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SCIENTIFIC ENGINEERING TO SOLVE PROBLEM OF DIRT ROADS

By Prof. S. S. Steinberg,
University of Maryland

Mother Shipton's prophecy made three hundred years ago that "carriages without horses shall go" has been abundantly realized to the people of the United States. We now have eighteen million motor vehicles on our highways. And yet we appear to be far from any stopping point. Indications are that motor transportation is going to develop beyond anything we can now visualize, and in so doing it will continue to make changes in our daily life and in our business, in our cities and in our towns. Upon the motor highways of the future will depend how rapid, and in how satisfactory a manner, this development will take place.

This year, as last year, another billion dollars will be expended in highway work, thus indicating that the people of the country expect the highways to keep pace with the increase in number of motor vehicles. Whereas, a few years ago a road contract two miles long was considered a large undertaking, now contracts are let in 10 and 20 mile stretches. In one day recently Pennsylvania let road contracts totaling twelve millions of dollars. The previous record was that of Illinois with a letting of nine million dollars in one day. As a result of this stupendous program, it has been truly said that the construction of highways will be the most active American industry during the current year.

Fortunately, highway engineers realize the necessity of having this great development of our highway system proceed on sound principles of engineering and of economics. This is evident from the fact that the federal government, the state highway departments and many universities are engaged on an extensive program of research into the problems affecting highway finance, construction and maintenance. A recent census showed that there are almost 500 highway research projects under way throughout the country. It is the function of the Highway Research Board of the National Research Council to coordinate these researches, spread as they are over such a wide territory; to prevent duplication of effort, by putting the workers in touch with one another; and finally, to make known to each state the findings which may be immediately applied in practice; thus resulting, not only in the better construction and maintenance of highways, but also in a great saving in the taxpayer's dollar.

The Highway Research Board thus occupies a unique position as a service organization to highway engineers and to the public, and it enjoys the complete confidence of all agencies throughout the country engaged or interested in highway development.

One of the most important investigations now being carried on under the auspices of the Highway Research Board, is on the development of earth roads. Although we may now travel with speed and comfort from one end of the country to the other, we must not forget that 85 per cent. of all our rural highways are still in a state of nature, and many of them impassable for several months of each year. It may help us to realize what a great economic loss this means when we consider that one-third of all the automobiles in use are owned by farmers, most of whom are compelled to use these earth roads. This problem is an especially significent one in the western states where there is a great mileage of highways to improve and maintain and the funds are so limited that any extensive program of surfacing with the more costly types of pavements is out of the question.

Many attempts have been made to solve this problem. For instance, in North Carolina, where they have a sea of sand stretching for hundreds of miles along the coast, the State Highway Commission has developed, as a result of research, a sand-asphalt surface made up of a mixture of 93 per cent. local sand and 7 per cent. of asphalt. This renders very satisfactory service to the locality. In South Carolina, Illinois and California, tars and oils are being used, either by mixing with the earth or as surface applications. In the southern states either the top soil of the fields, or a mixture of sand and clay is used. In Iowa, Missouri, and South Dakota, experiments are being conducted in which the natural soil is mixed with hydrated lime, or in some cases with Portland Cement, in an attempt to stabilize the natural soil.

Realizing that this is one of the most important problems confronting highway engineers, the Highway Research Board is attempting to coordinate completed and current research on this subject with the hope of developing a low-cost road surface that will be suitable for light traffic.

STONE AGE MEN HAD BIGGER BRAINS THAN MODERN RACES

Stone Age men in Africa had big brains even if they were lowbrows, according to Sir Arthur Keith who spoke recently before the Royal College of Surgeons at London. An examination of the modern Bushman, and of the human remains discovered in the Transvaal, he said, have led to the conclusion that prehistoric man in South Africa was a large-brained individual. His head was three quarters of an inch longer than that of modern natives, but lower vaulted. The brain was in fact 12 or 13 per cent. larger than that of the average European. In this connection, however, Sir Arthur reminded his audience, it must be remembered that the portion of the human brain used for intellectual operations was very small compared with the rest, which is occupied mainly with purely animal reactions.

