

THE SCIENCE NEWS-LETTER

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NEW FASHIONS IN LOCOMOTIVES

By Dr. Edwin E. Slosson

One curious thing is observable alike in the evolution of inventions and the evolution of plants and animals. They will run along about the same for many years or centuries, getting bigger perhaps but retaining essentially the original structure, and looking much alike; and then all of a sudden new varieties will appear, many different kinds, and the primary form, forced to meet these new competitors, is either crowded out or undergoes a rapid development. The biologists call this multiplication of novel forms and freaks a "mutation" period.

The railroad locomotive is now in the midst of such a mutation period. For the past hundred years it has stuck straggly close to its original type. In looking over the models of locomotives in the National Museum last week, I was struck with the monotony of the exhibits. The "John Bull" that was built by George Stephen in 1831 for the Camden and Amboy R.R. looks about as much like the giant locomotive of today as a colt looks like a horse. It employed the same power and consisted essentially of the same parts; coal tender, furnace, boiler, piston engine, big wheels behind, little wheels in front, smokestack, headlight, cowcatcher and bell, all the familiar things arranged in the familiar order.

But now we are beginning to see various new varieties of locomotives; some without coal, some without pistons, some without steam, some without fuel of any kind. The electric locomotives fed with power through a third rail or trolley wire, look more like the old steam engines than they need to, probably for fear of disconcerting the engineers and shocking the public. It is a wonder the makers do not think it necessary to stick on a fictitious smokestack with a pennant of black gauze streaming out of the top to satisfy our sense of the fitness of things.

In Europe steam turbines are being used in place of the old reciprocating engines. Leon Metais, a French engineer, has invented a locomotive in which the steam is first used in a high pressure turbine and from this passed onto a low pressure turbine. These run a dynamo which sends it current to eight motors, one on each axle. It is claimed that such an engine will run longer and get more than four times the power out of a given amount of fuel.

The Diesel engine, which does not employ coal or steam but gets its power from the explosive combustion of petroleum under high pressure, is still more efficient and economical. In Sweden the Atlas Company of Stockholm makes a locomotive with a Polar Diesel engine of the four cycle sort with twelve cylinders.

The Soviet Government has had constructed at the Esslingen works in Germany a Diesel electric locomotive which claims an efficiency of 21 to 27.4 per cent at a load of 440 to 1,060 horse-power, and a reduction of two-thirds in the fuel consumption.

In American also efforts are being made to break away from the steam engine by using some form of the Diesel engine with electric drive and control. The General Electric has built a trial locomotive of this sort which is now being loaned out to various railroads willing to give it a trial in their switching yards. Its 300 horse-power engine is directly connected with a direct current generator of 200 kilowatts. The 60-ton locomotive carries with it enough fuel for 48 hours of continuous switching service. It consumes only .43 pounds of fuel oil per brake horsepower hour.

The Baldwin Locomotive Works expects to be running trains this summer with its new type of Diesel-electric locomotive which it has perfected after ten years of experimentation on the problem of construction. This is said to save between 25 and 50 per cent. in the cost of fuel over the steam engine. It uses a twelve cylinder two-cycle Diesel of more than a thousand horse-power.

If the steam engine is to meet such competition it must reform its ways and curtail its extravagance, and it is beginning to do so. The American Locomotive Works has built for the Delaware & Hudson Company R.R. a 273-ton engine that brings steam to a pressure of 350 pounds instead of the customary 200, and is said to be capable of developing a third more power with the consumption of a third less fuel and water. The new locomotive is appropriately named the "Horatio Allen" after the engineer who imported and ran for this company in 1829 the "Stourbridge Lion", the first locomotive to be set to work in America.

The old steam engine has lost its monopoly and it remains to be seen whether it will be crowded completely off the tracks or be content with a humbler position.

MIRA, SECOND LARGEST STAR, COULD ENGULF EARTH'S ORBIT

A globe of glowing gases 250,000,000 miles in diameter, so vast that if the sun were placed at its center there would be sufficient room for the earth to revolve in its customary orbit; such is the nature of the star Omicron Ceti, known to the ancients as Mira, "the wonderful," because of its remarkable and periodical variations in brilliance. This was made known at the Carnegie Institution of Washington which announced measurements recently completed at the Mt. Wilson Observatory, Pasadena, Calif.

