the Journal. "From the MS. papers of the Connecticut Academy, now published by permission." Similar notes appear elsewhere. Ed.

In 1826, when the Journal was in great need of financial support, the Academy further voted to pay for a year the cost of printing such of its papers as might be published in it. In Baldwin's *Annals of Yale College*, published in 1831, it is described as a publication "honorable to the science of our common country," and having "an additional value as being adopted as the acknowledged organ of the Connecticut Academy of Arts and Sciences."

Many active campaigns were carried on over the country through paid agents to obtain new subscribers for the Journal and it was doubtless due to these efforts that the nominal subscription list was, at times, as already noted, relatively large as compared with that of a later date. The new subscribers in many cases, however, did not remain permanently interested, often failed to pay their bills, and the uncertain and varying demand upon the supply of printed copies was doubtless one reason why many single numbers became early out of print.

An interesting sidelight is thrown upon the efforts of Silliman to interest the public in his work, at its beginning, by a letter to the editor from Thomas Jefferson, then seventy-five years of age. The writer is indebted to Mr. Robert B. Adam of Buffalo for a copy of this letter and its interest justifies its being reproduced here entire. The letter is as follows:

Monticello, Apr. 11. '18.

Sir

The unlucky displacement of your letter of Mar 3 has been the cause of delay in my answer. altho' I have very generally withdrawn from subscribing to or reading periodical publications from the love of rest which age produces, yet I willingly subscribe to the journal you propose from a confidence that the talent with which it will be edited will entitle it to attention among the things of select reading for which alone I have time now left. be so good as to send it by mail, and the receipt of the 1st number will be considered as announcing that the work is commenced and the subscription money for a year shall be forwarded. Accept the assurance of my great esteem and respect.

Th. Jefferson

Professor Silliman.

Contributors.—An interesting summary is also given by Silliman of the contributors to the Journal and the extent of their work (vol. 50, pp. xii, xiii); he says:

We find that there have been about 600 contributors of original matter to the Journal, and we have the unexpected satisfaction of believing that probably five-sixths of them are still living; for we are not certain that more than fifty are among the dead; of perhaps fifty more we are without information. and if that additional number is to be enrolled among the “*stelligeri*,” we have still 500 remaining. Among them are not a few of the veterans with whom we began our career, and several of these are still active contributors. Shall we then conclude that the peaceful pursuits of knowledge are favorable to long life? This we think is, *cæteris paribus*, certainly true: but in the present instance, another reason can be assigned for the large amount of survivorship. As the Journal has advanced and death has removed its scientific contributors, younger men and men still younger, have recruited the ranks, and volunteers have enlisted in numbers constantly increasing, so that the flower of the host are now in the morning and meridian of life.

We have been constantly advancing, like a traveller from the equinoctial towards the colder zones,—as we have increased our latitude, stars have set and new stars have risen, while a few planetary orbs visible in every zone, have continued to cheer us on our course.

The number of articles, almost exclusively original, contained in the Journal is about 1800, and the Index will show how many have been contributed by each individual; we have doubtless included in this number *some few* articles republished from foreign Journals—but we think they are even more than counterbalanced by original communications without a name and by editorial articles, both of which have been generally omitted in the enumeration.

Of smaller articles and notices in the Miscellany, we have not made any enumeration, but they evidently are more numerous than the regular articles, and we presume that they may amount to at least 2500.

Of party, either in politics or religion, there is no trace in our work; of personalities there are none, except those that relate to priority of claims or other rights of individuals. Of these vindications the number is not great, and we could heartily have wished that there had been no occasion for any.

General Scope of Articles.—Many references will be found in the chapters following which throw light upon the character and scope of the papers published in the Journal, particularly in its early years; a few additional statements here may, however, prove of interest.

One feature that is especially noticeable is the frequent publication of articles planned to place before the readers of the *Journal* in full detail subjects to which they might not otherwise have access. These are sometimes translations; sometimes republications of articles that had already appeared in English periodicals; again, they are exhaustive and critical reviews of important memoirs or books. The value of this feature in the early history of the *Journal*, when the distribution of scientific literature had nothing of the thoroughness characteristic of recent years, is sufficiently obvious.

