SCIENCE

NEW YORK, JUNE 17, 1892.

INSECTS IN POPULAR DREAD IN NEW MEXICO.

BY C. H. TYLER TOWNSEND.

In the south-western portion of the United States there are many insects (using the term in its popular sense, and including Arachnida and Myriopoda) which are more or less striking in appearance. The Mexican element, which largely predominates, is wont to clothe many of these forms in superstition and fear. Some of them are more or less poisonous, while others are perfectly harmless. The malignant nature of the poisonous ones is, as a rule, greatly magnified. Space would forbid the detailing in this article of all the species which are held in dread by the Mexicans, and therefore only the most prominent ones will be noticed. It should also be mentioned that many Americans who have lived here for some length of time share to a large extent the fears of the Mexicans in this regard.

The centipedes (*Scolopendra sp.*) in southern New Mexico do not, as a rule, attain a length of more than four or five inches. Some are found at times which measure nearly six inches, but these are exceptional. They are often found in the adobe houses, the roofs of which are thatched and covered with earth. The summer rains disturb them, and they make their appearance inside. No one can be blamed for refusing to pick up a large centipede, yet they are not so dangerous as commonly supposed. As a general rule, a little ammonia applied to the stings will allay all irritation in a few hours, and no swelling will occur. With some persons the effects are more serious. At some future time a paper will be published by the writer, describing cases of bites and stings of this and other poisonous insects.

The whip-scorpion (*Thelyphonus sp.*) occurs here rather sparingly, but attains a good size. It is certainly a formidable looking beast when full grown. The Mexicans call it *viñagron*, and believe, so I am told, that its bite is sure death. A centipede is no comparison to it in the eyes of a Mexican, who would as soon face a rattlesnake or a Gila monster. I have been unable as yet to find anyone here who has been bitten by this insect, and the only specimens I have were brought to me dead. Some authors declare it to be harmless, while others assert the contrary. I believe, however, that a bite from the jaws is more or less poisonous. During a recent excavation in the city of El Paso, Texas, a gang of Mexican laborers was panic-stricken on the appearance, in the hole beside them, of a *viñagron* which had been disclosed by a stroke of the shovel.

The scorpion which occurs here is the smaller light-colored one (*Buthus sp.*), which does not attain a length of much more than two inches, and is usually smaller. It is dreaded by the Mexicans, but the sting is not more severe than that of a hornet, and often causes no swelling and but little irritation, which passes away in a short time.

One of the *Solpugidæ* (probably *Datemes sp.*) occurs here. This family is closely related to the scorpions, and contains some very strange-looking forms. The species in question attains a length of about one and three-quarters inches. The head consists very largely of two massive pairs of jaws, side by side, the two jaws of one pair working vertically on each other instead of horizontally. The pair on one side can work independently of that on the other, and this intensifies the strange appearance of the insect. These are held in great dread, and are doubtless in a certain degree poisonous.

The so-called tarantula (*Lycosa sp.*) comes next, and is undoubtedly the most venomous arthropod we have in this region. It is usually considered deadly. Its bite is attended with serious consequences, if we can believe reports which appear to be well authenticated. The largest specimen I have seen here measures two and one-half inches in the length of its body, which is as large as that of a half-grown mouse.

A huge unshapely cricket (*Stenopelmatus sp.*) is called *miño de la tierra* (child of the earth) by the Mexicans here, for the reason that it occurs in the ground and is supposed to resemble an infant in the form of its head and body. Its bite is believed to be fatal, and the writer once excited the admiration of all present by offering in public to handle all specimens that were brought him. The jaws are large and powerful, and doubtless can bite quite severely, but there is nothing of a poisonous nature connected with the bite. The Mexicans also have a superstition that the *Stenopelmatus* enters the uterus of pregnant females and causes monstrosities. Perhaps the dread of this cricket has arisen from the fact that in general appearance it greatly resembles the solpugid mentioned above.

The rear-horse (*Mantis sp.*) and walking-sticks (*Phasmidæ*) appear to be confounded by the Mexicans, and "old-timers" as well, under the name of *campamoches*. It is one of the most firmly grounded ideas in the mind of the average New Mexico resident, that these insects, when accidentally swallowed by horses or cattle, are sure death to the swallower. No idea apparently could be more absurd, and none is harder to dissipate. I have been told repeatedly of cases where the animal was immediately cut open, and in no case did the operator fail to find a *campamoche* in the stomach. Such positive declarations would almost incline one to the belief that some poisonous properties were resident in the bodies of these insects.

Agricultural College, Las Cruces, New Mexico, June 5.

SCIENTIFIC WORK IN CANADA, AT THE ELEVENTH ANNUAL MEETING OF THE ROYAL SOCIETY OF CANADA, MAY 30 TO JUNE 2.

Fifteen papers were read by fellows of the Royal Society of Canada at its last meeting, just closed, in the Section (IV.) of Geology and Biology, and five more in the Department of Chemistry and Physical Sciences (Section III.).

Of the latter, Professor Chapman's paper "On a New Form of Application Goniometer" is of interest to geologists and mineralogists, as is also his additional note "On the Mexican Type in the Crystallization of the Topaz, with some Remarks on Crystallographic Notation."

Then comes Professor J. G. MacGregor's address on "The Fundamental Principles of Abstract Dynamics." Here the independence of Newton's three Laws of Motion is first considered, and an attempt is made to establish it; Maxwell's deduction of the first from the "doctrine of space and time" and Newton's supposed deduction of the third from the first being subjected to criticism. Their sufficiency is then discussed. It is shown that Newton's second interpretation of the third law cannot be regarded either as an enunciation of the law of the conservation of energy or as an hypothesis from which that law may be deduced, and a fourth law is suggested, admitting of this deduction. It is then pointed out that, owing to the essential relativity of acceleration, the laws of motion can hold only by reference to certain points. These points are determined, and more precise enunciations both of the laws of motion and of all deductions from them are thus obtained. Finally, it is shown that the fundamental hypotheses from which all the laws of abstract dynamics can be deduced, may be reduced to two.

Geology and Palæontology come in for seven papers, as follows: Presidential Address, by Mr. G. F. Matthew of St. John, N.B., "On the Diffusion and Sequence of the Cambrian Faunas." In this address an attempt is made to distinguish the littoral and warm-water faunas of the Cambrian age from those which mark greater depths of the sea and cooler water. On the hypothesis that species capable of propagating their kind in the open sea would spread rapidly to all latitudes where the temperature of the sea was favorable, such forms as the graptolites are taken as fixed points in the successive faunas. The relation to the graptolites is noted of various species of other groups of animals, as they occur in different countries. It thus appears that several genera appeared first in America and afterwards spread to Europe. On the other hand, a very close connection appears to have existed between the Cambrian faunas of the north of Europe and those of the Atlantic coast of North America. Hence it is inferred that the temperature of the sea of these two coasts was similar, and the connection between them direct and unimpeded. Equal temperatures in these different latitudes would be maintained by a cold current flowing from the North European to the North Atlantic Coast. The evidence available seems to point to a migration of the American species by a route to the west and north of the main part of the Atlantic Basin.

Mr. Matthew contributed an additional paper, entitled "Illustrations of the Fauna of the St. John Group, No. VII." This is the final paper on this subject, and treats chiefly of the fauna of the highest horizon in the group. It will be accompanied by a list of all the species of the St. John group, showing the several horizons at which they have been found. From the highest horizon itself, the species are of the age of those of the Leirs shale, or thereabout, as shown by the graptolites found here. There are several Orthids, some of which are identical with, or are varieties of, species of the Leirs limestone described by Billings. The few trilobites known are of Cambrian types, and include a *Cyclognathus* allied to *C. micropygus* and a *Euloma*. Several minute pteropods occur in these shales, with the graptolites.

Sir William Dawson, F.R.S., presented a paper "On the Correlation of Early Cretaceous Floras in Canada and the United States and on Some New Plants of this Period." The purpose of this paper is to illustrate the present state of our knowledge respecting the flora of Canada in the early Cretaceous, and to notice some new plants from Anthracite, N.W.T., collected by Dr. H. M. Ami, and from Canmore, collected by Dr. Hayden. It is a continuation of the author's paper on the "Mesozoic Floras of the Rocky Mountain Region of Canada," in the Transactions of the Royal Society of Canada for 1885.

