dam and Rotterdam. At Hamburg it has almost quadrupled. In 1871, Liverpool took the lead with 3,300,000 tons, then came London with 3,100,000 tons, all the other ports being far in the rear. Antwerp, Hamburg and Marseilles received but 1,800,000 tons. London has surpassed Liverpool since 1875; and Antwerp and Hamburg also surpassed it in 1893. Antwerp even took second place in 1897, but yielded it to Hamburg in 1898. The increase of tonnage is due especially to the increase in the dimensions of vessels. From 1871 to 1898 the actual number of vessels has diminished for the ports of Marseilles, Havre, Genoa and Liverpool; it has increased at least 12 per cent for Bremen, Trieste, Antwerp, Amsterdam, and 27 per cent for London; for Rotterdam it has increased 65 per cent, and for Hamburg 90 per cent.

THE HEAVENS IN OCTOBER.

BY HENRY NORRIS RUSSELL, PH.D.

The planets which show so brightly in the evening skies are passing out of sight toward the sun, and the shortening days and the chilly air are no clearer signs of the arrival of autumn than is the appearance above the eastern horizon of the advance guard of the familiar winter constellations.

At 9 P. M. on October 15, Taurus is well above the eastern horizon, recognized unmistakably at once by the Pleiades, below which is the equally distinctive but perhaps less familiar group of the Hyades in form of a V lying on its side. At its lower extremity is the brilliant red Aldebaran, which marks the eye of the Bull, and between this and the point of the V is the pretty double star Theta Tauri, which is easily divided by an ordinarily good eye, the component stars being about 5½ minutes of arc apart. It seems almost incredible, however, when looking at the stars that their distance is over one-sixth of the moon's apparent diameter, but such is actually the case, as the moon's diameter averages about 31 minutes of arc.

North of Taurus is Auriga, the charioteer, marked by the bright yellowish star Capella, whose spectrum shows it to be very much like our sun in constitution.

Above and to the right of Taurus an oblique triangle of moderately bright stars forms the head of Aries, and further north is the conspicuous constellation Perseus, in the Milky Way, with Cassiopeia higher up.

A little east of the zenith is the great square of Pegasus, between which and Perseus is Andromeda.

Almost the whole of the southeastern sky is filled with the huge shapeless mass of Cetus. The head of the monster is marked by an irregular pentagon of stars almost below Aries, while Beta, the brightest star in the constellation, stands almost alone, a little to the left of the southward extension of the eastern edge of the great square of Pegasus. The two lowest stars of the head, with another smaller one below, form an obtuse angle triangle, not unlike the head of Aries, and the longest side of this triangle, if extended to the right for a little less than its own length, points out the remarkable variable star Mira, the first object of the kind known. For most of the time it is of the ninth magnitude and entirely invisible to the unaided eye, but at intervals of about eleven months it brightens up enormously, becoming occasionally the brightest star in the constellation, and being in such a case about 1,000 times as bright as at its minimum. It usually remains visible to the naked eye for about six weeks. The star is now approaching a maximum, which will afford a good chance to watch its light without losing sleep for the purpose.

The only other conspicuous object in the southern sky is Fomalhaut, a lonely bright star, low down near the meridian, belonging to the constellation of the Southern Fish.

West of the zenith are Cygnus, Lyra, and Aquila, Hercules and Ophiucus are lower down, and in the north the Dipper is swinging low, with the pointers almost under the pole.

THE PLANETS.

Mercury is evening star in Virgo and Libra throughout the month. On the 29th he reaches his greatest eastern elongation, but is not favorably placed for observation, being very far south and setting less than an hour after the sun.

Venus is morning star in Cancer and Leo, rising about three hours and a half before sunrise throughout the month. She is still very much brighter than anything else in the morning sky, though her light is not much more than half what it was in August. Mars is morning star in Cancer, rising before 1 A. M. and gradually, but slowly, increasing in brightness as the earth overtakes him.

Jupiter is evening star in Scorpio. By the middle of the month he sets at 8 P.M. and before its close he can only be seen in the twilight.

Saturn is also evening star in Sagittarius, setting about 9 P. M. in the middle of the month.