It is also interesting to note the long articles of geological description and others giving lists of mineral or botanical localities. Noteworthy, too, is the attempt to keep abreast of occurring phenomena as in the many notes on tornadoes and storms by Redfield, Loomis, etc.; on auroras at different localities; on shooting stars by Herrick, Olmstead and others.

The wide range of topics treated of is quite in accordance with the plan of the editor as given on an earlier page. Some notes, taken more or less at random, may serve to illustrate this point. An extended and quite technical discussion of "Musical Temperament" opens the first number (1, pp. 9-35) and is concluded in the same volume (pp. 176-199). An article on "Mystery" is given by Mark Hopkins A.M., "late a tutor of Williams College" (13, 217, 1828). There is an essay on "Gypsies" by J. Griscom (from the *Revue Encyclopédique*) in volume 24 (pp. 342-345, 1833), while some notes on American gypsies are added in vol. 26 (p. 189, 1834). The "divining rod" is described at length in vol. 11 (pp. 201-212, 1826), but without giving any comfort to the credulous; on the contrary the last paragraph states that "the pretensions of diviners are worthless, etc." A long article by J. Finch on the forts of Boston harbour appeared in 1824 (8, 338-348); the concluding paragraph seems worthy of quotation.

"Many centuries hence, if despotism without, or anarchy within, should cause the republican institutions of America to fade, then these fortresses ought to be destroyed, because they would be a constant reproach to the people; but until that period, they should be preserved as the noblest monuments of liberty."

The promise to include the fine arts is kept by the publication of various papers, as of the Trumbull paintings (16, 163, 1829); also by a series of articles on "architecture in the United States" (17, 99, 1830; 18, 218, 220, 1830) and others. Quite in another line is the paper by J. W. Gibbs (33, 324, 1838) on "Arabic words in English." A number of related linguistic papers by the same author are to be found in other volumes. Papers in pure mathematics are also not infrequent, though now not considered as falling within the field of the Journal.

Applied science takes a prominent place through all the volume of the First Series. An interesting paper is that on Eli Whitney, containing an account of the cotton gin; this is accompanied by an excellent portrait (21, 201-264, 1832). The steam engine and its application are repeatedly discussed and in the early volumes brief accounts are given of the early steamboats in use; for example, between Stockholm and St. Petersburg (2, 347, 1820); Trieste and Venice (4, 377, 1822); on the Swiss Lakes (6, 385, 1823). The voyage of the first Atlantic steamboat, the "Savannah," which crossed from Savannah to Liverpool in 1819, is described (38, 155, 1840); mention is also made of the "first iron boat" (3, 371, 1821; 5, 396, 1822). A number of interesting letters, on "Steam Navigation" are given in vol. 35, 160, 162, 332, 333, 336; some of the suggestions seem very quaint, viewed in the light of the experience of to-day.

A very early form of explosive engine is described at length by Samuel Morey (11, 104, 1826); this is an article that deserves mention in these days of gasoline motors. Even more interesting is the description by Charles Griswold (2, 94, 1820) of the first *submarine* invented by David Bushnell and used in the Revolutionary War in August, 1776. An account is also given of a dirigible balloon that may be fairly regarded as the original ancestor of the Zeppelin (see 11, 346, 1826). The whole subject of aerial navigation is treated at length by H. Strait (25, pp. 25, 26, 1834) and the expression of his hopes for the future deserve quotation:

"Conveyance by air can be easily rendered as safe as by water or land, and more cheap and speedy, while the universal and uniform diffusion of the air over every portion of the earth, will render aerial navigation preferable to any other. To

carry it into effect, there needs only an immediate appeal on a sufficiently large scale, to experiment; reason has done her part, when experiment does hers, nature will not refuse to sanction the whole. Aërial navigation will present the works of nature in all their charms; to commerce and the diffusion of knowledge, it will bring the most efficient aid, and it can thus be rendered serviceable to the whole human family."