Sir William then introduced Dr. Ami's paper "On the Occurrence of Graptolites and Other Fossils of Quebec Age in the Black Slates of Little Metis, Que." The paper contains notes on, and descriptions of, graptolites and other fossils from a small but interesting collection made by Sir William Dawson in rocks closely related to those from which the remarkable fossils were described conjointly with Dr. George Jennings Hinde.

Mr. J. F. Whiteaves, palæontologist and zoologist to the Dominion Geological Survey, read two papers, and introduced a third by Mr. Lawrence Lambe. In his first paper on the "Fossils of the Hudson River Formation in Manitoba," Mr. Whiteaves gives an historical sketch of the discovery and collection of fossils of that age, by Dr. R. Bell, in 1873; by Dr. Ells, in 1875; Dr. Bell, later, in 1879; and by Messrs. T. C. Weston and D. B. Dowling, in 1884 and 1891–92, respectively. The object of the present paper is to give as complete a list as possible of the fossils of this formation in Manitoba. There are now as many as sixty species in the Museum of the Survey at Ottawa. Mr. Whiteaves's second paper deals with "Notes on the Land and Fresh-Water Mollusca of the Dominion." Mr. Lambe's paper contains an account of the results obtained by that gentleman from a microscopical examination of recent sponges collected, in the waters of the Pacific, along the British Columbia or Canadian coast. The paper is entitled, "On Some Sponges from the Pacific Coast of Canada and Behring Sea." It will be illustrated with drawings made by the author, who is artist to the Geological Survey Department.

Professor L. W. Bailey, Ph.D., of Frederickton, New Brunswick, gives the result of his "Observations on the Geology of South-Western Nova Scotia," in the counties of Shelburne and Yarmouth. A careful description of the various contacts and occurrences of the auriferous rocks and other masses follows a review of the geological structure of the district in question. A geological map accompanies the paper.

"On Palæozoic Corals" is the title of Professor Chapman's contribution to palæontological science. It is an attempt to simplify the determinations of genera in the so-called "Tabulated and Rugose Corals of Palæozoic Rocks."

Dr. Wesley Mills's paper on "Hibernation and Allied States in Animals" referred to the winter sleep of groups of animals below vertebrates, hibernation in cold-blooded animals, hibernation in certain groups of warm-blooded animals, experimental study of the winter sleep of the bat, and especially of the marmot and allied states in man; all of which was followed by a discussion of the true nature of all such phenomena.

Dr. George Lawson presented two important contributions to botanical research. The one bore "On the Literary History and Nomenclature of the Canadian Ferns," the other consisted of "Notes Supplementary to the Revision of Canadian Ranunculaceæ." The object of these notes, the author said, was to bring together such additions as have been made to our Ranunculaceæ by Canadians and others since the first paper was published, in 1883; also to discuss certain moot points in nomenclature and specific relations, that have been started by French, German, and United States writers in botany; further, to bring our knowledge of the Dominion Ranunculaceæ up to date.

Rev. Moses Harvey of St. John's, Newfoundland, and a new fellow of the society, contributed a most important paper "On the Artificial Propagation of Marine Food-Fishes and Edible Crustaceans." This paper deals extensively with the rise and progress of pisciculture, the importance of modern fish-culture, artificial increase of fresh-water and anadromous fishes, also the results obtained by private and national enterprises. Aqui-culture may yet approach agriculture in usefulness. Scientific study of fish-life and the physics of the sea bore intimately on the value of fisheries. The work carried on by the United States Fish Commission, by the Canadian Department of Fisheries, and the success of Norwegian pisciculture, along with the great results already obtained by lobster hatching with the Nielson process, are all discussed by Dr. Harvey, and many important facts of great economic value are noted. The paper ends by calling attention to the need of fishery schools and biological stations in Canada, for the study of fish, and other animals of the sea, of most importance to man. These are of national importance.

Mr. James Fletcher, F.L.S., and Dominion entomologist, contributed two papers in that branch of work. The first was entitled, "Report on a Collection of Coleoptera made on the Queen Charlotte Islands by Rev. J. H. Keen and J. Fletcher;" the second, "The use of Arsenites as Insecticides." Both proved highly interesting and useful.

At the closing general meeting of the society the following were elected to office: president, Dr. J. G. Bourinot; vice-president, Dr. George M. Dawson; honorary secretary, Mr. James Fletcher; honorary treasurer, Dr. A. R. C. Selwyn. In Section III. and IV., which deal more particularly with science and scientific work, the following were elected officers of sections: Section III., president, Professor E. J. Chapman; Section IV., president, Mr. Whiteaves; vice-president, Professor Macoun; secretary, Professor D. P. Penhallow.

The discussions which took place on the papers read were lively throughout, and interesting points were brought to light.

The Royal Society of Canada unanimously agreed to invite the Geological Society of America to meet in Ottawa in December.

NOTES ON STAR PHOTOGRAPHY.

BY ROMYN HITCHCOCK.

THE writer would beg the indulgence of those astronomers who may be induced by the title to read these lines in the expectation that they are the results of practical work in photographing stars. These, unfortunately, he cannot give; but inasmuch as the astronomers have so liberally availed themselves of the simplified methods of modern photography, which they can carry out more or less satisfactorily themselves, it is only fair that photographers should have a word to say now and then in behalf of the branch of investigation which they represent. By the term *photographers* I do not mean mere operators in the dark-room, nor amateurs who can make fine pictures, nor anything of the sort. I mean what may be best designated as photographic chemists, who are practically familiar with the subject from a chemical and scientific standpoint, and capable of conducting researches and designing and using apparatus for that purpose. It is certainly true that astronomers generally have neglected the surest means of achieving the highest success and advancement in their photographic work, in that they have undertaken to carry out themselves that part of it which ought to engage the attention of the highest skill and knowledge of the photographic chemist. So little is this fact recognized, that we actually sent a party to photograph the last eclipse of the sun in Japan, absolutely without either a photographer or a photographic outfit. So far from any effort to utilize the latest knowledge and methods for eclipse work, that expedition might easily have proved a total failure from the absence of the essentials for common work. When the expedition to the coast of Africa was fitted out, great attention was given to designing certain forms of apparatus; but, if I recollect aright, no photographer was chosen until a few days before its departure. Then a certain commercial brand of color-sensitive plates was chosen, but on what grounds, or whether the spectrum sensitiveness of those plates was tested at all, I have never learned. There will be an excellent opportunity for eclipse work next year; but if anything new is to be learned from it, the work of preparation should begin now in a photographic laboratory. We have apparatus enough, or we know perfectly w what is required, but we do not know the photographic process best adapted to the work.

It may be but an idle dream, but I hope to see a photographic laboratory established in connection with one of our large observatories or universities, not for routine work but for purely scientific research in photographic chemistry, such as will enable us to apply the latest knowledge to astronomical and spectrographic work.

An announcement has recently appeared, to the effect that the French astronomers have begun to doubt the value of negatives of stellar bodies taken on orthochromatic plates, because the stellar discs are surrounded by a strong aureola due to the aberration of the red rays of the objective. For this reason the permanent committee on the chart of the heavens has decided to exclude orthochromatic plates for such work.

I presume everyone finds some satisfaction in saying, "I told you so." The announcement leads me to publish now an article, on this subject, which was written in Japan between four and five years ago. It was perfectly clear to me at that time, that color-sensitive plates were being used in astronomical work when the very opposite kind of plates would have been much better for the purpose. Instead of extending the sensitiveness, it should have been restricted as much as possible. My article was not published because I deemed the facts too obvious to require discussion. But since M. Léon Vidal, editor of *Le Moniteur de la Photographie*, has taken, as I believe, an erroneous view of the matter in opposition to the practical results of the astronomers, I have looked up my old MS., and publish it herewith without change.

I would add that the opinion then expressed as regards the future of collodion plates, for all scientific work, has been greatly strengthened by the results of later investigations.

