ume, and the arrangements for ballast are improved, with a higher power, it should give even a better performance than the first, with a greater range of action. Most of the maneuvers are worked by automobile steering wheels placed near the pilot. The floor of the nacelle is of steel plate. While building at Moisson the construction has been kept secret for the most part. The most recent reports state that the new airship is now entirely finished, and it is filled up with gas by a corps of military aeronauts commanded by an officer. Then the first trials will be made on all the different parts so as to show what modifications may be needed. After these are made the final tests will take place, probably near the first of December. Then the Minister of War will take possession of the airship, as has been agreed upon, when it will have been put in perfect shape by Messrs. Lebaudy. It is to be known as the "Patrie," while the other will keep the name of "Lebaudy," and will be allotted to the fortified post of Verdun. Here will be established a well-fitted airship park which will be much more complete than the temporary one first set up at the Toul fortress. A third airship will no doubt be built, and will be called the "Republique."

NATIONAL ACADEMY OF SCIENCES.

BOSTON MEETING.

BY WILLIAM H. HALE.

The meeting of the National Academy of Sciences at Boston, November 20 to 22, was notable in several respects. A majority of all the members of the Academy were present; forty-three papers were presented, so that both in attendance and number of papers all previous records were broken; and also a new and interesting feature was added in the conversazione, which means, as they use the word here, not merely a social gathering, such as the conversazione to which the British Association for the Advancement of Science has long been accustomed, but a collection of most interesting and instructive exhibits showing the latest phases of scientific research in many departments. Boston may well claim to be the best place in the world to hold a scientific meeting, and the sessions were held in the most delightful environment possible—the new group of marble palaces just opened for the Harvard Medical College.

With so much of interest to describe and report, no exhaustive account is practicable. The topics presented cover a wide range, from the evolution of the universe to the measurement of waves of electrical energy of the wireless telegraph, of but one or two millionths of a second duration. A very curious and novel theory as to the extent and nature of the stellar system was advanced by Prof. George C. Comstock, to the effect that there is something which quenches light coming from the regions outside the milky way than from the milky way itself; hence, that the bright stars in the latter may not really be larger than the faint ones outside; the small apparent motion of these stars is due to the fact that they are drifting in the same general direction as our sun; and there is reason to believe that the universe is infinite.

Dr. George E. Hale exhibited photographs of the sun taken at the Carnegie Institution in California, and discussed solar spectra and their bearing on stellar evolution. Photographs taken by the incandescent calcium vapor at different heights surrounding sun spots show that the atmosphere is hotter in its lower and cooler in its higher strata. It is also found that the temperature of sun spots is so much cooler than that of the surrounding atmosphere as to allow elements elsewhere dissociated to combine, notably oxygen and titanium, as the spectrum shows the presence of oxide of titanium in the sun spots. A similar evolution has taken place in the stars.

Prof. William H. Pickering demonstrated by a gyroscope the solution of a problem which has long perplexed astronomers—why the tenth satellite of Saturn has a retrograde revolution. This is really the original direction of revolution, but the other satellites and all but one of the planets of the solar system have been caused to change the original direction by the friction of the annual tide which in the course of ages has caused the axis of our earth, as well as of the other planets and satellites to turn clear around, causing the rotation to be opposite to its original direction. By imitating this tidal friction—producing an artificial tide on the gyroscope—Prof. Pickering caused a similar inversion of the gyroscope.

Prof. Bailey Willis discussed heterogeneous elements of the North American continent, indicating that this continent has had five elevations and four submergences.

Prof. Henry F. Osborn spoke of the American tertiaries, pointing out seven different successive changes of fauna due to the making or severing connections with different continents, so that North America has in turn been stocked from South America, Africa, again South America, and finally Europe, giving us from the last the types now prevalent.

Prof. Charles S. Van Hise gave an explanation of the origin of the ores of the cobalt-silver district of Ontario—the Nipissing mine, etc. This is the first discovery of cobalt of any extent in America; the only other important cobalt mines are in Saxony. The wonderful richness of the Ontario mines of cobalt and silver is attributed to the fact that the veins were filled as a result of two and in some cases of three successive concentrations.