A subject of quite another character is the first discussion of the properties of chloroform (chloric ether) and its use as an anæsthetic (Guthrie, **21**, 64, 405, 1832; **22**, 105, 1832; Levi Ives, **21**, 406). Further interesting communications are given of the first analyses of the gastric juice and the part played by it in the process of digestion. Dr. William Beaumont of St. Louis took advantage of a patient who through a gun-shot wound was left with a permanent opening into his stomach through which the gastric juice could be drawn off. The results of Dr. Beaumont and of Professor Robley Dunglison, to whom samples were submitted, are given in full in the life of Beaumont by Jesse S. Myer (St. Louis, 1912). The interest of the matter, so far as the Journal is concerned, is chiefly because Dr. Beaumont selected Professor Silliman as a chemist to whom samples for examination were also submitted. An account of Silliman's results is given in the Beaumont volume referred to (see also **26**, 193, 1834). Desiring the support of a chemist of wider experience in organic analysis, he also sent a sample through the Swedish consul to Berzelius in Stockholm. After some months the sample was received and it is interesting to note in a perfectly fresh condition; it is to be regretted, however, that the Swedish chemist failed to add anything to the results already obtained in this country (**27**, 40b, 1835).

The above list, which might be greatly extended, seems to leave little ground for the implied criticism replied to by Silliman as follows (**16**, p. v, 1829):

A celebrated scholar, while himself an editor, advised me, in a letter, to introduce into this Journal as much "*readable*" matter as possible: and there was, pretty early, an earnest but respectful recommendation in a Philadelphia paper, that Literature, in imitation of the London Quarterly Journal of Science, &c. should be in form, inscribed among the titles of the work.

THE SECOND, THIRD AND FOURTH SERIES.

The SECOND SERIES of the Journal, as already stated, began with January, 1846. Up to this time the publication had been a quarterly or two volumes annually of two numbers each. From 1846 until the completion of an additional fifty volumes in 1871, the Journal was made a bimonthly, each of the two yearly volumes having three numbers each. Furthermore, a general index was given for each period of five years, that is for every ten volumes.

Much more important than this change was the addition to the editorial staff of James Dwight Dana, Silliman's son-in-law. Dana returned from the four-years cruise of the Wilkes Exploring Expedition in 1842; he settled in New Haven, was married in 1844, and in 1850 was appointed Silliman professor of Geology in Yale College. He was at this time actively engaged in writing his three quarto reports for the Expedition and hence did not begin his active professional duties in Yale College until 1856. Part of his inaugural address was quoted on an earlier page.

Dana had already performed the severe labor of preparing the complete index to the First Series, a volume of about 350 pages, finally issued in 1847. From the beginning of the Second Series he was closely associated with his brother-in-law, the younger Silliman. Later the editorial labor devolved more and more upon him and the larger part of this he carried until about 1890. His work, was, however, somewhat interrupted during periods of ill health. This was conspicuously true during a year's absence in Europe in 1859-60, made necessary in the search for health; during these periods the editorial responsibility rested entirely upon the younger Silliman. Of Dana's contributions to science in general this is not the place to speak, nor is the present writer the one to dwell in detail upon his work for the Journal. This subject is to such an extent involved in the history of geology and zoology, the subjects of several succeeding chapters, that it is adequately presented in them.

It may, however, be worth stating that in the bibliography accompanying the obituary notice of Dana (49, 329-356, 1895) some 250 titles of articles in the Journal are enumerated; these aggregate approximately 2800

pages. The number of critical notes, abstracts, book reviews, etc., could be also given, were it worth while, but what is much more significant in this connection, than their number or aggregate length, is the fact that these notices are in a large number of cases—like those of Gray in botany—minutely critical and original in matter. They thus give the writer's own opinion on a multitude of different subjects. It was a great benefit to Dana, as it was to science also, that he had this prompt means at hand of putting before the public the results of his active brain, which continued to work unceasingly even in times of health prostration.