The observations from which these measurements were calculated were made by Francis G. Pease, astronomer at the observatory, using the great 100 inch reflecting telescope, the largest in the world. The method employed was one invented by Prof. A. A. Michelson, of the University of Chicago, by means of which a device called an interferometer is attached to the top of the telescope.

With a system of mirrors, the light from the star is divided into two beams, which, when reunited, give rise to a series of light and dark bands. This is because the waves of light in the two beams get out of step, and thus, at certain positions, interfere with each other. It is analogous to what might occur with waves in a pool of water. If there are two sets of waves, the peaks in one coinciding with the troughs in the other, they will tend to cancel each other. This effect is called "interference".

When the mirrors of the interferometer are moved, a place is found where the interference bands vanish, and from the distance apart of the mirrors at this point, the apparent diameter of the star may be calculated. This is the angle between two lines coming from opposite edges of the star and meeting at the earth. In the case of Mira, the apparent diameter is about six hundredths of a second of arc, the same as that of the head of an ordinary pin five miles away!

Obviously this apparent diameter has no direct relation to the actual size, for a small object nearby may appear larger than a much greater one at a distance. By other means, however, the distance of the stars may be determined, and when known, the actual diameter may be calculated. Thus, Mira is about 165 light years away. A light year is the distance that light can travel in one year, about 6,000,000,000,000 miles, since it can encircle the earth seven times in a second! The distance of Mira is therefore too many billions of miles to think about.

Since 1920, when Michelson's method was first applied to the measurement of stellar diameters, Mr. Pease has measured five other stars. The first one was Betelgeuse, a bright star in the constellation of Orion, which now adorns our southwestern sky in the evening. Alpha Orionis, the astronomers call it, and it may be seen above the three stars in a row that form Orion's belt. Its diameter is 215,000,000 miles.

After this he measured Arcturus, in the constellation of Bootes, which he found to have a diameter of 20,000,000 miles, Aldebaran, the red star in Taurus, the Bull, which is 30,000,000 miles across; Scheat, the second brightest star in Pegasus, which is 150,000,000 miles; and, largest of all, Antares, "the rival of Mars", in the Scorpion, with 400,000,000 miles!

Mira, therefore, is the second largest star known, but it is important because it is a variable star. Periodically it varies from the second magnitude, when it is prominent in the southern sky in early winter evenings, to the eighth magnitude, when it is too faint to be seen by the unaided eye. Another feature of great interest is that it is a double star. It is not a single body, but consists of two stars close together, and which revolve around each other. The companion was discovered about a year ago by Dr. Robert G. Aitken, associate director of the Lick Observatory, with the 36 inch refracting telescope there, after Dr. Alfred H. Joy, at Mt. Wilson had predicted its presence by studying observations of the star made with a spectroscope.

CRIMEAN NEANDERTHAL REMAINS SHOW MAN'S MIGRATION IN ICE AGE

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Prof. Bontisch-Osmolovsky of Moscow, in an exclusive interview with a Science Service representative stated the details of his recent sensational find of two primitive human Neanderthaloid skulls near Simferopol, in the Crimea, hundreds of miles to the eastward of any previous discoveries of that race of cave man.

"I had an idea that when the last glacial period began, something less than fifty thousand years ago, the men then living retreated before the oncoming cold into the country now known as the Crimea," said Prof. Bontisch-Osmolovsky. "In 1923 I began systematic explorations to test this theory, twenty-five miles from Simferopol, near the village of Kipchak. In a cave known as Koush Khat I came upon my first evidences. I found here skeletal remains of the mammoth, Siberian rhinoceros, cave hyena, cave bear, wild horse, wild ass, deer and other animals, together

with a number of small primitive tools, and the remains of a hearth, which indicated that the cave had once been a dwelling place of human beings.

"In 1924 I made my first find of actual human remains in a neighboring cave called Kiik Koba, in geological strata of the quaternary period. Here were two fragmentary hearths, with layers of ashes and coals, and here in regularly made graves, were human remains. In this cave also were bones of the same animals I had found in my first explorations, together with many flint implements, typical of the Middle Paleolithic period. This is the first find of its kind ever made in Russia, and is in my opinion a discovery of great scientific importance.