The article referred to is as follows: —

The so-called isochromatic, or orthochromatic, sensitive plates have been recommended for use in astronomical photography, in order to obtain impressions of red or yellow stars along with those having more blue and violet light in their radiations. Spectroscopic observations have shown that the light of different stars differs very much in the proportion of highly refrangible rays, and this difference must be of great influence in determining their photographic action. The ordinary sensitive gelatine plates possess a maximum of sensitiveness near the Fraunhofer line H, but some action can be traced into the yellow as the result of very long exposure, or even still further. For ordinary exposures, however, we may consider that the action does not pass the blue, particularly when photographing bright sources of light, such as the stars, because the more refrangible rays are so very much more powerful in their effect upon the plate that they exert their full action before the others can make a visible impression. To extend the time beyond that point would result in a reversal of the effect sought for, a change in the character of the negative, and serious irradiation or spreading of the light around the image, resulting in impaired definition. With ordinary sensitive plates, therefore, the images we photograph are images made with blue, violet, and ultra-violet rays, covering, indeed, a considerable range in the spectrum, but excluding a large and important portion of it.

The differences in the character of star radiations are so considerable that the blue is sometimes very strong and brilliant, even exceeding that of the sun relatively to the other parts of the spectrum, as we find it in α Lyræ and in Sirius; while in other stars the temperature is so low that there is scarcely any blue, and line-absorption gives place to flutings, or even to the bright lines of incandescence from comets and nebulæ. It is obvious, therefore, that one star not only differs from another in glory as seen by the eye, but the photographic plate, which takes no account of any colors beyond its limited range of sensitiveness, tends to exaggerate the difference, and give utterly false evidence of relative brightness. For a red star may appear very bright to the eye, while its image on the plate would be very faint or perhaps scarcely discernable.

With orthochromatic plates the result will be different, provided the telescope itself is not at fault. We will assume for the moment that the telescope is so constructed that the "chemical" and visual foci exactly coincide, and that the plates are equally sensitive to all the colors of the spectrum. Then the negative will show exactly what is seen by the eye, and these are the only conditions under which such a result can be perfectly attained.

Doubtless such perfectly corrected telescopes, or perhaps I should say such as are so corrected within the limits of the optician's skill, are rarely available, and a very usual plan is to make certain corrections for ordinary telescopes to adapt them to photographic work. The effect of these corrections now deserves consideration.

The difference between the so-called "chemical" focus and the visual focus of a telescope may be little or it may be half an inch. In either case the photographed image will be decidedly out of focus if allowance for this difference be not very carefully made. The usual means of doing this is to change the position of the plate-holder, and find the place of the sharpest definition by trials. By properly arranging the ground-glass and the plate-holder, the plate will always be in focus for the actinic rays when the image appears sharp on the ground-glass.

Having accomplished this result, we have succeeded in doing precisely what we do not wish to do, viz., instead of arranging the instrument to photograph what the eye can see, by means of the extended and uniform sensitiveness of an orthochromatic plate, we have arranged it to define only with blue or violet rays, and have restricted its range to stars that are specially characterized by highly refrangible radiations, effectually cutting off the red and yellow stars, and rendering the use of orthochromatic plates not only useess but positively objectionable.

As regards the red and yellow stars, the greater portion of their light will be brought to a focus at the point of distinct vision, not on the sensitive plate; and the feeble radiations of higher refrangibility, being too weak to act strongly upon the plate, such stars will be but faintly shown in the negative. The rays not focussed on the plate will tend to blur the images, and this effect will be more pronounced and objectionable in proportion as the range of sensitiveness of the plate to the different parts of the spectrum is increased. For this reason the most perfect pictures would be produced, under the conditions described, by using plates sensitive only to the particular rays that form the image on the plate, or else by cutting off the other rays by a screen, thus working with monochromatic light.

It is possible that there may be some object in photographing stars with the different colors of the spectrum separately, in which case orthochromatic plates can be so prepared that they will select the particular light required, and such observations may be made with ordinary telescopes, correcting them for each set of rays in turn, in the manner described. But if I correctly understand the purpose of photographic star-maps, they are intended not only to represent the distribution of stars and their relative positions, but also to show their respective brightness, or, as we usually call it, magnitudes. Now magnitude measured by brightness is not the same as the photographic action of the stars upon a plate of restricted spectrum sensitiveness, such as all ordinary sensitive plates, and this, although a self-evident proposition, has not received in practice the attention it deserves. On the other hand, orthochromatic plates will give perfectly truthful representations of the starry heavens when used with perfectly corrected telescopes, as already explained, and that they will only do so under such conditions is, I believe, obvious.

If it is possible to make plates of uniform sensitiveness as regards tests in the sensitometer, and also as regards all the rays of the visible spectrum, and if such plates can be produced regularly in large quantities, we may consider the problem of photographing the stars to be satisfactorily solved. But much yet remains to be done before a plate that can be regarded as standard can be adopted. The composition of the emulsion, the manner of rendering it sensitive, the means of testing the plates, including the standard of light to be used in the process, and the keeping qualities of the plates, must all be thoroughly investigated before it will be safe to adopt a standard plate for universal use. Nevertheless, we are in a position now to begin practical work, and the results will be of permanent value if we act upon the proposition that with orthochromatic plates there is no distinction of chemical and visual rays, and that such plates can only be advantageously employed when all the rays from red to ultra-violet are brought to a focus in a single plane.

I do not venture upon any speculations as to the probably best method of preparing color sensitive plates for astronomical work, for the reason that new methods are constantly being tried. I will say, however, that I deem it not at all improbable that collodion will be found superior to gelatine as a vehicle for the emulsion, and although the gelatine plates are at present more rapid than collodion emulsion plates, there is no obvious reason for this, further than that we not yet know how to make extremely rapid plates with collodion. But there are some objections to gelatine and none to collodion. Gelatine swells in water, particularly in warm climates, and, although this defect can be to some extent controlled, it is really at times a serious trouble, which no "tropical" plates can entirely overcome without a sacrifice of other good qualities.

The great point in favor of collodion is that it seems to lend itself peculiarly well to the production of color-sensitive plates, and this, coupled with the uniformity of the material that can by proper means be secured and the clearness with which it works, leads me to anticipate that it will eventually rival gelatine for fine, delicate work, and I believe it will come to be highly favored in astronomical work and spectrographic work.

Washington, D.C., June 10.

GLACIAL PHENOMENA IN NORTH-EASTERN NEW YORK.

BY D. S. KELLOGG.

CLINTON COUNTY, the very north-eastern county of New York, offers an interesting field for studying glacial phenomena. The rock striæ generally are nearly north and south, though in one place at least they are almost east and west. In many places the outcropping ledges are oval mounds with their longest diameters in the general direction of the supposed motion of the glacier.

There is an abundance of marine shells everywhere in the lower lands. These may be near the present surface and turned over by the plow in such quantities as to make the fields white, or they may be found from 5 to 10 feet under ground. A stratum 2 inches thick underlies much of Plattsburgh village at a depth of 5 or more feet. These are *Saxicava arctica* and *Macoma greenlandica*. Others undoubtedly are present in this county. The highest I have yet found are 346 feet above tide-water.

In Beekmantown ends a tortuous kame, over 50 feet high, which has been traced and mapped north into Chazy, 6 miles. Much of this is laid down upon clay of the former lake-bottom.

The lower slopes of Rand Hill and of Dannemora Mountain are covered with deposits of till, which wells of 50 feet do not go through. I have been over much of this surface for a distance of 20 miles north and south and of 6 miles east and west. There are scores of kame-like ridges from 5 to 70 feet high, generally running north and south, but sometimes in all directions. These ridges form a large number of swamps, varying in size from half a square mile down to a few rods. The bowlders and cobble-stones in these deposits are largely of sandstone, which crops out in immense surfaces in the northern part of the county, and probably lies underneath much of this till. At Cadyville in the Saranac valley, 10 miles from Lake Champlain, the glacier moved across the old valley, making by its deposits a dam 2 miles wide and upwards of 100 feet high. This dam made a lake 8 or 10 miles long, 2 miles wide, and in places 100 feet deep. This lake has been entirely emptied out. The Saranac River has not only cut a channel through this till dam, but has also made a gorge 60 or more feet deep in the sandstone that underlay the lower half-mile of the dam. Probably the old buried channel is not far distant. What was once the bottom of a portion of this lake is now known as the "seven-mile run" in the Saranac River.