It was well worth a journey to Boston to hear Dr. Charles S. Minot discourse on the nature and causes of old age. He began by saying that a German philosopher who told a visitor in the course of a short visit all the system of philosophy which it had taken him a lifetime to work out was angry that his guest could not master in so short a time what it had taken him a lifetime to acquire. Dr. Minot expressed much the same feeling at being expected to explain in a few minutes what it had taken him as many years to discover. Senescence, as he explained it, begins even before birth. The percentage of growth of an infant in comparison with its whole body rapidly diminishes. Guinea pigs as soon as they recover from the shock of being born, grow at the rate of 5 per cent a day, but at the end of the first month this rate has fallen to 1 per cent a day. Rabbits are born in a less fully developed condition, and they grow 17 per cent for the male and 16 per cent for the female at birth, which decreases to 5 per cent after one month and to 1 per cent after two months. But the rate in growth is many fold greater before birth. On the ninth day, immediately after the segmentation of the ovum is complete, the fœtus increases in weight 1,000 per cent, but this rate rapidly decreases. On the eighteenth day, the cells have differentiated in the different organs, and they are seen to have a thin coating of protoplasm. The differentiation of the cells continues to progress and the amount of enveloping protoplasm to increase. These two kinds of change are all that Dr. Minot has been able to discover; in other words, they are all that we know as to the changes which accompany increasing age. It is these changes in cell structure, then, that continue to progress as age increases and which constitute growing old or senescence, so far as we know anything about it. The only period of rejuvenation is the brief time occupied by the segmentation of the ovum immediately after impregnation. Senescence, therefore, begins long before birth.

The Alpha and Omega of the programme was Alexander Graham Bell on aerodromics, his name occupying both the first and the last place. He read only one of the papers, however, in which he gave an historical account of the development of aerial navigation, and described the form of apparatus on which he is now experimenting in Nova Scotia. He said that the problem was really solved by Langley in 1896, when he constructed a machine which actually did fly, for Bell saw it. Langley's later and more elaborate machine was unduly discredited because it never was actually launched, and so it never had a fair chance.

The discouraging factor of aerodromics is the well-known mathematical formula that the sustaining surface of a machine increases only as the square of its dimension, whereas its weight increases as the cube. If, then, you build your large machine in the same form as a small and successful model, it soon becomes too heavy to rise at all. To meet this difficulty, Dr. Bell decided to fasten together many small supporting surfaces. By this means he could increase the supporting surface at just the same rate as the weight. The best units are tetrahedra, with two faces covered and one face and the base open. These are made about double the size of samples which he passed around; probably about eight inches long on each edge. His first thought was to connect a set of these by their corners and to alternate this construction with open spaces; but he found that it was practicable to build up large masses of these units compactly, giving a great supporting power, combined with strength and lightness. The edges are of aluminium. The structure constitutes a sort of kite, using that word as a suitably descriptive one, but of course not at all in the nature of the old-fashioned simple flying toy.

In order to avoid needless risk of life, he uses his structures on water or at slight elevations, and kept captive. He finds it practicable to go at as low a rate as ten miles an hour, instead of the kilometer a minute, nearly thirty-seven miles an hour, at which the Wright brothers operated their machine in Dayton, Ohio. Apparently this high rate of speed was necessary to keep the machine in the air. He found also very recently that he could move his machine against a rather brisk breeze for the reason that it is heavier than the air, and momentum is the combined product of weight and velocity.

On archeology, Prof. Charles P. Bowditch gave an extremely interesting account of the temples of the cross, of the foliated cross and of the sun at Palenque, Mexico, which showed a high degree of accuracy of knowledge as to periods of revolution of the earth and the planets Mars and Venus.