"The bones are very different from those of modern man. Their measurements have not yet been completed, but those so far made suggest that they are representative specimens of the Neanderthaloid race. Some pieces, including a part of one of the skulls, are still missing, and I hope to find these by further search. Investigation of all the material in the Kiik Koba cave cannot be completed in Russia, since there is no comparative material in this country for a study of Middle Paleolithic Quaternary man."

Professor Joukoff of the Anthropological Research Institution states that statistical analysis of the bones of the Kiik Koba skeleton gives data approaching the Neanderthaloid type, with even a partial inclination toward the conformation of the anthropoid apes. A final decision will be pronounced when the data can be compared with figures for Neanderthal remains from older finds in western Europe.

Professor Pavlov, a well known Russian geologist, declares that the chief interest of Prof. Bontisch-Osmolovsky's excavations lies in its indication of new dwelling places of Neanderthaloid man and the extension of the known area of the Mousterian type of Paleolithic culture.

The primitive cave men that roamed Europe from about 50,000 B.C. to 25,000 B.C. were a race that has left no direct descendants, so far as scientists can judge today.

This early race lived in a very cold and wet climate in the midst of the great Ice Ages. Its name, Neanderthal, is derived from the limestone valley of the little Neander river in Germany in which the first skeleton was found by anthropologists. Subsequent to the first, or type discovery, about twenty other finds of remains of this race have been made, principally in France, though they extend eastward as far as Moravia, in what was formerly Austria-Hungary, and as far south as Gibraltar. One skeleton, that of a woman, has been found at Gibraltar; at Chapelle-aux-Saints, in France, another skeleton; in the cave of Spy, in Belgium, two skeletons. At La Ferrassie the remains of seven or eight persons were found, and at La Quina a wholesale burial of fifteen. Other smaller finds have been made, sometimes consisting of but a fragment of a skeleton.

Together the finds constitute a rich fund of material from which much information has been deduced. They were a squat, blocky people, probably walking with a shuffling, shambling gait, instead of freely and erect, like the tall Cro-Magnons who later replaced them. They had heavy jaws and powerful teeth, indicating a diet of tough food, much of it possibly raw. They were decided "low-brows", with backward-sloping foreheads.

Yet they were not brutes. They had large brains, and knew how to make stone tools. We even can be fairly sure they were right-handed, for one side of the brain was larger than the other. They had little or no art, but they had at least the beginnings of religion; for they buried their dead.

It is unlikely that they are part of modern man's family tree, for they had many features that are not represented in the present human types. There is just a possibility, lately emphasized by a French anthropologist, that some of the more primitive of modern savages may have a strain of Neanderthaloid blood in them. But to most of the present-day human race, they were great-uncles rather than grandfathers.

BRITISH MAKE ENTRY IN POLAR AIR RACE

Explorations of the polar regions in the near future will contain a certain sporting element, for there will be at least two expeditions striving to reach that difficult goal by air. The British entry, will be under the leadership of a young Icelander, Grettir Alagarsson, and Capt. Frank Worsley, who commanded Shackleton's ships in their explorations of south polar regions. The expedition will go to Spitzbergen in May, then north as far as the ice will permit, and establish a base somewhere near latitude 81 degrees north. The final six-hundred-mile dash to the pole will be made by Alagarsson and one companion in a special seaplane fitted with skis and floats.

The Danish explorer Roald Amundsen has already started for Spitzbergen on the Norwegian steamer *Livorno*, with two planes. He intends to make a number of test flights before attempting the long dash to the Pole.

A German expedition, under the leadership of the famous explorer Fridtjof Nansen, was announced some time ago. It will make use of a super-Zeppelin, planned to be about twice the size of the American aircraft *Los Angeles*. Due to the more extensive preparations necessary, this expedition is not expected to start until 1927.

X-RAYS, BELIEVED UNBENDABLE, PROVED REFRACTED BY MATTER

An accurate measurement of the refraction of X-rays has recently been made by Prof. Bergen Davis and his co-workers at Columbia University. The bending of the rays at the surface of matter is very small, but by proper refinements of apparatus it can be measured quite accurately. These measurements permit the computation of the number of electrons in the inner level of an atom. The number found is two, in agreement with the Bohr scheme of atomic structure.