This may be the most convenient place to add that as Dana became gradually less able to carry the burden of the details involved in editing the Journal in addition to his more important scientific labors, particularly from 1890 on, this work devolved more and more upon his son, the present editor, whose name was added to the editorial staff in 1875, with volume 9, of the Third Series. The latter has served continuously until the present time, with the exception of absences, due to ill health, in 1893-94 and in 1903; during the first of these Professor Henry S. Williams and during the second Professor H. E. Gregory occupied the editorial chair.

The THIRD SERIES began in 1871, after the completion of the one-hundredth volume from the beginning in 1818. At this date the Journal was made a monthly and as such it remains to-day. Fifty volumes again completed this series, which closed in 1895.

The FOURTH SERIES began with January, 1896, and the present number for July, 1918, is the opening one of the forty-sixth volume or, in other words,—the one hundred and ninety-sixth volume of the entire issue since 1818. The Fourth Series, according to the precedent established, will end with 1920.

Associate Editors.—In 1851 the new policy was introduced of adding "Associate Editors" to the staff. The first of these was Dr. Wolcott Gibbs of Cambridge. He began his duties with the eleventh volume of the Second Series in 1851 and continued them with unceasing care and thoroughness for more than twenty years. In a note dated Jan. 1, 1851 (11, 105), he says:

It is my intention in future to prepare for the columns of this Journal abstracts of the more important physical and chemical memoirs contained in foreign scientific journals, accompanied by references, and by such critical observations as the occasion may demand. Contributions of a similar character from others will of course not be excluded by this arrangement, but I shall hold myself responsible only for those notices which appear over my initials.

The departments covered by Dr. Gibbs, in his excellent monthly contributions, embraced chemistry and physics, and these subjects were carried together until 1873 when they were separated and the physical notes were furnished, first by Alfred M. Mayer and later successively by E. C. Pickering (from 1874), J. P. Cooke (from 1877), and John Trowbridge (from 1880). The first instalment of the long series of notes in chemistry and chemical physics by George F. Barker, was printed in volume 50, 1870. He came in at first to occasionally relieve Dr. Gibbs, but soon took the entire responsibility. His name was placed among the associate editors on the cover in 1877 and two years later Dr. Gibbs formally retired. It may be added that from the beginning in 1851 to the present time, the notes in "Chemistry and Physics" have been continued almost without interruption.

The other departments of science have been also fully represented in the notes, abstracts of papers published, book notices, etc., of the successive numbers, but as with the chemistry and physics the subject of botany was long treated in a similar formal manner. For the notes in this department, the Journal was for many years indebted to Dr. Asa Gray, who became associate editor in 1853, two years after Gibbs, although he had been a not infrequent contributor for many years previously, Gray's contributions were furnished with great regularity and were always critical and original in matter. They formed indeed one of the most valuable features of the Journal for many years; as botanists well appreciate, and, as Professor Goodale has emphasized in his chapter on botany, Gray's notes are of vital importance in the history of the development of his subject. With Gray's retirement from active duty, his colleague, George W. Goodale, took up the work in 1888 and in 1895 William G. Farlow, also of Cambridge, was added as an associate editor in cryptogamic botany. At this time,

however, and indeed earlier, the sphere of the Journal had unavoidably contracted and botany perforce ceased to occupy the prominent place it had long done in the Journal pages.

This is not the place to present an appreciation of the truly magnificent work of Asa Gray. It may not be out of place, however, to call attention to the notice of Gray written for the Journal by his life-long friend, James D. Dana (35, 181, 1855). The opening paragraph is as follows:

“Our friend and associate, Asa Gray, the eminent botanist of America, the broad-minded student of nature, ended his life of unceasing and fruitful work on the 30th of January last. For thirty-five years he has been one of the editors of this Journal, and for more than fifty years one of its contributors; and through all his communications there is seen the profound and always delighted student, the accomplished writer, the just and genial critic, and as Darwin has well said, ‘The lovable man.’ ”

The third associate editor, following Gray, was Louis Agassiz, whose work for science, particularly in his adopted home in this country, calls for no praise here. His term of service extended from 1853 to 1866 and, particularly in the earlier years, his contributions were numerous and important. The next gentleman in the list was Waldo I. Burnett, of Boston, who served one year only, and then followed four of Dana’s colleagues in New Haven, of whose generosity and able assistance it would be impossible to say too much. These gentlemen were Brush in mineralogy; Johnson in chemistry, particularly on the agricultural side; Newton in mathematics and astronomy, whose contributions will be spoken of elsewhere; and Verrill—a student of Agassiz—in zoology.