The Lake Champlain of the closing glacial period reached up to the lower border of this glacial dam, 500 feet higher than the present lake and 600 feet above the sea. When at its highest level a plateau was formed that extended 2 miles or more out in the lake. After a time the lowering of the lake by the erosion of its outlet left this plateau uncovered. Then a second was formed, perhaps 250 feet lower than the first, spreading out several miles. A third lowering formed a third plateau, on which much of Plattsburgh village now stands, and which makes "The Plains," south. This third plateau in general is from 50 to 75 feet above the present lake, and, like the other two, is composed mostly of sand. Nearly all the time while these plateaus were forming, the outlet of Champlain was south into the Hudson.

A dam of 60 feet now in the Richelieu would throw the Champlain water into the Hudson, unless there is a lower valley out from the Missisquoi Bay. By erosion of the valley from Whitehall to Fort Edward the lake was lowered until the ice had retreated enough to allow the Richelieu to be made. I have not studied the conditions between South Bay and the Hudson. For a time this may have been one of the southern outlets of Champlain. The Champlain Canal at Fort Edward receives its water from a feeder which taps the Hudson at Glen's Falls. *This* water from the Hudson flows north now from Fort Edward in the canal, and empties into Lake Champlain.

Did the pre-glacial upper Hudson flow through into the old river bed which is now Lake Champlain and thence into the St. Lawrence valley?

Plattsburgh, New York, June 13.

NOTES AND NEWS.

IN a circular, "American Reports upon Anatomical Nomenclature," issued last winter by Professor Wilder, as Secretary of the Committee of the Association of American Anatomists, in the third paragraph of the third page, the Chairman of the Committee of the Anatomische Gesellschaft should be Professor A. von Kölliker, and the chairman of the American division (appointed in 1891 by the American Association for the Advancement of Science) of the International Committee on Biological Nomenclature should be Professor G. L. Goodale. Professor Wilder desires to express his regret for the errors, due in the one case to his own misapprehension and in the other to a clerical mistake.

—Professor Bardeleben has recently delivered an address in Berlin on the modern bullet (*British Medical Journal*, May 21). The modern rifle sends a bullet with a narrow cylindrical form and pointed apex, which at a distance of 1,000 metres has the power to pass through several human bodies or to disable two horses. Its line of flight differs but slightly from the line of sight. It has an inner core of lead enclosed in a casing of steel which prevents the lead from becoming deformed and spreading at the point of contact. This change is of much interest for military surgery. The bullet is lighter than any of the lead bullets, but is sent with a greater velocity. On account of its velocity and its small surface of contact, it merely punches out a hole causing very little commotion of the neighboring parts. It is more likely to cause fatal hæmorrhage than the old bullet. If the new bullet wounds at all it will have sufficient power to pass through any part of the body. Colonel Boonen-Rivera, in his report on the civil war in Chili, the only war in which Mannlicher rifles have been used, says that the number of dead on the battlefield was four times larger than that of the wounded. The effect of these bullets on bone has been made the subject of a series of experiments. Up to a distance of 400 metres the bone is invariably shattered, and at greater distances either clean perforations or oblique fractures result. In the next war the ratio of recoveries of those who can be removed still living from the field will be larger than formerly. The new projectile is by no means so humane as it is sometimes called, since within similar periods of time and under equal conditions it kills and wounds more men than the old bullet. But the wounds which it causes, if they are not of a directly fatal nature, open to the surgeon, as a general rule, a far more promising field for exercising his skill and activity than those which were caused by the old bullet.

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CURRENT NOTES ON ANTHROPOLOGY. — VIII.

[*Edited by D. G. Brinton, M.D., LL.D.*]

The Palaeo-Ethnology of Mahgreb.

UNDER the name Mahgreb (*Beled el Mahgreb*, Land of the West) the Arabs distinguish that portion of Africa west of the Nile Valley, and north of the southern boundary of the Sahara, from the Soudan (*Beled es Sudan*, Land of the Blacks). It is a convenient geographic term, and as we have adopted Soudan we may as well also take Mahgreb, especially as it is a well-marked ethnic area. It is and has been from time immemorial the home of the Berber, or Hamitic, or Proto-Semitic peoples, as they have variously been termed.

In a late number (April 9) of the *Revue Scientifique*, A. Chatelier gives an admirable summary of the prehistory of this region. Signs of Palæolithic man abound in all parts, carrying his residence far back into the quaternary, when quite different geographic distributions of water and climate prevailed from the present. He was succeeded, apparently without a hiatus, by neolithic communities, who developed the art of stone-implement making to great perfection. Their numerous workshops and village sites occur on the watered lowlands, showing that the physical geography of the country had then reached its present state. The neolithic industry continued to nearly the Christian era, flint chips being found in tumuli overlying Roman remains. There are also many rock-drawings belonging to this period, rude, but revealing Egyptian inspiration in the costumes depicted, the human figures with ibis heads, etc.

But the most striking features of the prehistoric remains are the megalithic structures, the dolmens, menhirs, cromlechs, triliths, stone circles, etc, which are abundantly scattered over the soil from Fez in Morocco to the Tripolitan plateaux, where they abruptly cease, none extending into Egypt. These were undoubtedly constructed by the ancestors of the present Berber population. They not only claim them as the tombs of their forefathers, but to this day some of the tribes surround their cemeteries with similar stone circles, called *Heuch*, That they were in common use at a late date is proved by the discovery in some dolmens of iron and Roman coins; and that these relics were of contemporary date and not intrusive, is proved by the presence of several structures of this character in southern Tunisia, built on an old Roman road.

That precisely similar megalithic remains are found in Palestine, is explained by the presence there of the Amorites and other true Hamitic tribes; that they can be traced in a continuous line across the Straits of Gibraltar, through northern Spain and France to England and Denmark, and not beyond, offers a suggestive hint concerning the prehistoric migrations of the Mediterranean peoples.

The conclusion which M Le Chatelier especially impresses on his reader is, that the same Berber stock has possessed Mahgreb, so far as all evidence goes, from the very earliest times of which we have any cognizance down to the present day.

The Prehistoric Culture and Commerce of the Mediterranean.

Archæological research is rapidly dispelling the erroneous notions that the early civilizations of the Mediterranean were derived from Asia or Egypt; and that previous to the mythical advent of Cadmus, or the founding of Carthage and Rome, the coasts of this great sea were peopled by savages. In fact, one of the most brilliant periods of commerce and culture on the Mediterranean was about 1500 B C. At that date there were several centres on the European shore of high civilization, wholly independent and occidental in their ideals and technique; on the southern shore the Hamitic Libyans and Mauritanians had, by spontaneous development, reached a degree of culture quite up to that of their neighbors, the Egyptians. It is chiefly by the accident that their art-products have been better preserved, that we have hitherto attributed a superior grade of advancement to the latter. There is no reason for believing that the Egyptians were much in advance of the other nations of the Mediterranean basin at the close of the Old Empire. The introduction of metals was what chiefly led to the predominant influence of oriental ideas. This event occurred between 1500 and 1200 B.C.

These opinions, which are now gaining general credence, are well set forth in a volume published lately in London, by Professor W. M. Conway, entitled "The Dawn of Art in the Ancient World." It would be easy to support his views by abundant evidence.

On Ethnic Nosology.

Differences in races are not confined to matters of anatomy and physiology, but show themselves to a marked degree in special liability to, or immunity from, certain classes of diseased conditions. This has attracted the attention of the medical profession from time to time, but only recently, since the discriminating traits of races have been more closely studied, has it received proper attention. In this country the practitioner who has treated of it most extensively is Dr. Albert S. Ashmead, of New York City. His articles on racial immunity and inoculation, on the ethnic extension of syphilis, leprosy, tuberculosis, yellow and scarlet fevers, have appeared in various medical journals, and embody a mass of instructive observations on the relative presence of these complaints in different peoples.

The study of the causes of racial immunity from disease has a very practical side. When we find, for instance, that the Japanese are not liable to scarlet-fever, and the negroes are equally exempt from yellow-fever, if we could ascertain what condition it is that confers upon them this exemption, we might be able to take a long step in the direction of personal and general prophylaxis. There is no more vital question, none more attractive to the most active minds of the medical profession to-day, than this of immunity; and in the direction of ethnic immunity there lies a wide avenue for investigation promising to lead to results of the utmost utility to the health and welfare of mankind.