The possible refraction of X-rays was indicated by the experiments of Stenstrom a few years ago. Recently Professor Manne Siegbahn of Upsala, Sweden, succeeded in showing this refraction directly by the bending of the rays in passing through a glass prism.

Cotton waste has been prohibited as packing for imports in Africa.

NEW DEVICE AUTOMATICALLY SOUNDS OCEAN'S DEPTHS

Sounding the seas acoustically has been developed to such a point that it will soon be possible to record automatically on the bridge of a ship the depth of the ocean over ^{which} the vessel is steaming. Leo P. Delsasso of the Southern Branch, University of California, recently told the American Physical Society.

A mechanism has been devised and tested on board the U.S.S. Maryland steaming at full speed which records on a paper chart the time of transit of a sound wave from the sound producer to the bottom and back.

Probing the depths of the ocean by echo has been developed by the U. S. Navy during the past two years and the old lead and line method of determining depth promises to be replaced or at least materially supplemented by the speedier method devised by science.

EARTH'S CENTER IS CORE OF RIGID AND DENSE METALS

New evidence that the center of the earth is very hard and very rigid was presented at the meeting of the American Physical Society, Pasadena, Cal., recently by James B. Macelwane of the University of California.

By studying the records of the South Pacific earthquake on June 26 of last year, he has been able to prove conclusively that the earth has a core that is more rigid than most solid materials at the surface of the earth. This view has been advanced by German scientists and although it has been accepted by some American geologists, it has been generally denied.

The core is believed to consist of nickel and iron, perhaps with a center of precious gold and platinum, and it is known to occupy about four-tenths of the earth's diameter.

HOW TO KNOW THE PLANETS

By Isable M. Lewis,
U.S. Naval Observatory

There are certain characteristics or peculiarities of the five brightest planets, Mercury, Venus, Mars, Jupiter, and Saturn, that serve to distinguish them from one another and from the brightest of the stars - the twenty select of the starry hosts.

Mercury and Venus, we soon find, never keep late hours. You will never find either of these members of the solar system up around midnight though they are on occasion very early risers. Mercury, to be sure, is far more sun-bound than Venus. The chances are that you have never seen Mercury though it is a planet well worth seeing. At the most it cannot get as far as thirty degrees from the sun, so you must look for it always in the twilight, either immediately after sunset or before sunrise. At such times it appears silvery white in color and generally as bright as Vega, the brightest star of the northern hemisphere, though it varies considerably in brightness. Mercury, when at its greatest brightness, is slightly more brilliant than Sirius, the brightest star. An observer of Mercury at the time of the

total eclipse in 1900 recorded it as brighter than Venus at her best but this was undoubtedly an overestimation of the brightness of Mercury for no planet of the solar system, even the mighty Jupiter, ever approaches Venus in brightness.

This queen of the solar system far surpasses any other stellar object - planet or star - in this respect. However indifferent you may be to the splendors of the heavens in general it is not possible that you have failed to admire the silvery white radiance of Venus either in the western sky after sunset or in the east before sunrise. At present Venus is in the eastern sky but is now drawing in so close to the sun that it will shortly be lost to view and will not be seen again until June when it will be visible in the western sky after sunset. From then on for the remainder of the year it will be a magnificent object in the western evening sky.

Next to Venus, Jupiter is the brightest of all the planets, except on the rare occasions when Mars is nearest the earth when for a short period it may outclass Jupiter in brightness. It has been said that the planets may be distinguished from the stars by the fact that their light shows no twinkling or scintillation. This is not always true in the case of Venus and Mercury for Venus may twinkle noticeably when close to the horizon and Mercury was called "The Twinkler" by the ancients. It is noticeably true in the case of the giant planet Jupiter, however, which is remarkable for the unflickering steadiness of its deep yellow light, which with its exceptional brilliancy is quite sufficient to identify this planet.