Sir Arthur stated that it was a mistake to believe that the further back you went the more you would approximate to the Negro type, for the Negro of prehistoric times was less negroid than his Negro descendants, and eventually one came to a common ancestor of both the European and the Negro. The discovery of this large-brained, small-faced type was entirely unexpected. It had evidently been superseded in later times by a smaller brained race. It is clear, he said, that there must have been a relation between the cultures of the Mediterranean man and his contemporaries in South Africa, though how this was effected was undetermined.

BRAIN OF LITERARY GENIUS FOUND TO BE LIGHTWEIGHT

Large brains do not necessarily go with great genius. The brain of Anatole France which was willed to science was not only exceedingly small for a well developed old man of 1665 pounds but was over a quarter smaller than even the average brain. But Dr. Felix Renault who examinedd it states that the brain showed an unusually large number of deep furrows, and that this characteristic, rather than the actual brain weght should be looked upon as proof of highly developed intelligence.

Another example of small brain in a man of genius, Dr. Renault states, is that of Gambetta, the French statesman, whose brain weighed 1160 grams or 143 grams more than Anatole France's, and was likewise furrowed deeply. Both of these cases suggest that it is the area of the outer surface of the brain and not its weight that has a direct relation to intelligence.

TWO LANGUAGES AT ONCE SLOWS CHILD'S DEVELOPMENT

Learning two languages at once is a handicap to children rather than a help, and it may also have the odd and unexplained effect of making them uncertain in the choice between right and lefthandedness. Three psychological research workers of the University College of Wales, D. R. Saer, Frank Smith and John Hughes, have come to this conclusion asa result of their investigation of large groups of children in the Welsh schools.

Some of these children know only English, while others have been bilinguists, speaking both English and Welsh, ever since they have been able to talk. The tests used for purposes of comparison included the Stanford-Binet intelligence scale, tests for righthandedness, for rhythm, and a large variety of verbal tests. Not only were bilingual children compared with one-language children but, in each of these two groups, children in the rural areas were compared with children in the urban schools.

The tests indicate that the one-language child in both rural and urban schools has an advantage over the bilingual child. The difference is more pronounced in the case of rural than of urban children.

Dr. Saer's explanation of this difference turns upon the degree of bilingualism. All degrees of bilingualism exist. The mother language may be used in the home only or as the play language also, and possiblyy in church. The rural children use their mother tongue in play, hence it becomes for them their preferred language and one charged with emotional values. The urban children who use the mother tongue only at home form less righ associations with it.

One of the most interesting results of the investigations was the demonstration that monoglots in both urban and rural districts are markedly superior to bilinguists in right-handedness. Bilinguists are subject to confusion in the matter of right and left. It is suggested in explanation that the left hemisphere of the brain controls speech and is also associated with specialization in the use of the right hand, so that hesitation and confusion arising from the use of the two languages apparently has an adverse influence upon dextrality.

The investigators of bilingual intelligence, although they have worked on the problem for several years and have used many hundred children in their investigations are cautious in their conclusions. The cite them as valid only for the groups with which they worked and under the present organization of schools in Wales.

SEISMOGRAPH RECORDS FORETELL STORMS

The seismograph, the instrument used to record earthquakes, is also a weather forecaster, and its records may be used to foretell storms, according to Robert W. Sayles, of the Harvard University Museum. This is possible, he says in an article on "Superficial Factors in Earthquake", in "Science", because the reduced air pressure that comes in advance of a storm causes the earth's crust to rise slightly. This tilting is recorded by the motion of the pendulum of the seismograph, and the direction of the tilt shows the direction from which the storm is approaching.

In the opinion of Mr. Sayles, such variations in air pressure, together with deficiency in rainfall, form the most important of the superficial causes of earth quakes. In particular, he has been studying the earthquakes that shook New England last winter.

"According to the data collected at the Blue Hill Meteorological Observatory at Harvard University," says Mr. Sayles, "we had a deficiency of about 8.1 inches of rainfall during the five months previous to March 1, 1925. The quake of January 7 was preceded by three months of very dry weather and immediately followed by rain and a normal rainfall for that month. Then during February there was a deficiency again in rainfall, and then the quake of the 28th, which was likewise followed by rain. Just before this quake, on the 26th, we had the lowest barometric pressure recorded in two years, 28.96 inches at Boston. This low pressure area went northeastwardly and when it reached the Saguenay region, where there is a weak place in the crust, the crust gave way and we had the earthquake. It is true that the lowest pressure had passed on to the east before the shock came, but there is often a lagging effect in earth processes. In my opinion the deficiency in rainfall and the very low pressure acting together was the straw that broke the camel's back."