All of these gentlemen, besides their frequent and important original articles, were ever ready not only to give needed advice, but also, to furnish brief communications, abstracts of papers and book reviews, and otherwise to aid in the work. Verrill particularly furnished the Journal a long list of original and important papers, chiefly in systematic zoology, extending from 1865 almost down to the present year. His abstracts and book notices also were numerous and trenchant and it is not too much to say that without him the Journal never could have filled the place in zoology which it so long held. Much later the list of New Haven men was

increased by the addition of Henry S. Williams (1894), and O. C. Marsh (1895).

Of the valuable work of those more or less closely associated in the conduct of the Journal at the present time, it would not be appropriate to speak in detail. It must suffice to say that the services rendered freely by them have been invaluable, and to their aid is due a large part of the success of the Journal, especially since the Fourth Series began in 1896. But even this statement is inadequate, for the editor-in-chief has had the generous assistance of other gentlemen, whose names have not been placed on the title page, and who have also played an important part in the conduct of the Journal. This policy, indeed, is not a matter of recent date. Very early in the First Series, Professor Griscom of Paris, as already noted, furnished notes of interesting scientific discoveries abroad. Other gentlemen have from time to time acted in the same capacity. The most prominent of them was Professor Jerome Nicklès of Nancy, France, who regularly furnished a series of valuable notes on varied subjects, chiefly from foreign sources, extending from 1852 to 1869. On the latter date he met an untimely death in his laboratory in connection with experiments upon hydrofluoric acid (47, 434, 1869).

It may be added, further, that one of the striking features about the Journal, especially in the earlier half century of its existence, is the personal nature of many of its contributions, which were very frequently in the form of letters written to Benjamin Silliman or J. D. Dana. This is perhaps but another reflection of the extent to which the growth of the magazine centered around these two men, whose wide acquaintance and broad scientific repute made of the Journal a natural place to record the new and interesting things that were being discovered in science.

The following list gives the names and dates of service, as recorded on the Journal title pages, of the gentlemen formally made Associate Editors:

Wolcott Gibbs	(2) 11, 1851 to (3) 18, 1879
Asa Gray	" 15, 1853 " " 34, 1887
Louis Agassiz	" 16, 1853 " (2) 41, 1866
Waldo I. Burnett	" 16, 1853 " " 17, 1853
George J. Brush	" 35, 1863 " (3) 18, 1879
Samuel W. Johnson	" 35, 1863 " " 18, 1879

Hubert A. Newton	(2)	38, 1864 to	(4)	1, 1896
Addison E. Verrill	"	47, 1869		
Alfred M. Mayer	(3)	5, 1873 to	(3)	6, 1873
Edward C. Pickering	"	7, 1874 " "		13, 1877
George F. Barker	"	14, 1877 " "	(4)	29, 1910
Josiah P. Cooke	"	14, 1877 " "	(3)	47, 1894
John Trowbridge	"	19, 1880		
George W. Goodale	"	35, 1888		
Henry S. Williams	"	47, 1894		
Henry P. Bowditch	"	49, 1895 to	(4)	8, 1899
William G. Farlow	"	49, 1895		
Othniel C. Marsh	"	49, 1895 to	(4)	6, 1899
Henry A. Rowland	(4)	1, 1896 " "		10, 1900
Joseph S. Diller	"	1, 1896		
Louis V. Pirsson	"	7, 1899		
William M. Davis	"	9, 1900		
Joseph S. Ames	"	12, 1901		
Horace L. Wells	"	18, 1904		
Herbert E. Gregory	"	18, 1904		
Horace S. Uhler	"	33, 1912		

PRESENT AND FUTURE CONDITIONS.

