toward scientific training became national, the prospective institutions were sufficiently endowed for the initiatory stages, and each was free to suit its organization to the wants of its locality; the scientific schools previously established had been organized and developed in accordance with strict scientific principles, and their example afforded a powerful opposition to the influences which tended to hold the new schools to a lifeless routine of mechanical exercises on the one hand or to a feeble modification of the methods of classical colleges on the other. The reports of the year indicate that the future of these institutions as schools of applied science, conducted according to the laws of intellectual progress and directed 'to the liberal and practical education of the industrial classes' is assured, and that in the main the character of each school is to be determined by the material condition of the section in which it is placed. Thus, in the East, the tendency is to the training of engineers and scientific experts; in the great agricultural section of the West and South, agriculture and horticulture receive most attention; while in the mineral region of the Pacific section mining and metallurgy are made prominent; but even where these special tendencies are marked, other branches of scientific and industrial instruction have received attention proportionate to the demand."

Interesting facts are presented illustrating the practical advantage of these institutions to our industrial progress. The Commissioner adds that there has been marked advance in the general organization of these schools and in their preparation for efficient work in science and mechanics.

SCHOOLS OF MEDICINE.

The number of schools of medicine, dentistry, and pharmacy reported to the Bureau during the year was 106. These had 1,337 instructors and 11,830 students. The regular school of medicine and surgery reported 64 institutions, 915 instructors, 8,279 students, 2,506 graduates, 46,065 volumes in libraries, $1,685,250 in grounds, buildings, and apparatus, $214,347 of productive funds, yielding an income of $13,186, and tuition receipts to the amount of $289,398. The eclectics reported 6 institutions, 51 instructors, 448 students, 211 graduates, 3,000 volumes in libraries, $161,000 in grounds, buildings, and apparatus, and $8,960 receipts from tuition. The homœopathists reported 11 schools, 158 instructors, 1,215 students, 363 graduates, 39,800 volumes in libraries, $349,000 in grounds, buildings, and apparatus, and $95,471 receipts from tuition fees.

The dental schools report as follows: number, 12; instructors, 161; students, 701; graduates, 218; volumes in libraries, 505; value of grounds, buildings, and apparatus, $68,000; receipts from tuition fees, $60,734.

The pharmaceutical schools number 13; instructors, 52; students, 1,187; graduates, 380; volumes in libraries, 5,175; value of grounds, buildings and apparatus, $155,000; receipts from tuition fees, $25,487.

COLLEGIATE AND PROFESSIONAL DEGREES.

"This Office," says the Commissioner, "is informed that the better colleges and universities of the country are becoming increasingly careful in the bestowal of honorary degrees. At the same time it is well known that the sale of diplomas by persons who have obtained control of collegiate and university charters by purchase or fraud is still going on. This disgraceful proceeding has already injured the reputation of American learning and the value of American degrees in other countries; but the Federal Government did not create the corporations which are causing this scandal and has no power to cancel their charters. It is for the authorities of the State to move in the matter and thus vindicate the honor of the nation and of American scholars."

The following summary of degrees in course and honorary conferred by reputable institutions of learning needs no further explanation:

The number of degrees of all classes conferred was, in course, 9,999, honorary, 396, divided as follows: letters, in course, 3,631, honorary, 114; science, in course, 990, honorary, 6; philosophy, in course, 222, honorary, 31; art, in course, 46; theology, in course, 222, honorary, 159; medicine, in course, 3,814, honorary, 4; law, in course, 1,000, honorary, 78. Of these degrees, classical and scientific colleges conferred 6,367 in course and 388 honorary; colleges for women, 674 in course and 1 honorary; professional schools, 2,958 in course and 7 honorary.

EDUCATIONAL BENEFACTIONS.

The total amount of educational benefactions is $3,103,289, which is distributed as follows: universities, and colleges, $1,389,633; schools of science, $49,280; schools of theology, $397,852; schools of law, $100,000; schools of medicine, $18,562; institutions for the superior instruction of women, $241,820; preparatory schools, $97,191; institutions for secondary instruction, $759,817; institutions for the deaf and dumb, $49,134.

EDUCATIONAL BENEFACTIONS.

During the year 1878 the sum of $3,103,298 was presented to various educational establishments in the United States by private individuals.