Ellsworth Huntington, who has recently returned from a tour of three thousand miles in Central Asia, presented evidence to prove that the climate of Chinese Turkestan has greatly increased in aridity in recent times. He showed photographs of villages inhabited from fifteen hundred to two thousand years ago, and necessarily requiring abundant supply of water, which were now in ruins, and very remote from water, in some cases as far as sixty miles.

Prof. Joseph Barrell showed how a comparison of sedimentary rocks over a continental area may enable us to discover what were climatic conditions in geologic ages. Periods of great rainfall were characterized by large areas of fresh-water sedimentation, and those of small rainfall by a greater proportion of marine deposits. The inclosed fossils indicate whether they were organisms of marine or of fresh-water life. He stated also that about one-tenth of the earth's present land surface is desert.

Dr. R. S. Woodward exhibited and explained a double suspension pendulum, devised especially in order to determine the rate of acceleration of the speed of a falling body. He avoids defects of previous pendulums, especially the knife-edge. His invention vibrates more steadily than the pendulums of the best astronomical clocks.

POINTS ABOUT NEEDLES.

BY H. R. CHRISTY.

One needle is a pretty small item, but the daily consumption of something like 3,000,000 needles all over the world makes a pretty big total. Every year the women of the United States break, lose, and use about 300,000,000 of these little instruments.

Our needles are the finished products of American ingenuity, skill and workmanship, and yet how many people, threading a needle or taking a stitch, have ever given a thought to the various processes through which the wire must pass ere it comes out a needle? The manufacture of a single needle includes some twenty-one or twenty-two different processes, as follows: Cutting the wire into lengths; straightening, by rubbing while heated; pointing the ends on grindstones; stamping impression for the eyes; grooving; eying, the eye being pierced by screw presses; splitting, threading the double needle by the eyes on short lengths of fine wire; filing, removing the "cheek" left on each side of the eye by stamping; breaking, separating the two needles on the one length of wire; heading, heads filed and smoothed to remove the burr left by stamping and breaking; hardening in oil, the needle is thus made brittle; tempering; picking, separating those crooked in hardening; straightening the crooked ones; scouring and polishing; bluing, softening the eyes by heat; drilling or cleaning out the sides of the eye; head-grinding; point-setting, or the final sharpening; final polishing; then papering, and finally, labeling. For wrapping, purple paper is used, because it prevents rusting.

There are many sorts and kinds of needles: First, there is the surgeon's gruesome outfit—the probing needle, made for tracking bullets or hidden cavities of pus; the hairlip needle, the long pins for pinning open wounds, the post-mortem needle of curious pattern. Some of these little instruments are thin, some are thick; others are long and straight; others, again, curve once, twice or three times. The veterinary surgeon has his special outfit also. The cook's needles are wonderfully, fearfully made. His larding needle is used to sew large pieces of meat together. The trussing needle is made on purpose to insert melted butter or sauce right into the vitals of a Christmas turkey. It is hollow, and has a large opening into which the sauce is poured. Nor less interesting are the needles which the upholsterer uses. Some are half curved, and some have round points. He has needles with curious eyes—long, round, egg, and counter-sunk eyes; the same kinds of needles are used by collar-makers. Then there are the delicate needles used by wig makers, glove makers, and weavers; these are often as fine as a hair. The glove needles are splendid specimens of skillful workmanship; the finest of them have three-cornered points. The great sail needle, which has to be pushed with a steel palm, would puzzle most people; so, too, the broom-maker's needle, which must also be pushed with a steel palm. The curious knitting-machine needle, with its latchet; the arrasene and crewel needles, and the needle for shirring machines; the weaver's pin for picking up broken threads, with an open eye in the hook. The long instrument used by milliners, the needle of the rag-baler, the knife-point ham needle used in the stock yards, the astrakhan needle—these and other varieties do not call for special notice.

The needle, as we see it to-day, is the evolved product of centuries of invention. In its primitive form it was made of bone, ivory, or wood. The making of Spanish needles was introduced into England during the reign of Queen Elizabeth. Point by point the manufacture has improved, until the little instrument is one of the highly-finished products of nineteenth century machinery and skill.