Jupiter, Saturn and Mars, unlike Mercury and Venus, are at times visible all night from sunset to sunrise - on the occasions of their oppositions to the sun. Saturn is due to reach its opposition for this year on the second of May and Jupiter on the tenth of July, so they will come into fine position for observation in the evening within a few months. At present Jupiter is rising after midnight and Saturn a few hours earlier. Saturn is a pale yellow in color in contrast to the deep golden hue of Jupiter and is, of course, far inferior to Jupiter in brightness. It is at present equal in brilliancy to the first magnitude star Procyon, in Canis Minor, but is increasing slightly in brightness as it nears opposition. The remarkable steadiness of its light will aid in identifying it. As it is the most distant of the five bright planets it moves very slowly among the stars and for the remainder of the year will not stray far from the boundary between the constellations of Virgo and Libra, where it is now located.

Mars which outshone Jupiter last August is now so shorn of its former glory that it is inferior to the least of the first magnitude stars in brightness and as it is still receding from the earth and decreasing in brilliancy it will soon be classed among the stars of second magnitude. It is the only planet now visible in the evening sky and we will find it in the west after sunset. Mars is best identified by its deep reddish color, the steadiness of its light, and its rapid motion among the stars which is great enough to become noticeable in a few evenings. During March it will move from a point considerably west to a point south of the Pleiades in Taurus.

Apple trees with short trunks are hardier than those with standard ones.

Bone meal is an excellent phosphorus fertilizer for lawns.

AUTOMOBILES DANGEROUS INVENTION FOR ANIMALS

More than 1,000,000 animals are killed daily during the tourist season by motorists. These figures, based on the ones compiled by Dr. Dayton Stoner, of the University of Iowa, make the 16,000 human lives taken yearly seem a comparatively moderate rate of fatality. The automobile is, however, responsible for one fifth of all the fatal accidents in the United States.

Going from Iowa City to Lakeside Laboratory, a distance of about 200 miles Dr. Stoner counted 105 dead animals of 29 different species. Red-headed woodpeckers headed the list of casualties with a total of 29. Chickens, supposed to be the most common victims, ran a poor second with a total of eight. Averaging the total loss of animal life for the 3,000,000 miles of auto roads in the United States the daily total runs well over 1,000,000 for all species of small birds and animals.

Commenting on a later trip, Dr. Stoner said, "Further comment need not be made upon the various factors entering into the situation here discussed. It will be sufficient to point out that on a summer trip of 632 miles over Iowa roads, 29 species of our native and introduced vertebrate animals, representing a total of 225 individuals, were found dead as a result of being crushed by passing automobiles, and that this agency demands recognition as one of the important checks on the increase of natural life."

VAST RANGE OF "INVISIBLE LIGHT" FLOODS MAN AND HIS WORLD

Much as man prides himself on his ability to see, his eyes are sensitive to only a very small portion of the "light" or ether vibrations constantly flooding the world.

For this reason reports from India that a scientist there has devised a "super-retina" for "invisible light" have not created great interest in American scientific circles.

As "super-retinas" science now has in successful operation photographic plates, X-rays screens, thermometers, radio receivers, and electrical instruments to receive and record "invisible light" in the form of ultra-violet and infra-red rays, X-rays, heat waves, radio and electrical waves.

Stretching on both sides of the small portion of the spectrum that can be seen by human eyes are great ranges of ether vibrations that, while invisible, vitally affect man and his work.

Visible light, ranging from the deep violet with a wave-length of 16 millionths of an inch to deep red with a wave-length of 28 millionths of an inch, occupies only an octave of the spectrum of ether vibrations. Our eyes tell us what materials are opaque and translucent to visible light.

Shorter than visible light are the ultra-violet rays with wave-lengths from a millionth to 16 millionths of an inch. These rays affect photographic plates markedly and, in fact, much of the image in ordinary negatives is due to these rays which can not be seen by the eye. They have also been found to affect the growth

and health of man, animals and plants. The sun's radiation is rich in these rays and light from mercury vapor lamps in fused quartz containers contain much of these wave-lengths. Most materials opaque to visible light are also barriers to ultra-violet light, yet ordinary window glass will not let it through. The minerals fluorspar, quartz and rock salt are transparent to ultra-violet. These rays also have the property of making some substances, finger nails for instance, glow with visible light.