Uranus too is evening star. On the 19th he is in conjunction with Jupiter, being less than half a degree south of the latter, and could be easily identified with a field-glass, were it not that both planets are very low in the twilight.

Neptune is in Taurus, rising about 9 P.M., but it is always invisible to the naked eye.

THE MOON.

First quarter occurs on the evening of the 1st, full moon on the morning of the 8th, last quarter on the night of the 14th, new moon on the morning of the 23d, and first quarter again on the night of the 30th. The moon is nearest the earth on the 7th, and farthest from it on the 20th. She is in conjunction with Neptune on the morning of the 13th, with Mars on the evening of the 16th, with Venus on the afternoon of the 19th, with Mercury on the morning of the 25th, with Uranus and Jupiter on the afternoon of the 26th, when an occultation of Jupiter will be visible in the Western States, and with Saturn on the morning of the 28th.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The first and most obvious difference between the American and British meetings is the great prominence given to the meeting here by press and people. All the newspapers in the United Kingdom teem with full reports of the proceedings, while the local papers give many full pages daily to the reports.

The attendance of members and associates exceeded nineteen hundred. Many papers of great scientific interest were presented, beginning with the address of the president, Sir William Turner,* and the several presidents of sections.

Prof. Turner discussed at length the problem of cell life in organisms both animal and vegetable, but his address has been already published in full, so I need not attempt to summarize it.

Probably the boldest of the addresses of presidents of sections was that of Prof. W. J. Sollas to the geological section, in which he essayed the difficult task of harmonizing Kelvin's and Joly's estimates of the age of the earth. An exhaustive review of the whole subject from the best data attainable seems to show an age of somewhere near 100,000,000 years.

Sir George Robertson, in the geographical section, made a very patriotic address, and therefore very pleasing to the people here. He urged the necessity of government control and extension of ocean cables and of means of transportation.

Electricity is, after all, the dominant feature of the meeting. Important papers were read on theoretical and practical questions connected with it.

On the side of theory was a long discussion of ions, by such men as Lodge and Fitzgerald, in which, however, no really new ideas seemed to be brought out, at least none that could be accepted as adequate explanations of the remarkable phenomena involved, which really are so intimately connected with the ultimate constitution of atoms and molecules as to require for their solution a knowledge of the alternate constitutions of matter.

In practical applications of electricity, an epoch-marking paper was that of Sir Wm. Preece, describing the complete success of wireless telephony in actual operation over a distance of about eight miles from the north coast of Ireland to a near island, and capable of extension certainly for several miles further, and this with comparatively short base lines. The success of this experiment resulted from the discovery that the efficiency of the apparatus was vastly enhanced by connecting the wires with plates at each end immersed in water.

The speaker recommended the system as applicable to communication from ship to ship by stretching the wire in each ship from bow to stern, bringing it up around over the topmasts. This, when ships are nearly parallel to each other, must give excellent telephone communication. How it would be with ships at right angles is not yet known,

Sir Wm. Preece also presented a project for a monorail electric railway, devised by Mr. Behr, and soon to be actually constructed between Liverpool and Manchester, 34½ miles. This distance will be covered in twenty minutes more cheaply, comfortably and safely than ordinary surface travel. The car, weighing 45 tons and seating 64 persons, rides a sinlge rail saddle-wise with its center of gravity below the rail, and having guide wheels on each side supported on light ties. There will be no stops between stations, but electricity of 10,000 volts pressure will be transmitted over the wire, and reduced to one thousand volts, at which it will be supplied to the motor and by actuating it with 1,600 horse power at the start will communicate velocity to the car at the rate of 1½ feet per second, which is as much as can be given with comfort to passengers, till after 110 seconds the car attains a velocity of 110 miles an hour, when 500 horse power will maintain it.

Mr. Aldrich described an electric automobile bus, supplied by light overhead trolley system of two wires; which, as it requires no rails, is the most economical means of road propulsion, and the system is actually in successful operation in the outskirts of Paris. Kinematograph views of the bus in motion were given—the first time the kinematograph has been used in the association.

* This lecture is published in the current issue of the SUPPLEMENT.