Mr. Sayles points out that when the barometer goes down one inch, a weight of over a million tons is taken off every square mile of the earth's surface, and a deficiency of eight inches of rainfall over New England would be equivalent to taking nearly forty billion tons off the region. Mr. Sayles also points out that an unusual dry spell proceded the Montana tremblor of June 27.

"NORTHERN LIGHTS" STUDY MAY SOLVE RADIO MYSTERY

By James Stokley,
Science Service Staff Writer

The mystery of the green color of the northern lights and the problem of the Heaviside layer, believed to make long distance radio broadcasting possible, may have been solved as the result of a series of researches just completed by Dr. J. C. McLennan, professor of physics of the University of Toronto, and described by him to the Royal Society of London. From this work, it seems that the upper atmosphere, at a height of sixty miles or more, consists largely of helium, and gas used to float dirigibles, even though at the earth's surface the air contains only a minute fraction of a per cent. of this useful gas.

A number of years ago, the English physicist, Sir William Crookes, produced what are called cathode rays by passing a high-voltage electric discharge through a tube from which the air had been exhausted. These are now known to be rapidly moving electrons, the minute electrical charges of which ... the atoms of matter consist. As some of these phenomena appear very much like the aurora borealis, it was suggested that cathode rays were being emitted by the sun and that when they encountered the gases in the upper atmosphere of the earth, auroras were produced.

In confirmation of this theory, a Scandinavian scientist, Prof. Kristian Birkeland, placed a magnetized sphere representing the earth in a vacuum, and when he bombarded it with cathode rays, artificial auroras appeared.

But while the aurora could be partly reproduced in the laboratory, there was one effect that could not be duplicated. If a photograph is made of the northern lights, or even of the northern night sky, with a spectroscope, which analyzes the light into various colors, a prominent green line appears, along with a number of others. Prof. L. Vegard, a French scientist, worked on the problem of its origin in Leyden, Holland, at the laboratory of Prof. Kamerlingh Onnes, one of the two places in the world where extensive low temperature research is carried on. He found that many of the colors of the aurora were due to the action of the cathode rays on nitrogen; and finally, in the spring of 1924, he announced that he had obtained the green line artificially by freezing nitrogen to a solid, with a temperature of 346 degrees below zero, Fahrenheit, and subjecting it to the action of the rays.

At first, this seemed conclusive, but Prof. McLennan, director of the Physics Laboratory at Toronto, the only other laboratory in the world possessing such equipment for low temperature investigations, repeated it, with the assistance of Dr. G. M. Shrum. He found the green color, but as he used a more powerful spectroscope than had Vegard, also found that it did not agree with the line in the aurora. The line in the spectrum obtained from the solid nitrogen turned out to be triple, with one part on one side, and two on the other side, of the green line in the aurora spectrum.

In his latest work, Dr. Mclennan has been able to reproduce the line artificially, in precisely the same place as it occurs in the natural aurora. As helium is so light, he supposed that the atmosphere at an altitude of 60 miles, would contain a large proportion of it, so he passed the cathode rays through a partly exhausted tube containing about 25 parts of helium to one of oxygen. The line was obtained, even though the use of oxygen or helium alone did not show it. Thus, the origin of all the observed colors in the northern lights are known, and even more important evidence is obtained as to the composition of the upper atmosphere. The Heaviside layer, supposed to consist of ionized gases which reflect radio waves back to the earth, instead of going out in space to be wasted, may consist largely of helium, and the northern lights study may lead to a better understanding of one of the greatest mysteries of radio.

GERMAN BIRTHRATE CONTINUES TO DECLINE

The German birth rate has gone down steadily since the war and was at the lowest point in five years in 1924, according to the latest German census figures. The number of births for every thousand inhabitants was 21.1 or 25 per cent. less than in 1913. These fewer births were partially offset, however, by lower death rates, although these latter did not go down equally fast. In Berlin, where conditions are abnormal, deaths exceeded births by 1.5 per thousand population.