The shortest waves known to man are the gamma rays of radium, given off when this wonderful chemical element spontaneously disintegrates. These are even shorter than the hard X-rays used medically in the treatment of cancers and tumors and in scientific work. Rays from radium and the X-rays created when cathod rays impinge on solid objects are very penetrating, passing through skin and flesh and many other substances. By allowing them to strike fluorescent screens they can be made visible to the eye and they can also be permanently recorded on photographic plates.

Between the ultra-violet rays affecting photographic plates and the X-rays lie a zone of ether waves but recently explored and little is known about them.

On the long wave side of visible light are the infra-red or heat waves. Many substances, such as water, easily penetrated by visible light are relatively opaque to infra-red rays and most of the hydrocarbons stop these wave lengths that range from 16 millionths to 12 thousandths of an inch. Thermometers recording this sort of radiation and photographic plates specially treated with red-sensitive dyes can also be made to permanently record the infra-red.

Still longer than the infra-red rays are the Hertzian or radio waves used in wireless communication and broadcasting. These are received by wires and coils and may be rectified in such a way that they produce audible sound waves when fed into telephone receivers. They range in length from a few meters or yards to many thousand meters or several miles.

The longest waves in the spectrum are those of ordinary alternating current that pulsates relatively slowly. Such waves are often several thousand miles in length.

GOVERNMENT GATHERING DATA ON RECENT QUAKE

The government is hounding the earthquake of February 28 that shook most of the eastern part of the United States. It desires to know more about where it occurred and what damage it did. The investigation is in the hands of the Coast and Geodetic Survey of the Department of Commerce which is charged with seismological investigations.

Although the area of greatest intensity of the disturbance was probably located in the northern part of Canada now out of communication with the rest of the world, the government scientists desire to collect all the data possible in this country in order to allow a complete official report.

Those who felt the earthquake are requested to send in a report to the Director U.S. Coast and Geodetic Survey, Washington, D.C., giving their location at the time, the standard time of the shock to the nearest minute, their activity at the time, and data on character of motion felt, duration and number of shocks, sounds, outstanding disturbing or destructive effects, and appearance of cracks in ground. The Coast and Geodetic Survey also desires copies of any reports or newspaper clippings relating to the quake.

CALIFORNIA CHEMIST GETS GOLD MEDAL

The Nichols Medal was bestowed upon Dr. E. C. Franklin, professor of organic chemistry in Stanford University, California, March 6. This medal, bearing the name of William F. Nichols, is awarded annually by the New York Section of the American Chemical Society for distinguished achievements in chemical science.

For the past 25 years Professor Franklin has devoted himself to the investigation of the reactions of liquid ammonia with organic and inorganic compounds, a particularly difficult and dangerous field of research since the experiments must be carried on in air-tight and moisture-free all-glass apparatus and often under high pressure. At the meeting at the Chemists Club, New York, Dr. James F. Norris, president of American Chemical Society and chairman of division of chemistry and chemical technology, National Research Council, described the results of Franklin's researches, and Dr. E. E. Slosson, director of Science Service, Washington, told of his student life in the University of Kansas.

ELECTRICAL GUIDE NOW AIDS LONDONERS

London is to have its first electrical guideposts. This is a device by which one will be enabled to find the way from any point in the city to any other point without asking questions.

The device consists of a map of London enclosed in a dial on which the names of the streets and corners are marked. The questioner turns the dial until it indicates the spot to which he wishes to proceed. Then he presses a button. A stream of light will then shine across the map along exactly the right route to follow.

The first of these devices has been prepared for installation near London Bridge.

TABLOID BOOK REVIEW

PHYSICAL ANTHROPOLOGY: BY Ales Hrdlicka, curator division of physical anthropology. U. S. National Museum. 164 pages. The Wistar Institute of Anatomy and Biology, Philadelphia.

ANTHROPOMETRY: by Ales Hrdlicka. 161 pages. The Wistar Institute of Anatomy and Biology, Philadelphia.

The two books are standard works by one of America's leading authorities. The first of these volumes is a history of the growth of the study of man's physical body and its configurations. The romance in the early work of anthropologists is touched upon and the present state of the science is outlined in detail. The book on "Anthropometry" is a handbook to methods of making measurements and observations. It is nearly a prerequisite to anthropometric work.

Grapefruit, carefully cleaned and stored in moist sand or sawdust will keep several months.