The field to be occupied by the "American Journal of Science and Arts," as seen by its founder in 1818 and presented by him in the first number, as quoted entire on an earlier page, was as broad as the entire sphere of science itself. It thus included all the departments of both pure and applied science and extended even to music and fine arts also. As the years went by, however, and the practical applications of science greatly increased, technical journals started up, and the necessity of cultivating this constantly expanding field diminished. It was not, however, until January, 1880, that "the Arts" ceased to be a part of the name by which the Journal was known.

About the same date also—or better a little earlier—began an increasing development of scientific research, particularly as fostered by the graduate schools of our prominent universities. The full presentation of this subject would require much space and is indeed unnecessary as the main facts must be distinct in the mind of the reader. It is only right, however, that the large part played in this movement by the Johns Hopkins University (founded in 1876) should be mentioned here.

As a result of this movement, which has been of great benefit in stimulating the growth of science in the

country, many new journals of specialized character have come into existence from time to time. Further localization and specialization of scientific publication have resulted from the increased activity of scientific societies and academies at numerous centers and the springing into existence thereby of new organs of publication through them, as also through certain of the Government Departments, the Carnegie Institution, and certain universities and museums.

As bearing upon this subject, the following list of the more prominent scientific periodicals started in this country since 1867 is not without interest:

- 1867- . American Naturalist.
- 1875- . Botanical Bulletin; later Botanical Gazette.
- 1879-1913. American Chemical Journal.
- 1880-1915. School of Mines Quarterly.
- 1883- . Science.
- 1885- . Journal of Heredity.
- 1887- . Journal of Morphology.
- 1887-1908. Technology Quarterly.
- 1888-1905. American Geologist.
- 1891- . Journal of Comparative Neurology.
- 1893- . Journal of Geology.
- 1893- . Physical Review.
- 1895- . Astrophysical Journal.
- 1896- . Journal of Physical Chemistry.
- 1896- . Terrestrial Magnetism.
- 1897-1899. Zoological Bulletin; followed by
- 1900- . Biological Bulletin.
- 1901- . American Journal of Anatomy.
- 1904- . Journal of Experimental Zoology.
- 1905- . Economic Geology.
- 1906- . Anatomical Record.
- 1907- . Journal of Economic Entomology.
- 1911- . Journal of Animal Behavior.
- 1914- . American Journal of Botany.
- 1916- . Genetics.
- 1918- . American Journal of Physical Anthropology.

The result of the whole movement has been of necessity to narrow, little by little, the sphere of a general scientific periodical such as the *Journal* has been from the beginning. The exact change might be studied in detail by tabulating as to subjects the contents of successive volumes, decade by decade, from 1870 down. It is sufficient, here, however, to recognize the general fact that while the number of original papers published in the periodicals of this country, in 1910, for example, was very

many times what it was in 1825, a large part of these have naturally found their home in periodicals devoted to the special subject dealt with in each case. That this movement will continue, though in lessened degree now that the immediate demand is measurably satisfied, is to be expected. At the same time it has not seemed wise, at any time in the past, to formally restrict the pages of the *Journal* to any single group of subjects. The future is before us and its problems will be met as they arise. At the moment, however, there seems to be still a place for a scientific monthly sufficiently broad to include original papers of important general bearing even if special in immediate subject. In this way it would seem that "*Silliman's Journal*" can best continue to meet the ideals of its honored founder, modified as they must be to meet the change of conditions which a century of scientific investigation and growth have wrought. Incidentally it is not out of place to add that a self-supporting, non-subsidized scientific periodical may hope to find a larger number of subscribers from among the workers in science and the libraries if it is not too restricted in scope.

The last subject touched upon introduces the essential matter of financial support without which no monthly publication can survive. With respect to the periodicals of recent birth, listed above, it is safe to say that some form of substantial support or subsidy—often very generous—is the rule, perhaps the universal one. This has never been the case with the *American Journal*. The liberality and broad-minded attitude of Yale College in the early days, and of the Yale University that has developed from it, have never been questioned. At the same time the special conditions have been such as to make it desirable that the responsibility of meeting the financial requirements should be carried by the editors-in-chief. At present the Yale Library gives adequate payment for certain publications received by the *Journal* in exchange, though for many years they were given to it as a matter of course, free of charge. Beyond this there is nothing approaching a subsidy.