The lecture to workingmen by Silvanus P. Thompson was on electricity applied to industries, and brought a great throng to St. George's Hall. The lecturer said that whereas the nineteenth century had been the age of steam, the twentieth must be that of electricity. He urged the consumption of coal at the mouth of the mine, and generation of electric power, to be thence distributed, thus saving the cost of transportation of coal, the great loss in generating power by applying it as now in production of steam, and the purification of the air from the oppressive smoke cloud which overlies the whole north of England. He says that England can produce electric power cheaper by the use of coal in this way than America can by utilizing her abundant water power.

The lecture of Prof. Gotch on animal electricity showed a wonderful power generated by several electric fishes, notably the malapterurus, which has 3,000,000 cells consisting of nerve ends arranged beneath its skin, and gives a sharp electric shock.

Prof. Perry, in commenting on this paper, said that these studies were of immense practical value, because by the study of animal life we should probably succeed in securing electro-chemical composition of fuel, which is that whereby the animal utilizes its food, and this means the utilization of 98 per cent of the fuel instead of the waste of 88 per cent of it now made in the best marine engines down to 99½ per cent in poor engines.

Space must still be found for a word as to the fine Municipal Technical School and the fine exhibit of industrial work there. It is pronounced exactly adapted to the needs of industrial workers in Bradford. A fine array of textile fabrics produced by students was shown. Several looms were seen in actual operation, also machines for testing strength of material. I was particularly struck by the excellent imitation of silk produced by mercerization of cotton, a process named after Mr. Mercer, of Bradford, who invented it. The process consists in stretching a hank of cotton thread taut between two bars, and, while stretched, immersing it in suitable liquid; several kinds are used, the most simple being water, which produces a marked effect in giving the silky gloss. The thread is also dyed while still stretched. While the mercerized fabric has very much the appearance, it has not at all the strength of silk.

The next meeting will be held at Glasgow, beginning September 11, 1901, and the meeting for 1902 will be at Belfast. Some of the members already begin to talk of arranging another American meeting soon.

Prof. A. W. Rücker, secretary of the Royal Society, has been elected president of the Glasgow meeting.

WILLIAM H. HALE.

THE INTERNATIONAL PHYSICAL CONGRESS.

The International Physical Congress opened at Paris on August 6, with President Cornu in the chair. Among those present were Lord Kelvin, Prof. Alexander Graham Bell, Prof. John Millis, Prof. Cleveland Abbe, Prof. Arthur G. Webster, Secretary S. P. Langley, of the Smithsonian Institution, and Carl Hering. The French vice-presidents were MM. Cailletet and H. Poincaré and the foreign vice-presidents were Prof. Alexander Graham Bell, Sir W. Roberts-Austen, M. Schivendoff of Russia, Herr Warburg of Germany, Herr Vanderwaals of Holland, M. Exner of Austria, Signor Righi of Italy.

The Congress comprised seven sections; the first dealing with general questions, such as measuring units and teaching; second, mechanical and molecular physics; third, optics and thermodynamics; fourth, electricity and magnetism; fifth, magneto-optics, cathode rays, etc.; sixth, cosmical physics; seventh, biological physics.

Each section was provided with a president, one French and two foreign vice-presidents, and two secretaries. The programme included seventy-eight papers, which, when published, will make three volumes. Many of them were of the highest possible interest, specially those of Prof. Poincaré and Prof. Kelvin, the former dealing with the philosophy and methods of physical science, the latter with the ether hypothesis. The President of France held a reception for the members of the Congress; Prince Roland Bonaparte also held a reception for them. Many of the papers were illustrated, and demonstrations were given by MM. Becquerel, Curie, Cornu and others. Mme. Curie, who is well known for her brilliant discoveries in physical science, was secretary of one of the sessions.

THE CHICAGO AUTOMOBILE SHOW.

An international automobile exhibit and race meet opened at Washington Park, Chicago, Ill., September 18. More than four thousand persons witnessed the contests, and the grandstand was crowded. Among the events were automobile parades for manufacturers, races for steam, gasoline and electric automobiles, obstacle races, automobile parades for private owners, 10-mile races, 5-mile races for motor tricycles, etc. The short distance automobile speed records were broken by T. E. Griffen, who made a mile in 1:06. Alexander Winton made 10 miles in 16:02.