The Builders of the Great Zimbabwe Ruins.

Among the auriferous reefs of Mashona-land, in south-western Africa, about 20° south latitude, are found a number of remarkable ruins of well-built stone cities, towers, and forts, which have long been an enigma to archæologists. Needless to say, they were not constructed by any Austafrican people; no negro or negroid race ever built stone walls voluntarily. The problem seems to be solved by the researches of J. Theodore Bent, which are published in the last number of the Proceedings of the Royal Geographical Society. He visited and explored the ruins of the largest city, called the Great Zimbabwe. This being a word of the local dialect, meaning krall or town.

His excavations show that these ruins were built and occupied by a people engaged in gold-mining. Crucibles and smelting furnaces were found, and in the vicinity "millions of tons" of quartz have been worked over. The stone work is massive, very firm, the stones often carved and decorated, and the sites usually of great strategic strength. Many images of birds, carved in stone, and also many phalli, in the same material, were unearthed. Pottery was abundant, the fragments often decorated with neat designs of animals, plants, and scenes from life. No coins were exhumed, and no inscriptions discovered, except some rude scratchings on a bowl, which resembled Ogham characters. What is significant, is the presence in the *dêbris* of Persian and Chinese Celadon pottery, which is not of very ancient date. Bent's conclusion is that the gold-seekers were Himyarites from southern Arabia, and that their settlements were destroyed by the savage Zenj from Abyssinia about the ninth century of our era.

Many consider this to be the Ophir of the Hebrews. An interesting visit to it, not mentioned by Bent, is described in the *Verhandlungen* of the Berlin Anthropological Society for 1889, carried out by a young German named Posselt. Both accounts present engravings of carved stones, figures of birds, etc.; but it is singular that neither explorer could find a single grave or skeleton of this ancient people.

THE PROPER MOTIONS OF THE STARS.[1]

BY W. H. S. MONCK.

SOME time since I pointed out in the columns of the *English Mechanic* the great preponderance of proper motions in diminishing right ascension in certain catalogues which I examined. I have now examined O. Struve's great Pulkova Catalogue, which contains the proper motions of nearly 2,500 stars, with a similar result. About two-thirds of these motions are in decreasing right ascension. I suspect that the sidereal year has been under-estimated by a small fraction of a second, in consequence of which a star whose proper motion is really insensible appears to have a small motion in decreasing right ascension. The effect of the sun's motion in space is very evident in the Pulkova Catalogue. The right ascension of the apex of the sun's way (the Americans use the shorter term, goal) may be roughly taken at 18 h. The effect will be to produce an apparent motion in diminishing right ascension on all stars between 6 h. and 18 h., and an apparent motion in increasing right ascension on all stars between 18 h. and 6 h. Diminishing right ascension predominates in both cases, while in the latter the excess is only about 20 per cent.

I noticed, however, a curious fact as regards the motions in North Polar distance. The sun's motion produces an apparent increase in North Polar distance in all parts of the sky save the portions situated between the apex and the North Pole on the one hand, and between the antapex and the South Pole on the other. But taking the right ascension of the apex at 18 h., as before, the motions in North Polar distance ought to be symmetrically situated between 6 h. and 18 h. and between 18 h. and 6 h. But this is not the case. Between 18 h. and 6 h. the proportion of increasing to diminishing North Polar distances is two to one, while between 6 h. and 18 h. it is only about four to three. It occurred to me that this difference might arise from some special drift in the stars of the Galaxy, of which a comparatively small number lie between 6 h. and 18 h. in the Pulkova Catalogue, which deals chiefly with northern stars. I accordingly tried Mr. Stone's "Catalogue of Southern Stars," which so far verified my conjecture. The great preponderance of increasing North Polar distances in it lie between 6 h. and 18 h., and the relative proportions are not very different from those in the Pulkova Catalogue reversed. Further examination will be necessary to clear up the question; but I venture to suggest that the Galaxy has a southerly drift relatively to the majority of the non-Galactic stars, and that we would obtain different goals for the sun from the Galactic and the non-Galactic stars.

May I add that in dealing with the fixed stars our present unit of distance—a year's light-passage—seems to me inconvenient. Besides the advantage of having a space unit instead of a time unit, and the existence of some little uncertainty as to the rate of propagation of light; we must recollect that our standard of measurement is the distance of the sun from the earth. The time occupied by light in traversing this distance is uncertain to the extent of at least two or three seconds, and the difference becomes considerable when we are considering very remote bodies. I venture to suggest as a better unit the distance of a star having an annual parallax of 1″. This distance is 206,265 times that of the sun. The distance of α Centauri on this scale is about 1.33 and Sirius about 2.5 We should seldom, if ever, have to use numbers as high as 1,000, and the reciprocal of the parallax expressed in fractions of a second would in all cases give the distance.

[1] From the English Mechanic, May 27.

THE PEAR-TREE PSYLLA.

BY J. A. LINTNER.

UNTIL within a few years the pear-tree has been remarkably free from insect attack, the amount of injury from such source being probably less than five per cent of that to which the apple has been subjected. Recently two pests have forced themselves upon the notice of pear growers, which have already inflicted serious losses, and threaten, unless arrested, greatly to interfere with the cultivation of this most excellent fruit. Of these, the pear midge, *Diplosis pyrivora*, which was introduced in this country about the year 1880, has not become broadly distributed, and has not occasioned much trouble except in western Connecticut and in portions of the Hudson River valley.

The pear Psylla, *Psylla pyri*, also an importation from Europe, has been with us at least from 1850, when, as recorded, it infested an old Virgalieu pear-tree in Greenbush, N.Y. Since then it has become quite widely spread, and seems to be rapidly increasing in number and in the injury that it is doing. It was very destructive last year along the Hudson River in Columbia and Greene Counties. Mr. Powell, an extensive fruit-grower in Ghent, Columbia County, has stated that it reduced his pear-crop from an estimated yield of twelve hundred barrels to an actual one of less than one hundred barrels. Mr. A. F. Coe, of Coe Brothers, owners of large orchards in Meriden, Conn., has written me that on his return from Europe last September, he found that two of his pear orchards had been devastated by the Psylla.

It is a small suctorial insect, somewhat resembling in size and in its transparent steep-sloping wings the typical plant-louse, but is readily distinguishable from that in its being a jumping insect, whence it has been given the name of *Psylla*, meaning in the Greek a flea. Its injuries are caused by the large amount of sap which the myriads of individuals draw from the twigs, buds, leaves, and leaf-stalks of an infested tree, and the "honey-dew," which it freely deposits, thickly coating the surface and thereby preventing the normal vital action of the bark and leaves.

Without consuming space with a detail of so much as is known of its life-history, suffice it to say that at the present time, or about the middle of June, the insect in its four stages of egg, larva, pupa, and imago may be found upon infested trees, and an abundant deposit of the honey-dew. Later in the season the winged insects are more numerous, and at the time of gathering the fruit, as the branches are disturbed, they have been reported as "flying up in clouds from the foliage."

With the appliances now at our command it should not be a difficult task to check and control the ravages of this pest. Its most vulnerable period is doubtless, as in the Aphididæ, at the hatching from the egg. At this time proper spraying with a kerosene emulsion will be fatal to it. If the spraying be deferred until the larvæ have become half-grown, the presence of the honey-dew would interfere with the action of the kerosene. Early spraying should also kill such of the eggs as may be reached by it, but many are placed in positions where they are almost entirely protected.

When the insect has passed to its winged stage, it has attained comparative immunity in the alertness with which it takes wing and leaves the tree upon the first motion communicated to the foliage by the impact of the spraying liquid. But even so late as this the war against the insect should not be abandoned, for multitudes may be destroyed, and the egg-crop for the following year greatly reduced. The kerosene emulsion will still be effective, but in its application all of the ordinary spraying-nozzles should be discarded, even the finest gauge of the Nixon nozzles, and a Vermorel used, adjusted to the delivery of the finest possible mist-like spray. With proper care the emulsion may be distributed over the entire foliage without scarce stirring a leaf and with the least possible alarm to the winged tenants. Of those that take wing — after circling about the tree for a while — on their return to the leaves, their bodies will in most cases come in contact with the liquid and cause their death.

