to a place among carbohydrates as derivatives or modifications of the same.

E. Fischer proposes to apply the name "sugars" to all the members of this homologous series, to which he has lately added the glycol-aldehyde $C_2H_4O_2$ as the simplest possible example. The popular conception of the properties of a sugar are not, however, easily reconciled with the properties of some of these bodies, while "carbohydrates" at least possess some reference to their impirical composition. With regard to glycol-aldehyde, moreover, its optical inactivity would exclude it from the list under the conditions here proposed, although its constitution undoubtedly satisfies the requirements.

ELECTRICAL NOTES.

Variations in Resistance.

IN a recent article in the *Philosophical Magazine* appears a paper by Mr. Fernando Sandford, entitled "A Necessary Modification of Ohm's Law." Why it should have been given this title does not appear, for it nowhere calls in question the law which goes by Ohm's name. A better title would have been "On the Variation of Resistance of a Conductor with Change of the Medium Surrounding It." The facts observed are of interest, though not new, as it has long been known that the resistance of a wire changes when immersed in different gases. Chatelier, for example, found that the resistance of a silver wire changed enormously when immersed in hydrogen gas, and that if left in it for some time its temperature coefficient changed also. Mr. Sanford has extended the list considerably, his experiments, though made with a wire of one metal only, i.e., copper, embrace a great variety of mediums, both liquid and gaseous. That the variation is due to the causes noticed in the experiments of M. Chatelier and not to heating of the conductor, as proposed by some, is probable from the following considerations. The total heat generated in the wire, using the ordinary coefficients of emissivity for polished copper, would not raise the temperature of the wire more than the one ten-thousandth of one degree centigrade, and the increase of resistance from this cause would be inappreciable. But the effect of a thin film on the wire would be far different. It was first pointed out by Mr. Kennelly to the writer that the extremely thin film of tin on electric conductors was sufficient to lower the resistance of moderately small wires as much as five per cent. If we suppose that when a wire is placed in a gas like SO_2 a thin film of a compound of the copper and the gas is formed, only the one twenty-five-thousandth of an inch in thickness, it will account for all the phenomena observed by Mr. Sanford. For, as the wire experimented on was one millimetre in diameter, the formation of a layer $\frac{1}{25000}$ of an inch thick would reduce the cross section of the copper by two-tenths of 1 per cent, and therefore increase the resistance by 0.2 per cent, or nearly the maximum change observed by Mr. Sanford. This thickness of film is not much greater than the thickness of the films which cause the iridescent colors on steel, being about three to five times as thick; so that we see that the slightest action of the gases on the surface of a wire would change the resistance quite appreciably, and on exposure to air the wire would recover itself again. It should be added, moreover, that such films would not necessarily be visible.

An easy way of settling the question would be to use wires of different diameters. With a wire whose diameter was .0035, or No. 40 B.W.G., and which is furnished for commercial purposes, the resistance should vary as much as one and a half per cent, while with a wire one centimetre in diameter it should be inappreciable. R. A. F.

A JOINT meeting of the Scientific Alliance of New York, in memory of Professor John Strong Newberry, will be held at Columbia College, Monday evening, March 27, 1893, at 8 o'clock. An address will be given by Professor H. L. Fairchild, "A Memoir of Professor John Strong Newberry." Remarks will be made by others, and a number of letters regarding Professor Newberry will be read.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Does the Ether Absorb Light?

WHETHER or not light is absorbed in any degree by the ether through which it passes has been argued a good many times, and to-day is not settled on any experimental basis. That it is not so absorbed to any considerable degree is evident from the light from such distant stars that reaches us. From theoretical considerations some have concluded that many more stars would probably be seen by us if in some way their light was not stopped by the ether, and that the midnight sky would or should be brighter than it really is.