Of this sum $1,389,633 were placed at the disposal of universities and colleges. We regret to find that while Theology received nearly $400,000, but $49,280 were devoted to Science, and $18,562 to Medicine. Schools of Law received $100,000. The deaf and dumb received about the same amount as Science.

The University of California received $125,000, $25,000 to build a library building, and $50,000 to purchase books. This amount did not include a collection of works of art and a library valued at $50,000.

Yale College received $189,590. Boston University $30,000 towards the purchase of the Shepard Collection of minerals. From various sources Harvard University received $177,207; Dartmouth College, $35,000: Cornell University, $27,663; Union College, N. Y., $84,000; Oberlin College, O., $25,000; University of Virginia, $50,000 to endow School of Geology and Natural History; Wellesley College, $155,000; Thayer Academy, Mass., $417,000; Deerfield Academy, Mass., $88,000; Dean Academy, $38,000.

PALÆONTOLOGY.

THE DEVONIAN INSECTS OF NEW BRUNSWICK.

In a memoir, on the Insects in the Devonian of New Brunswick, Mr. S. H. Scudder draws the following conclusions in regard to the earliest known insects:

"It only remains to sum up the results of this re-examination of the Devonian Insects, and especially to discuss their relation to later or now existing types. This may best be done by a separate consideration of the following points:

"There is nothing in the structure of these earliest known insects to interfere with a former conclusion that the general type of wing structure has remained unaltered from the earliest times. Three of these six insects (Gerephemera, Homothetus, Xenoneura) have been shown to possess a very peculiar neuration, dissimilar from both Carboniferous and modern types. As will also be shown under the tenth head, the dissimilarity of structure of all the Devonian Insects is much greater than would be anticipated; yet all the features of neuration can be brought into perfect harmony with the system laid down by Heer.

"The earliest insects were Hexapods, and as far as the record goes, preceded in time both Arachnids and Myriapods.

"They were all lower Heterometabola.

"They are all allied or belong to the Neuroptera, using the word in its widest sense.

"Nearly all are synthetic types of comparatively narrow range.

"Nearly all bear marks of affinity to the Carboniferous Palæodictyoptera, either in the reticulated surface of the wing, its longitudinal neuration, or both.

"On the other hand they are often of more and not less complicated structure than most Palæodictyoptera.

"With the exception of the general statement under the fifth head they bear little special relation to Carboniferous forms, having a distinct facies of their own.

"The Devonian Insects were of great size, had membran

ous wings and were probably aquatic in early life. The last statement is simply inferred from the fact that all the modern types most nearly allied to them are now aquatic.

"Some of the Devonian Insects are plainly precursors of existing forms, while others seem to have left no trace. The best examples of the former are Platephemera, an aberrant form of an existing family; and Homothetus which, while totally different in the combination of its characters from anything known among living or fossil insects, is the only Palæozoic insect possessing that peculiar arrangement of veins found at the base of the wings in Odonata typified by the arculus, a structure previously known only as early as the Jurassic. Examples of the latter are Gerephemera, which has a multiplicity of simple parallel veins next the costal margin of the wing, such as no other insect ancient or modern is known to possess; and Xenoneura, were the relationship of the internomedian branches to each other and to the rest of the wing is altogether abnormal.

"If, too, the concentric ridges, formerly interpreted by me as possibly representing a stridulating organ, should eventually be proved an actual part of the wing, we should have here a structure which has never since been repeated even in any modified form.

"They show a remarkable variety of structure, indicating an abundance of insect life at that epoch.

"The Devonian Insects also differ remarkably from all other known types, ancient or modern; and some of them appear to be even more complicated than their nearest living allies.

"We appear, therefore, to be no nearer the beginning of things in the Devonian epoch than in the Carboniferous, so far as either greater unity or simplicity of structure is concerned; and these earlier forms cannot be used to any better advantage than the Carboniferous types in support of any special theory of the origin of insects.

"Finally, while there are some forms which, to some degree, bear out expectations based on the general derivative hypothesis of structural development, there are quite as many which are altogether unexpected, and cannot be explained by that theory without involving suppositions for which no facts can at present be adduced."

MICROSCOPY.

Mr. W. H. Bullock, of Chicago, the maker of the microscope for lithological work described by us in Vol. I, No. 21 of SCIENCE, writes to us, objecting to an editorial remark, that the arrangement of the polariscope for instant use, claimed as a novelty by Mr. Bullock, had been used in the same position by Swift, of London, for many years.