The difficulties on the financial side met with by the elder Silliman have been suggested, although not adequately presented, in the various statements quoted from early volumes. The same problems in varying degree have continued for the past sixty years. Since 1914 they have been seriously aggravated for reasons that need not be

enlarged upon. Prior to that date the subscription list had, for reasons chiefly involved in the development of special journals, been much smaller than the number estimated by Silliman, for example, in volume 50 (p. xiv), although there has been this partial compensation that the considerable number of well-established libraries on the subscription list has meant a greater degree of stability and a smaller proportion of bad accounts. The past four years, however, the Journal, with all similar undertakings here and elsewhere, has been compelled to bear its share of the burden of the world war in diminished receipts and greatly increased expenses. It is gratifying to be able to acknowledge here the generosity of the authors, or of the laboratories with which they have been connected, in their willingness not infrequently to give assistance, for example, in the payment of more or less of the cost of engravings, or in a few special cases a large portion of the total cost of publication. In this way the problem of ways and means, constantly before the editor who bears the sole responsibility, has been simplified.

It should also be stated that as those immediately interested have looked forward to the present anniversary, it has been with the hope that this occasion might be an appropriate one for the establishment of a "Silliman Fund" to commemorate the life and work of Benjamin Silliman. The income of such a fund would lift from the University the burden that must unavoidably fall upon it when the responsibility for the conduct of the Journal can no longer be carried by members of the family including the editor and—as in years long past—a silent partner whose aid on the business side has been essential to the efficiency and economy of the enterprise. Present conditions are not favorable for such a movement, although some thing has been already accomplished in the desired direction. At the present time every patriotic citizen must feel it his first duty to give his savings as well as his spare income to the support of the National Government in the world struggle for freedom in which it is taking part. But, whatever the exact condition of the future may be, it cannot be questioned that the Journal founded by Benjamin Silliman in 1818 will survive and will continue to play a vital part in the support and further development of science.

The present year of 1918 finds the world at large, and

with it the world of science, painfully crushed beneath the overwhelming weight of a world war of unprecedented severity. The four terrible years now nearly finished have seen a fearful destruction of life and property which must have a sad influence on the progress of science for many years to come. Only in certain restricted lines has there been a partial compensation in the stimulating influence due to the immediate necessities connected with the great conflict. One hundred years ago "the reign of war" was keenly in the mind of the editor in beginning his work, but for him, happily, the long period of the Napoleonic wars was already in the past, as also the brief conflict of 1812, in which this country was engaged and in which Silliman himself played a minor part. We, too, must believe, no matter how serious the outlook of the present moment, that a fundamental change will come in the not distant future; the nations of the world must sooner or later turn once more to peaceful pursuits and the scientific men of different races must become again not enemies but brothers engaged in the common cause of uplifting human life. The peace that we look forward to to-day is not for this country alone, but a peace which shall be a permanent blessing to the entire world for ages to come.

NOTE.—The portrait which forms the frontispiece of the present number has been reproduced from the plate in volume 50 (1847). The original painting was made by H. Willard in 1835, when Silliman was in Boston, engaged in delivering the Lowell lectures; he was then nearly fifty-six years of age. The engraving, as he states elsewhere, was made from this painting for the Yale Literary Magazine, and was published in the number for December, 1839.

It is interesting to quote the remarks with which the editor introduces the portrait (50, xviii, 1847). He says:

The portrait prefixed to this volume was engraved for a very different purpose and for others than the patrons of this Journal. It has been suggested by friends, whose judgment we are accustomed to respect, that it ought to find a place here, since it is regarded as an authentic, although, perhaps, a rather austere resemblance. In yielding to this suggestion, it may be sufficient to quote the sentiment of Cowper on a similar occasion, who remarked—"that after a man has, for many years, turned his mind *inside out* before the world, it is only affectation to attempt to hide his face."