DID STONE AGE WARRIORS PLAY "AFRICAN GOLF"?

By Alonzo W. Pond,
Assistant Curator, Logan Museum of Beloit College.

(This is the second of a series of news stories written for Science Service by Mr. Pond, who is now exploring the northern Sahara desert for the dwellings and remains of the Old Stone Age, after spending the summer in the Dordogne region in southern France, the classic ground for paleolithic explorations. Other articles from Mr. Pond will appear from time to time.)

Is the painted pebble which Dr. George L. Collie is taking back to Beloit College with him half of a pair of 25,000 year-old "galloping dominoes", or just an innocent early alphabet block? Dr. Collie, who is professor of archeology at Beloit, obtained this puzzling object at the old rock shelter home of the stone age men at Mas d'Azil, the home of the transition between the Old and the New Stone Age cultures, which has given the name "Azilian" to all relics of the same type as those found beneath this ancient rock shelter.

The earliest, and still the best known, theory about these bits of stone, spotted and striped with red ochre, is that they were primitive forms of writing. A tribe has been discovered in Australia that decorates pebbles in much the same fashion. Very recently also it has been learned that certain tribes in Africa play a game with ornamented pebbles similar to those of Mas d'Azil.

In Les Eyzies, in the Dordogne region, Dr. Collie secured a collection of bone points, harpoons and flint chisels from the rock shelter known as the Rock of Pain. This collection represents the culture of the Magdalenian period, which is the last of the Paleolithic or Old Stone Age and the period in which the interesting paintings and carvings on the cave walls were done. A five year lease on this rock shelter makes it possible for the students of the department of anthropology at Beloit College to do practical excavation during the summer.

Just before returning to America Dr. Collie spent some time with M. Maurice Reygasse, governor general of the Commune of Tebessa, Algeria, in North Africa. M. Reygasse is the only original investigator of North Africa in prehistory and has discovered one three hundred paleolithic habitation sites. Naturally such a wealth of material requires years of study before proper publication can be made, so that only a small part of the work has appeared in print so far, although two books are at present in press. Dr. Collie is the only American professor of anthropology who has seen the enormous collections of M. Reygasse or any of the sites from which the collections have come. As all of the Reygasse paleolithic material has been found in place with tremendous hearth deposits, it is destined to greatly modify the existing theories on the migrations of paleolithic peoples. American archeologists have supposed that the African finds were all "surface finds" and accordingly not good evidence; but as Dr. Collie has made the tedious journey to the end of the railroad in Algeria and actually visited several of these sites, American students will have the privilege of first hand information.

Legal child adoption has never been authorized by English law.

RADIUM DESTROYS DANGER OF LEPROSY INFECTIONS

The successful use of radium in the treatment of leprosy which, it is hoped, will result in the abolishment of the law of segregation that is imposed on those suffering from the dread disease, is reported by Doctors M. H. Neil and R. P. Sandidge of the Kalihi Leper Receiving Hospital at Honolulu. So far as can be discovered, this is the first use of radium in the treatment of leprosy, they state.

Following a series of experiments, the surgeons announce that in all cases treated with radium, "the leprous nodules disappeared. It is hoped that, by the use of radium many lepers may be converted from dangerous carriers, emitting millions of bacilli from their noses, to persons not dangerous to public health and thus no longer in need of segregation," they assert.

Experiments with the radium treatment of leprosy have extended over a period of six months, the study being concentrated on the use of the element with especial reference to treatment of leprous lesions of the nose.

Seven cases having nodules in the nose were treated by the insertion of a 50 milligram tube in either nostril, alternating at intervals of from two to three weeks, exposure to the treatment being from one and a half to two and a half hours.

In all cases the nodules disappeared, it is said. In three of the cases the bacteria disappeared from the area under treatment. Other similar cases, not receiving the radium treatment, showed no change in nasal condition.

"It is the intent to extend the scope of this work to determine the permanence of its effects and the effect of clearing up the nose on the patient's general condition," the investigators conclude.