In all the treatments of the subject which I happen to have seen, there is one important element which has not been considered at all, and to me it seems as if that one would account for the limit to the number of stars we see without assuming that the ether possesses the ability to transform energy within itself, which would be the case if the energy of waves like light waves were changed into any other kind of energy not capable of affecting our eyes This fact is, that, in order to see, some energy is needful. I mean that there must be some limit to the amplitude of the vibratory movement beyond which we could not see, simply because the energy of the wave is insufficient; so that no matter what the intrinsic brightness of a given light may be, if it be far enough removed from an observer it will cease to be visible, simply because the energy of the waves is too small to excite the sensation. As the energy of such radiant energy on unit area varies inversely as the square of the distance, and as the amplitude of the vibrations at the initiating atoms or molecules can at best not exceed the diameter of the atoms or molecules, the extreme minuteness of the amplitude at the distance of the fixed stars from us shows how exceedingly delicate is the eye for perceiving it at all. The enormous frequency of the waves gives them a degree of energy they could not otherwise have; but if there were no amplitude there would be no energy, and it is to be conceived that if space be illimitable and the number of stars be infinite, yet with eyes constituted like ours only the light of stars within a limited space would be visible, and such optical data would give no reason for holding that what could be seen was the whole, nor for the conclusion that the light from more distant stars was absorbed by the medium through which it was distributed.

The photographic work done in this field testifies to the same conclusion when we are presented with the image of a star which had never been seen. The photographic plate acts cumulatively and if one minute's exposure is not enough, take ten minutes or ten hours, but the eye cannot so act; if one cannot see an object in a second, he can see it no better by continued looking. I conclude, therefore, that we have no evidence that the ether absorbs any of the energy of the ether waves. A. E. DOLBEAR.

Tuft's College, Mass., March 9.

Natural Selection at Fault.

IN your issue of Feb. 17, Mr. Richard Lees replies to the rather misleading article of Mr. J. W. Slater in your issue of Jan. 20, and takes, it appears to me, the right view of the case as regards the Felidæ, but misses it when he attempts to account for the hen's cackle. No one reason will account for the latter. Frequently the hen that is a member of a large barn-yard flock may be observed cackling at the top of her voice prior to the laying of the egg, and it has been my observation that in 9 cases out of 10 this is due to the fact that she has found a usurper in her nest in the person of another hen engaged in egg laying. Close observation, covering many years, leads me to think that the cackling after the egg is laid has nothing whatever to do with nest-disclosure or nest-hiding, but is simply a notification to the cock of the flock that the important task of the day is accomplished.

There is no time at which the hen is so susceptible to the gallant attentions of her liege lord as just at the end of this cackling period. I have frequently observed this of our barnyard fowls, of guinea hens, both domestic and in the wild state, and of peafowls. In my opinion, the cackle is intended to notify the male bird of the Barkiss-like condition of his mate.

As to the case of the cat tribe, it is so common to see a mother cat in the country bring field-mice, young rabbits, moles, or ground squirrels in to her kittens and watch their playful antics with them, that the conclusions arrived at by Mr. Lees are irresistible. This winter an intelligent house-cat, on a farm where I have been studying winter life in field and woods, led me some distance to where several grain-ricks had stood during the fall. I soon saw that she wanted me to turn over the fence-rail floor that still remained there, that she might capture the field-mice living beneath. This I did, while Tabby caught four mice in quick succession. The first one she gulped down at a rapid rate, the second she played with a little while, the third she played with much longer and, half-devoured, left to her eldest son, a full-grown Tom who had accompanied us, and the fourth she barely wounded and also turned over to his tender mercies. In a word, while hunger was a dormant passion, she quickly devoured her prey, after that her instinctive disposition to practise and keep perfect the arts whereby such elusive game is captured was paramount.

Mr. Slater is in error in thinking that a comparatively few now possess the power to "wag the ear." This power is common among the West Indian half-breeds and the Maya and other derivatives of Mexico and Central America, and many whites have the power who hardly realize the fact. It is not uncommon to observe this if one will suddenly say to a companion, "What was that noise?" If Mr. Slater will say this in a semi-startled way, he will notice that in no inconsiderable number of cases there will be a slight instinctive movement of the muscles in question, more or less pronounced. Nor is the ear that Darwin illustrates in his "Descent of Man" as being allied to the pointed type belonging to our Simian relatives as uncommon as many may imagine. It is my observation that this peculiarity of the fold in question is oftenest to be observed in women, and in many of these cases the persistence of the wisdom teeth is also a characteristic. I have in mind two cases of this sort, one of a man, the other of a woman, both residents of one of our leading cities, and their social and intellectual forces. The latter is a remarkable reversion to an earlier type, in ear, in teeth, in length of arm, in painless childbirth, in flexibility of hand-joints, and in other marked characteristics. It appears to me that the ear, like the vermiform appendix, the suspension of the viscera, the position of the orifice to the bladder, and the unprotected condition of certain main arteries, is yet in a transitional state, and not fully adapted to the newer human conditions imposed by the erect position and the artificialities of civilization.