Office of the State Entomologist, Albany, June 13.

THE TECHNICAL EDUCATION OF THE ELECTRICAL ENGINEER.[1]

BY DUGALD C. JACKSON.

PERHAPS it would be well to call my subject the "College Education of the Electrical Engineer," for it is strictly of the technical college course that I shall speak. We can truly affirm that the technical education of an engineer does not end until his work is ended, and the college course is but the commencement of it. That the college course can be made a very important fundamental part of this education, is becoming more thoroughly appreciated as the work of the technical schools comes into closer harmony with the demands of the profession, and it is now generally agreed that a technical college course, of the proper kind, forms a valuable aid towards the success of the average young man who wishes to enter the engineering professions. It therefore becomes a matter of no little moment to so arrange the course that its usefulness will be a maximum. A few years back, a college course entirely devoted to the training of electrical engineers was unknown. At the present time there is no dearth of such courses and their organization is progressing right and left, whence it is well to carefully consider what requirements of the electrical engineer's profession they may be made to meet, in order that no powder be wasted. It is neither possible nor desirable that the courses of study of electrical engineering students in the various schools should be alike, but a certain unity of purpose and treatment should be observed, and all can profit by the suggestions made by the practical man.

With this in view, I present the subject to your attention as it is looked upon at the Engineering School of the University of Wisconsin. There is no originality claimed for the ideas presented, as they are based upon the recorded experience of some of the country's most successful practical men, and are virtually followed in such other engineering schools as make their courses thoroughly practical, and therefore, in the true sense, professional. I trust, however, that a discussion will arise that is in proportion to the wide importance of the subject to the electrical profession, and that must result in a considerable increase in the efficiency of the electrical engineering courses in our various colleges, nearly all of which are still in process of crystallization.

In order to enter the freshmen class of the best engineering schools, the applicant must have a thorough common school education, including mathematics through ordinary algebra, a fair knowledge of English, a reading acquaintance with German or French, a little elementary physics and chemistry. This can be gained in the high schools of most of the cities of this country. The high school timber (some of it quite green) the college is required to work, and to work it to the best advantage requires no little careful designing. In order that an engineer may use his abilities and training most advantageously, he should have a good general education, including a fair knowledge of literature, history, economics and certain elements of law. This cannot be expected to come from the high school, and you can readily appreciate that an attempt to give a general education in an engineering course can only result in sacrificing the good of the students by omitting essential fundamentals. Thus, to have an average chance of proving successful, an electrical engineer must be well grounded in three sciences besides those gained in the common schools, and which can-

[1] A paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6-8.

not be classed as engineering. These are : Higher mathematics, as far as it may be practically applied in engineering; chemistry and physics (including elementary electricity and magnetism); and manual training. A few students enter college who have been given a fair start in these, but they are the exception, consequently the subjects must be taught from the ground up, with a common-sense view to their practical applications. Unlimited time could be given to these preparatory subjects, but it is necessary to clear them away in the actual time of two college years. With this requirement, it is impossible to give a very thorough knowledge of analytical chemistry, or of physics, but they are taught so as to give the student a good working knowledge and so that he can readily go deeper if he finds it to his advantage in his future practical experience. The higher mathematics require all the time that can be afforded, especially in its last division, that of applied mechanics, where the student gets his systematic knowledge of the properties and uses of materials.

With the preparatory studies cleared away the student must enter into professional studies in earnest, but there is little time for true engineering. The developing electrical engineer must expand his physics and his chemistry and mathematics into the laws of electro-magnetism, alternating currents, electrolysis and electro-metallurgy, and study the conditions of their numerous practical applications in engineering and the arts, each of which may demand months of constant effort before an intelligent mastery is attained. Neither can he confine his attention to these during two full years, for he must gain an elementary but practical knowledge of thermo-dynamics and hydraulics, with an efficient working knowledge of their applications in steam and water-power plants. He must also get a common-sense knowledge of the principles underlying the design, manufacture and selection of machinery.

This is a great deal to expect a student to efficiently absorb in four years, and it requires a most judicious selection in order that nothing unessential be allowed to enter and that nothing essential be omitted. Let us see how the selection is made at the University of Wisconsin. The arrangement of the fundamentals will first claim our attention.

During the first year the student is given a course of four subjects, continuing through the year. These are: 1st, English and rhetoric, with such reference to technical forms as seems desirable so early in the course; 2d, mathematics, beginning with higher algebra, passing through trigonometry and descriptive geometry, and into analytical geometry; 3d, advanced French or German, grammar and reader; 4th, manual training. In the latter, which continues during the following two years, we do not think it necessary or desirable for the student to spend sufficient time during his course to become a carpenter, machinist, blacksmith or foundryman. His future calling will probably not demand that his wages be earned in either of these trades, but they are tributary to his profession, and he must have an intelligent mastery of the tools, and an appreciation of shop requirements. In order that some future day he may become a successful designer, or a useful shopman or superintendent, it may be desirable for him to take a properly arranged apprentice course in a first-class commercial shop, after completing his college course. Mathematics are also continued through the second and third year, during which time analytic geometry, calculus and applied mechanics are passed through. All mathematics are taught with especial view to future practical applications, and good use is made of the laboratory in applied mechanics. During the second year of the course, elementary chemistry and physics are disposed of, and here again the laboratory is put to good service. At the same time, work in draughting and the elementary designs of machines is begun. The third year is about half, and the fourth year wholly devoted to what may properly be called professional studies. The arrangement of the latter in the electrical engineering course, we will examine later.

Upon completing his technical college course of four years, an average student has spent at least 144 weeks of hard study, much of it of a practical work-day nature. During this time he has been called upon to spend upwards of five hours per day in class-room and laboratories, and about as much more time in individual study. No one is likely to go satisfactorily through such a course unless he has a decided taste for engineering work, but many students find themselves capable of doing a considerable amount of extra work, and yet have sufficient time for recreation to keep their health and spirits. It is well for an engineering course to stand beyond the reach of students without a taste for the work, for a successful engineer must be pre-eminently an enthusiast, while he is at the same time a candid and careful thinker. Those who are not fitted by nature to become engineers, are better placed in a general educational course at college, and they are then more likely to become useful to society and to themselves than if passed through the technical mill.

It may here be asked, Of what use is the severely specialized education to the successful student in the engineering courses? The graduate does not become an engineer merely because he has successfully met the college examination. College cannot make an engineer, however practical the course of study may be. Practice has made thousands of good ones, without the aid of the college, but I venture to say that these would frequently have become more eminent if they had received a thorough technical college course. While theory alone, wherever learned, cannot make a practical man, it is the one who can follow the guide of theory, along the paths of practical work and experience, who makes the fully-developed engineer. In order, however, that neither theory nor practice may lead him astray, he must have a well-educated common sense. The eminent and eloquent engineer, Alexander L. Holley, well illustrated this in one of his addresses, when he said: —

"Mere familiarity with steam-engines is not, indeed, a cause of improved steam engineering, but it is a condition. The mechanical laws of heat were not developed in an engine house, yet without the mechanism, which the knowledge derived through this familiarity has created and adapted, the study of heat would have been an ornamental rather than a useful pursuit. So in other departments. . . . When one in any art can make a diagnosis by looking the patient in the face rather than by reading about similar cases in books, then only may he hope to practically apply such improvements as theory may suggest, or to lead in those original investigations upon which successful theories shall be founded."

The true object of the technical college is here outlined. It is to teach the fundamental theories, with a common-sense view to their practical applications, in such a way as to aid in a diagnosis, not by the application of a mathematical formula, but by comparing the accumulated experience of the practical world. Take two young men of equally good ability and equal age; put one through a thorough technical college course and the other through an apprenticeship of the same length of time. Finally, put them side by side in a working position, where they must work out their own salvation, and the college man will usually have more ambition and adaptability, and will outstrip his mate, though perhaps not at once. The college man may fall behind at first, but, having worked through the transition period, he will prove the winner. I venture to say this is the well-nigh universal experience of those who have had the opportunity of dispassionately trying the experiment.