Mr. Bullock admits the accuracy of this statement, but now sends details, as evidence, that he has shown considerable ingenuity in arranging his analyzing prism, "mounting it in such a manner, that it can be turned round 90 degrees, so that when the lower prism is at the spring stop or zero point, and the upper prism is pushed into position with the indicator forward, the prisms are parallel, and upon its being turned back or revolved 90 degrees the prisms are crossed." "The lower prism is also arranged differently to that used by Swift; it can be fitted either to the sub-stage or used in the supplementary sub-stage, and thus used close under the stage, so that no light can reach the object under observation, except that which passes through the lower prism." Mr. Bullock also notices other improvements which must render the instrument very perfect for the purposes for which it was designed, namely, lithological work.

Mr. Bullock sends a photograph of this microscope and we readily admit that it appears to be an excellent instrument; of the workmanship we are, of course, unable to speak, but probably the reputation of Mr. Bullock is sufficient guarantee in this respect.

NEW YORK ACADEMY OF SCIENCES.—Section of Chemistry.—Monday Evening, December 13, 1880, at 8 o'clock, the following paper, by Dr. HENRY A. MOTT, is announced:—Chemical Decomposition incited by a Cold Fluid Stratum floating on a Warm Liquid.

ASTRONOMY.

JUPITER.

MOTION OF SPOTS ON HIS SURFACE.

Jupiter, always enigmatical, has, since the appearance of the great red spot in his Southern hemisphere, become more and more perplexing. It was supposed this object would afford a ready means of determining Jupiter's true period of rotation. It has not done this, but has certainly led to the development of many interesting facts, one of which is that no period can be determined, because there are not two parts of the planet's visible surface which rotate in equal times. It would seem reasonable that any two points on the same parallel of latitude and in the same hemisphere must necessarily rotate with equal velocities; this does not even hold good. Could we be placed in such a position that the rotation of the planet would not visibly change the position of objects on his surface, we should still see the spots moving not only with different velocities, but in contrary directions. Spots very rarely change their latitude, as the very great axial rotation of Jupiter confines their motion to a parallel with his equator. In Jupiter's Southern hemisphere are two or three small dusky oblong spots. The most distinct of these I first observed on the morning of July 25, 1880, (see *English Mechanic*, No, 804, where an engraving showing its position is given). This group of small spots lies on a parallel of latitude about even with the Southern edge of the great red spot. On July 25, the centre of the first observed of the spots preceded the centre of the large spot by 1h. 35m. Since that date the red spot has been observed constantly, and the small one frequently. Up to November 23, thirty-five transits of the great spot across the central meridian, and nine of the smaller have been carefully observed. On November 22, the small spot preceded the greater by 3h. 17m. The interval between their transits having increased 1h. 42m. since July 25. The large spot has moved backward, compared with the direction of rotation, making its transit on November 22 occur 49m. later than on July 25, while the small spot came to its transit 53m. earlier than on July 25, showing that the two are moving with nearly the same velocity, but in opposite directions. The mean daily drift backward of the great spot since July 25 has been 0.40245m, while the forward motion of the small spot has been, during the same period, 0.43948m per day. It will be seen from this that a rotation derived from the small spot would indicate a quicker period than that derived from the large red spot.

From the observations of July 25 and Nov. 22, the great spot rotates in 9h. 55m. 37.065s., and the small one in 9h. 55 m.16.176s. The mean rotation of the two is 9h. 55m. 26.621s. A reduction of all the observations on hand will, doubtless, slightly change these figures. It would be well for observers to watch this small spot, as it may last as long as the large one. If it should continue permanent, it will eventually make the circuit of Jupiter and meet the red spot; this would occur about the middle of February, 1882.

But the motion of these two objects is very slow compared with the rapidly moving black spots which appeared just north of the equatorial belt on the last of October. But as attention has already been called to these remarkable objects by Messrs. Dennett, Williams and Denning, in *English Mechanic*, No. 816, I will not refer to them here, further than to say that they have been observed and sketched as often as the weather would permit since their first appearance. The region occupied by the great equatorial belt is subject to constant and quite rapid change, being filled at times with the most delicately soft plumey forms. Brilliant white spots are not unfrequent in this zone. These bright spots generally appear as intensely white heads, followed by a light, diffused and fainter train. Sometimes this train is composed of light,