EUGENE MURRAY AARON.

Philadelphia, March 6.

BOOK-REVIEWS.

Die Zukunft des Silbers. By EDUARD SUESS. Vienna and Leipsic, Braumüller. 1892 227 p.

DR. SUESS is eminent as a geologist, and it would be impertinent on the part of the present writer to attempt a criticism, or even an exposition, of his views on the geological and metallurgical conditions which affect the production of the precious metals. Dr. Suess's conclusions are similar to those which he gave to the world some fifteen years ago, in his monograph on the "Future of Gold," published in 1877. He believes that the production of gold is likely to be limited in the future, and will not supply sufficient gold to meet the monetary consumption and the consumption in the arts. He believes also that the production of silver will not progress as rapidly, or that its depreciation will descend as far, as is often supposed. He believes that gold must eventually cease to be used as a standard of value; while the production of silver is likely to continue at a comparatively equable pace, making that metal eventually the basis of the world's money. International bimetallism, even if it were practicable, would be only a half-way measure, paving the way to the ultimate adoption of the single silver standard.

To this line of reasoning, the economist who, like the present writer, believes that the gold standard works to reasonable satisfaction, would answer in some such fashion as this. If it were true that all exchanges were effected by the actual use of coined money, undoubtedly the monetary supply of gold would not suffice, at the present range of prices; and on that supposition the maintenance of the gold standard must be accompanied by a fall in prices, which would in many ways be distressing. But the fact is that in modern communities gold is used but to an insignificent extent as a medium of exchange. The great bulk of the exchanges are effected by credit substitutes of various sorts. Much the most effective of these is the modern machinery of banking, by means of which, especially in countries like the United States and England, an enormous volume of transactions is settled with an insignificant use of coin. So far as retail transactions are concerned, bank notes, government notes, silver as a subsidiary coin, do the greater part of the money work in all civilized communities. Gold, therefore, acts in the main simply as a measure of value or a standard of value; something in terms of which the values of commodities are expressed, and into which all other forms of currency are convertible. It performs its function very largely by being held as a reserve in the great central depositaries, serving simply to sustain and regulate the circulating medium. The evidence does not indicate that the supply of gold is insufficient for this purpose. On the contrary, large accumulations of gold have been made in recent years by civilized countries; by Germany in 1873, by the United States in 1879, by Italy in 1883, by Austria in 1892–3, without causing, in the opinion of the present writer, any appreciable difficulties. It is not impossible that in the distant future the supply of gold will prove insufficient, and that some change may be made by the great civilized countries in their standard of value. But such a change for the visible future is highly improbable. The drift of the time is toward the gold standard in all the great countries; with a constant development and use of credit substitutes, but with gold as the sole basis. So far as we can see into the future, this policy will work no harm, and will conduce greatly to stability and convenience in the circulating medium.

So far as silver is concerned, it is undoubtedly true that the method of occurrence of silver ores makes it probable that each individual find will soon be exhausted. The great bonanzas, of which the Comstock lode was the first in the United States, have soon given out, and the great and rapid increase in the production of silver has been due to successive lucky finds. Geologically speaking, therefore, the enormous increase in production, which has taken place in the last twenty-five years, may be regarded as temporary. But historically speaking, it is impossible to say that these finds will not continue for a period of great length in human history. The hard fact is that the production of silver has increased with extraordinary rapidity in the last twenty years, and that as yet there are no signs of relaxation. If this process continues, the decline in the value of silver cannot be checked. If it ceases, the price of silver in terms of gold is likely, at best, to remain where it now is. In either case, there is no ground for supposing that silver will come to be used on the same terms as gold by civilized nations, still less that it is likely to displace gold, as Dr. Suess predicts.

F. W. TAUSSIG.

Harvard University, Cambridge, Mass.

How to Manage the Dynamo. By S. R. BOTTONE. New York, Macmillan & Co.

THIS little book is meant, as its author tells us, for steam engineers who are called upon to take care of dynamos, without having any previous training or knowledge. As this class is a rather large one, there is no doubt but that there will be a considerable demand.

The book is very clearly written, and contains just about all that the men for whose benefit the author is writing will require