NEW METHOD STARVES JERSEY MOSQUITOES

A new method of exterminating mosquitoes by starvation is being successfully tried in New Jersey. "When mosquitoes are in the wriggler or larval stage, "says Dr. Rudolfs of the State Agricultural Experiment Station, "they have jaws and feed on bacteria and other minute forms of vegetable or animal life. By putting chemicals in ponds or creeks this food matter is destroyed and the young starve to death before they have grown their stinging bills. The quantity of chemicals is so small that it will not injure fish or plant life."

New Jersey is the first state to try this method. Dr. Rudolfs is also of the opinion that the dripping of oil and gasoline from motor cars on the roads is helping to kill off mosquitoes.

Country bred children are just as undernourished and in need of scientific treatment as city children; because many farmers sell practically all their milk, according to Miss Florence Ward, extension agent of the U.S. Department of Agriculture.

PAPER MILL WASTE HELPS CLEAR AIR

Instead of fouling streams, the waste from Swedish paper pulp mills is expected henceforth to help keep dust out of the air. Though the air in Stockholm is on the average ten times as free from dust as that of London in a heavy fog, for instanc a campaign has been started to make it as nearly dust-free as possible, and in this a valuable ally has been found in the sulphite lye which the pulp mills of Sweden have hitherto poured away as worthless waste. This summer all the macadamized or unpaved roadways and streets in Stockholm have been sprayed with the lye, to which lime water has been added to make it less soluble in rain. The city authorities of Malmoe and other places have also begun to buy the sulphite lye by the car load to use it on the roads, and a separate company has been formed to exploit the new dust-binding material.

The measurements of dust particles in the air have been made by the meteorologists and the Swedish Government's official weatherman, Prof. Anders K. Angstrom, h calculated that on the average the air in Stockholm contains 4,000 dust particles per cubic centimeter, while in London the usual figure is 10,000 and in heavy "pea soup" fogs runs up to 50,000. The number of dust particles inhaled each minute by a person walking through a London winter fog has thus been estimated at 450,000,000.

NINE TENTHS OF WORLD OPIUM TRAFFIC ILLICIT

The appalling swiftness with which international traffic in narcotic drugs has grown during and since the world war is told by John Palmer Gavit, former New York newspaper editor. Figures gathered by the Opium Advisory Committee of the League of Nations show that narcotic drugs are manufactured in quantities ten times as great as even the most generous estimates of legitimate medical and scientific needs allow, he says.

The evil is not now an exotic affair of the Far East, for although the eating drinking, and smoking of raw opium are injurious enough, these are surpassed by the present day use of derivative drugs in concentrated form. These are compact, easil disguised and much more profitable to smuggle, especially with the push of Western criminal genius behind the traffic.

The Opium Advisory Council of the League of Nations estimated the amount of opiu m and crude cocaine needed for medical and scientific purposes by the part of the world's population that is within reach of such service. Four hundred fifty milligrams of raw opium and 7 milligrams of cocaine is allotted for each person. It is estimated that 744,000,000 people of an assumed world population of 1,747, 000,000 are within reach of medical service; therefore the legitimate world need for drugs is estimated as follows: opium,100 tons, morphine, 136 tons, codeine, 84 tons, and heroin, 16 tons, makinga total of 335 tons of narcotics.

Allowing 450 milligrams of opium to every man, woman and child in the entire world, regardless of needs, would require a total of 786 tons annually. "No one knows how much is actually produced," says Mr. Gavit, "but conservative estimates converge with remarkable closeness to 8,600 tons a year, including the 5,000 tons attributed to China. Since the most generous estimate of world needs calls for only 786 tons, less than one tenth of it could possibly find legitimate use."

If the Opium Advisory Committee of the League of Nations were given powers, Mr. Gabit believes it could ration supplies among the nations, and the production of manufactured narcotics could be controlled at the factories. With the cooperation of the various governments the trade could be very well patrolled, for the factories are few and the governments know where to find them.

TUBERCULOSIS GERMS IN BOOKS LIVE LONG LIVES

The best books may be a great source of danger if a careless tubercular person used them last, for Drs. Touchais and Moureau, of Paris, have found that the germs live on the pages for four or five months. The question is regarded as of practical importance because it shows the necessity of disinfecting books circulating in public schools or libraries.