Another illustration of the advantage of the technical college course, lies with the designer. To design good machinery is a natural gift, and to become thoroughly successful requires long experience, in order that the widely varying requirements may each be given due weight. Proper instruction at the technical school may here do much towards stimulating an appreciation of the lessons of experience. The considerations of primary importance to be followed in designing machines, are admirably divided by Professor A. W. Smith into four: 1, Adaptability; 2, strength and stiffness; 3, economy; 4, appearance. In developing the design of a machine, the practical, but highly sanguine inventor often forgets all the considerations except the first. A theoretical draughtsman may figure the strength to great precision by formulas that may not fully cover the required conditions, and in the meantime forget the other considerations. When the design reaches the shopman, it must be altered to suit his views of economy, as the prime factor. A machine is thus produced that has lost part of its adaptability as designed, and has neither sufficient stiffness to properly do its work, nor a thoroughly substantial, workmanlike appearance. The economical shopman has been defeated in his object, for the machine is hard to sell, or requires costly repairs at the expense of the maker. A proper college course should sufficiently broaden a man, so that he can quickly appreciate the demands of the prime considerations of practice, and will apply his formulas with common sense and moderation. If we replace our three men in the machine transaction by men of equal experience and a technical college education of the right sort, the work of each should supplement the work of the other, and the product can be predicted, with some confidence at least, to be a satisfactory commercial one. The fault of much of the college training for engineers, has been the lack of this education of the common sense or judgment. The result has often been graduates with as great a contempt for the practical man as the latter could return. These graduates have, it is needless to say, been a failure in their calling, and it is such men that technical colleges should not turn out. The best engineering schools desire to, and do, turn out men who have a capacity for practical work and research, and who are in a fair way to make useful engineers.

It is comparatively easy to properly teach the fundamental theories, hence it is so frequently overdone. It is not so easy to educate the judgment of a student in electrical engineering, whose entire knowledge of his future profession has been acquired from the electric bells in his father's house, and who may never have examined a dynamo or storage battery until he visited the college laboratories. But it is wonderful how rapidly such students, when of good timber, absorb a beginner's information and a thirst for investigation. In this part of a student's education, the manufacturers and large users of electrical apparatus, who have become directly or indirectly interested in the work of the graduates, can assist with little direct inconvenience and much indirect advantage. In a properly organized technical school, as shown above, the student gains his fundamental theory during the first three years, and, if of good timber, he will absorb much of the practical methods of thought required for successful after-work. Moreover, a considerable part of the third year is spent in practical instruction. As the fourth year is wholly spent in practical training, or the education of the common sense, the student must have some acquaintance with the methods of commercial work before entering it, in order that he may properly profit by the instruction. It is impossible for many, and doubtless undesirable for the majority, to take a year from the midst of their college course for outside work. The summer vacation between the third and fourth years should, therefore, be occupied in some such employment as wireman on electric light or telephone construction, or better, in the station and repair-room of an electric railway, under the eye of an appreciative superintendent. Three months spent in this work may seem very little, but it will do a deal of good in giving an apt student a fair idea of how far exact formulas will carry him. It is only by the generous co-operation of employers, that students can obtain this summer's work. At first thought it appears that the employer gains no advantage from it, but, upon careful consideration, an advantage is evident. To begin with, the properly trained student will not prove useless during the summer, and the satisfactory one will usually find employment after graduation, with the interests of those who afforded him summer work, and who thus gain the benefit of his greater advancement during his last year at college. In a similar manner, the manufacturer gains an advantage from placing his apparatus in the technical school laboratories for proper use in instruction.

Suppose a student has completed the prescribed college course, and has done a proper portion of repairing armatures, stringing wires, or similar work, at some interval between his terms at college, what shall we call him? A few of the technical colleges of the front rank call their graduates engineers, but we have already seen that they must pass through a transition period, during which the claim to the title can be proved. To call an untried graduate an engineer does not seem proper respect for himself or the successful workers in his profession. The transition period may never end for some graduates, while its length must always depend upon the man. Until the graduate has been in practical life a sufficient time to show his capacity, and has reached a position of responsibility, he has no right to claim from his college an engineer's degree. Upon this ground the University of Wisconsin, as do many others, confers degrees in engineering upon graduates of its engineering school of not less than three years' standing, who have held engineering positions of trust for at least one year. The minimum transition period is thus tacitly recognized as three years. Upon completing his college course, the student is given a graduating degree of Bachelor of Science by the engineering school, which is simply an endorsement by the University that he has received a good technical college education and is in a fair way to profit by it.

That the rigid specialization required in the technical school may not diminish the graduate's field of vision and thus his usefulness to society, is a matter of much concern. With the college left behind, there is little opportunity to gain a broadening culture, except that received by contact with broad men, while we have seen how little opportunity for this can be afforded in the technical course. With this in view, we recommend at the University of Wisconsin, that all who can afford the time and money complete a four-years' undergraduate course in the University School of Arts and Sciences before entering the School of Engineering. By proper elections during the general course, the studies of an engineering course can be completed in two additional years. By this plan a solid educational foundation is laid for the specialized studies of the engineering student, and the best conditions are developed for his ultimate success in professional work. The plan offers two other points of advantage: First, the student comes to his professional studies in the engineering courses with a more matured mind, which is of much importance; second, students without the taste for hard engineering work, which is required for their future success in technical industries, will not often attempt a technical course after having completed a general course.

We can now usefully inquire into the specialized work that should be prescribed for the average electrical engineering student during his last two years at college. Up to this point, students in mechanical and electrical engineering courses have received virtually the same instruction. Here, we hold, with several others, their paths should diverge. The student of mechanical engineering goes into careful study of shop practice, designing and utilizing various types of machinery, and similar subjects. The electrical engineering student must receive a good working knowledge of the problems of the mechanical engineer, but he must, above all, be trained in the practical problems of electrical engineering. He, therefore, goes into a study of that which will aid most in making him truly an electrical engineer. His knowledge must all be based on mechanical laws, but he must be much more than one-tenth electrical.

Before reaching his truly professional studies, the student should gain, during his course in physics, a common-sense grasp of the elementary notions of electricity and magnetism, and of the "all-pervading law of Ohm." The latter can be properly enforced in the laboratory by placing in the student's hands ordinary electrical instruments, such as bridges, galvanometers, amperemeters, voltmeters, etc. Before beginning his specialized work, the student's knowledge of Ohm's law and its common results should have become almost instinctive.

With due regard for his preparation, it seems best to arrange the professional studies for the average electrical engineering student in four divisions, thus:—

1. Electro-magnetism and its application to practical uses, with special reference to dynamos and motors.

2. Electro-chemistry (including primary and secondary batteries) and electro-metallurgy.

3. Alternating currents and alternating current machinery, including dynamos, converters, condensers, etc.

4. The special application of the preceding divisions in electric light, power, railway, mining and other types of plants.

The last division is allotted about twice the amount of time given to each of the others.

While higher mathematics is a useful aid in each of the divisions, its limitations as an agent must be carefully set forth in the class-room and laboratory. For the purpose of educating the judgment and fully defining the limitations of theories and mathematical deductions, the laboratory is indispensable. As much as one-half of the total time spent by the student under the direct instruction of the professors of electrical engineering, should be devoted to the laboratory. This work, moreover, should as far as possible deal with commercial instruments and machinery, and actually follow the methods of testing and research used in practice. Physics, chemistry, mechanics, the steam engine, hydraulics, dynamos, electrolysis, alternating currents, and other subjects, should all be properly represented by a commercial laboratory equipment, which is made useful in every day instruction under the direction of a man who has had experience in similar commercial work. The laboratory method of educating the student is unfortunately too little developed in many of our engineering schools, but a strong movement has begun in most schools to increase it in efficiency and amount. At the University of Wisconsin, we carry the laboratory instruction as a part of the required work in every subject in which it is possible.

While the specialized course of the electrical engineering student during the last two years is largely devoted to strictly electrical engineering, he is also given proper class-room and laboratory instruction in useful allied subjects, such as the steam engine, boilers, water-wheels, laws of contracts, etc., as has been already explained.

Students who are mature and show that they can usefully specialize more severely than is done in the regular prescribed course, are permitted, by election, to devote a greater proportion of their time to either of the first three divisions already enumerated. Thus a student may have reason to know that a thorough course in electro-metallurgy will be specially useful to him. In this case, his work in the second division is increased beyond the course requirements, and his work in the first and third divisions is proportionately decreased. Other things being equal, a student who has thus arranged his course may graduate with his classmates who have followed the fixed course, as laid down. In the same way, a student of sufficient maturity, who feels assured of special advantages in the field of electric transmission of power or electric railways, may increase his work in the first or third divisions and proportionately decrease it in the second.