Drs. Touchais and Moureau made tests to see how long the germs from tubercular sputum and from a laboratory culture kept their virulence when smeared on the pages of a large number of books kept in all sorts of conditions such as are found in homes, schools, and libraries. The germs from sputum were the hardiest and were able to infect guinea pigs with the disease even after four and a half months. The germs from the laboratory cultures were still active after two months, but in about three months they were impotent.

MOTIONS PROVE STARS AT VAST DISTANCES

Confirmation of estimates made by Dr. Harlow Shapley, director of the Harvard College Observatory, of the distance of globular star clusters are contained in a series of measurements recently completed by Dr. Adrian Van Maanen, astronomer at the Mt. Wilson Observatory. Dr. Shapley's figures, which placed some of these objects so far away that their light takes a hundred thousand years or more to reach us, though travelling at a speed sufficient to encircle the earth seven times in a second, was based on the variation in light of certain stars known as Cepheid variables.

These stars undergo a periodic increase and decrease in their magnitude, the length of the period varies according to the average brightness, and so by watching them for a while, the astronomer can determine how bright they really are. The more distant the star is, the fainter it seems, and so the relation between the actual and the apparent brightness permits an estimate of the distance.

Criticisms of this method have been expressed, but Dr. Van Maanen has compared photographs made of one of these clusters, in the constellation of Hercules, taken eleven years apart with the great 60 inch telescope at Mt. Wilson, to determine the motions of its stars. They are undoubtedly moving and many at high speeds, but Dr. Van Maanen's results revealed practically no motion, and he concludes that this is due to the fact that they are so far away that a much longer time would be required for the movements to become apparent. "This is a beautiful confirmation of Dr. Shapley's distance," he says, "because with the distance derived by him, even a fairly high speed would still give an extremely small motion on the plates."

Dr. Van Maanen also says that his work confirms the motion which he has found by a similar method for the spiral nebulae, cloud-like objects with spiral arms, and which some other astronomers have suggested might be due to some error.

TABLOID BOOK REVIEW

PROMETHEUS OR BIOLOGY AND THE ADVANCEMENT OF MAN, by H. S. Jennings.

LYSISTRATA, OR "WOMANS FUTURE AND FUTURE WOMAN, by Anthony M. Ludo-vici.

HYPATIA, OR WOMAN AND KNOWLEDGE, by Hon. Mrs. Bertrand Russell.

To-day and To-morrow series New York, E. P. Dutton & Company, $1.00 each.

Professor Jennings is looked upon as one of the elder statesmen in genetics, yet he pitches bombshells about like the reddest young radical. Just when men had about completed hammering the innocent experiments of Mendel into a newer and more iron Calvinism, damning the unelect in body and mind as well as in soul, this mild-mannered Johns Hopkins dean arises and remarks: "The idea of representative hereditary units, each standing for a single layer characteristic, is exploded; it should be cleared completely out of mind." As who would say, "Destroy this temple." Professor Jennings' thesis does for the idea of the gene what the newer physics has done for the idea of the atom. Pairs of genes can no longer be represented as solid little marbles, one white, the other black; one absolutely endowed with its proper character, the other absolutely without it. A gene is a complex thing, it fragments into a whole lot of little bits, fifty or a hundred or more, and the absence of one tiny shard may wreck the whole mosaic-- or it may not. And it affects not one character only, but reaches out and has its influence throughout the whole organism. Not only that, but the genes are themselves subject to outside influences; chemical and other revolutions can get at them; the holy Weismannian wall is down. "There is no *a priori* reason why anything that may be done by a chemical produced from an individual's own genes may not be done equally by a chemical introduced in some other way. Shortcomings due to defective genes are essentially as subject to supplement and remedy as are other defects." What this sort of doctrine does to the cocksure, Nordiolatrous schools of eugenics and sociology needs no labored telling.

The other two volumes of this futuristic series are more sensational than scientific. "Lysistrata" is a fanatical attack on what the author regards as "Puritanism" and "Feminism", while Mrs. Russell counters from the opposite extreme with criticism, alike of Ludovici and the existing order.

A regular passenger and mail service is soon to be started in the Congo with a three-engine airplane designed to eliminate forced landings on account of engine failure.

In Yellowstone National Park, limestone deposits left by hot springs cover the whole face of Terrace Mountain, which is over 1000 feet from its base to its summit.