The student who satisfactorily completes a proper professional course at college, whether laid down in the college catalogue or carefully elected from that prescribed, is not likely to become one who "turns out results like a cornsheller, and never grows wiser or better tho' it grinds a thousand bushels of them." In order that he may have a fair opportunity of growing "wiser and better" in the practice of his art, he should be given reasonable encouragement. As Mr. Holley one time said, an understanding should obtain "among the owners, directors, and commercial managers of engineering enterprises that it is not a matter of favor, but a matter of as much interest to themselves as to any class, that young men of suitable ability, and of suitable preliminary culture, however acquired, should have an opportunity and encouragement to master the practical features of technical education in works, not as mere apprentices, but under reasonable facilities for economy of time and completeness of research."

A legend on the cover of a circular lately issued by the Engineering School of the University of Wisconsin, gives the true object of the technical college, when it says, "We do not aim to produce engineers, but to produce men with great capacity for becoming engineers." If our product is accorded the treatment advised by Mr. Holley (himself an experienced manufacturer), we feel sure the work of our school and of similar technical schools will not be useless.

Madison, Wis., May, 1892.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

How to Protect Inventions in Foreign Countries.

In my article on protecting inventions in foreign countries, the matter quoted below should be amended, as indicated, by adding the clause in italics.

"The term, 17 years, of a United States patent is not shortened by an application filed, within 7 months of the United States application, in Belgium, France, Great Britain, Guatemala, Italy, Netherlands, Norway, Portugal, Servia, Spain, Sweden, Switzerland, and Tunis, or within 6 months, in Brazil or San Domingo," *if the respective dates of the foreign patents are the same or later than that of the United States patent.*

The error occurred through no fault of yours; but you would greatly oblige me by entering the correction.

EDWARD P. THOMPSON.

New York, June 9.

The current issue of *The Weekly Bulletin of Newspaper and Periodical Literature*, published at 5 Somerset St., Boston, is twice its usual size, containing a classified index of 1300 articles from recent numbers of the periodical press. The *Bulletin* catalogues the impotant articles in the leading daily and weekly papers and the monthly magazines of the United States and Canada, including *Science*. Its value to readers, writers, and students, is sufficiently indicated by its title, and, although still in its first volume, its success as evidenced by the current issue is a surprise to no one acquainted with its plan and purpose.

— A State Academy of Science was established in Ohio last December by a few of the workers in various departments, and held its first field or summer meeting at Akron on the 3d and 4th of June. Arrangements were made for its reception by the Akron Scientific Club, and these were carried out to the evident satisfaction of the members attending. Their number was, however, diminished by a heavy downpour of rain during the preceding night though on the two days of the meeting the weather was fine. A small steamer was engaged for the day, and both hosts and guests enjoyed together ample opportunities for study and collection, in all departments, on the banks and in the waters of several of the morainic lakes so numerous in the vicinity of Akron. In the evening a reception was held at Buchtel College, when short addresses of welcome were made by the mayor, the president of the college and the president of the club, and were suitably replied to by several of the visiting members. A short business session and a microscopic exhibition by the students completed the programme. On Saturday the members went by an early train to the Gorge of the Cuyahoga, where they spent the

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CALENDAR OF SOCIETIES.

Chemical Society, Washington.

May 12.—E. E. Ewell, The Carbohydrates of the Coffee-Berry; G. L Spencer, An Improved Extraction Flask and an apparatus for Rapid Drying over Sulphuric Acid; K. P. McElroy and W. D. Bigelow, Behavior of Chromates in Acetone Solutions. Adjournment was until November.

Biological Society, Washington.

June 11.—C. Hart Merriam, The Southern Fur Seal (Arctocephalus) at Guadalupe Island; Frederick V. Coville, Uses of Plants among the Panamint Indians; J. M. Holzinger, On Amarantus crassipes Schlectendal; C. Hart Merriam, The Death Valley Expedition.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Taxidermist going out of business has quantity of finely-mounted specimens of North American birds, mammals and reptiles and skins of birds for sale, including a full local collection of bird skins, showing some great variations of species; also quantity of skulls with horns of deer and mountain sheep, and mounted heads of same. Will give good exchange for Hawk Eye camera with outfit. Apply quickly to J. R. Thurston, 265 Yonge St., Toronto, Canada.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—We want any and all of the following, providing we can trade other books and magazines or buy them cheap for cash: Academy, London, vol. 1 to 28, 35, Jan. and Feb., '89; Age of Steel, vol. 1 to 66; American Antiquarian, vol. 1, 2; American Architect, vol. 1 to 6, 9; American Art Review, vol. 3; American Field, vol. 1 to 21; American Geologist, vol. 1 to 6; American Machinist, vol. 1 to 4; Art Amateur, vol. 1 to 7, Oct., '4; Art Interchange, vol. 1 to 9; Art Union, vol. 1 to 4, Jan., '44, July, '45; Bibliotheca Sacra, vol. 1 to 46; Godey's Lady's Book, vol. 1 to 20; New Englander, vol. 11; Zoologist, Series 1 and 1, Series 3 vol. 1 to 14; Allen Armendale (a novel). Raymer's "Old Book" Store, 243 4th Ave. S., Minneapolis, Minn.

WANTED.—By a young man, a Swarthmore College junior, a position as principal of a public high school in one of the Gulf States, or as instructor in botany, physiology, and geology in an academy or normal school. Address B., care of Librarian, Swarthmore College, Penn.

WANTED.—A teacher of Geology who is familiar with the fossils of the Hamilton Group, as instructor of Geology during July next at the Natural Science Camp on Canandaigua lake. Apply to ALBERT L. AREY, Director, 229 Averill Ave., Rochester, N. Y.

WANTED.—To act as correspondent for one or two daily or weekly papers. Have worked on paper for about two years Would like a position on editorial staff of humorous paper. Address GEO. C. MASON, 14 Elm St., Hartford, Conn.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B, care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

day in a specially rich field for study in geology and botany, and where entomology was not lacking in opportunity. Those who were compelled to return took the afternoon trains, and a few who could remain assembled and took tea at the home of the president, where they spent the evening. The meeting broke up with the conviction that the first summer gathering of the young Academy had been a pleasant and successful occasion.

—In a paper read before the Washington Chemical Society, May 12, the carbohydrates of the coffee-berry were discussed by Erwin E. Ewell. Our knowledge of the carbohydrates has been materially extended during very recent years, in consequence of which investigation in this line has been greatly stimulated. Maxwell has demonstrated the presence of an insoluble, galactose-yielding carbohydrate; Reiss has reported an insoluble carbohydrate that yields mannose by hydroysis with dilute sulphuric acid. The water-soluble carbohydrates have received less attention; indefinite statements concerning sugar, gum, and dextrin make up the existing literature of the subject. By experiments made in the laboratory of the United States Department of Agriculture, cane-sugar, accompanied by small percentages of a substance resembling dextrin and some reducing sugar, has been shown to make up the water-soluble carbohydrate material of coffee. The cane-sugar was obtained in pure and well-defined crystals. A gum was prepared from the portion insoluble in water. The latter has been shown to be a galactose and pentose-yielding substance, and is now being studied farther. At the same meeting, K. P. McElroy and W. D. Bigelow described a new method for the qualitative separation of calcium and strontium, based on the solubility of calcium chromate in dilute acetone. The chlorides of these metals are dissolved in 50 per cent acetone, and a solution of potassium chromate in 50 per cent acetone added. After standing ten minutes no strontium can be detected in the filtrate, and the precipitate is practically free from calcium salts. These investigations will be continued with the hope that the separation may prove quantitative.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
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Barnes, Charles Reid, Madison, Wis.
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Beals, A. H., Milledgeville, Ga.
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Boas, Franz, Clark University, Worcester, Mass.
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Hale, George S., Boston, Mass.
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Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
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Howe, Jas. Lewis, Louisville, Ky.
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West, Gerald M., Clark University, Worcester, Mass.
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