as to throw their shadows on a new portion of the rod-and-cone layer. From the nature of the case, the corpuscles cannot be rendered invisible, like the capillaries.

The phenomena described above were first observed by the writer a dozen years ago; and, though it is probable that others have observed the same, consultation with persons and books that would be likely to furnish the information of such knowledge have shown that these facts are either unknown, or at least not generally known. That the facts here published may be observed by any one seems proved by the fact that they have been corroborated by almost every one who has made the attempt under the writer's direction. J. E. TODD.

Tabor College, Tabor, Io., Feb. 16.

Classification of American Languages.

IN your issue of Feb. 6 appears an article by Major J. W. Powell, chief of the Bureau of Ethnology of the Smithsonian Institution, on the study of what he calls "Indian" languages, with a list of families in the United States.

This article contains statements so much at variance with the leading authorities in linguistic science, that they should not be allowed to pass in silence.

In the first place, the term "Indian languages," applied to those spoken by the native tribes of this continent, is a misnomer based on an ancient blunder, and has been repudiated by all modern writers of weight. The so-called "Indians" are the "American race," and their languages are "American languages," by the common consent of ethnographers. Is the Bureau of Ethnology a sanctuary for the preservation of exploded errors, that it throws its influence into the scale to perpetuate this discarded blunder?

Much of the article alluded to is devoted to explaining and defending the nomenclature adopted by the bureau. In several points it requires still further defence. The arbitrary assumption of the date 1836, anterior to which the "law of priority" is decreed not to hold good, is not justified by the reasons given.

The dictum that "no family name shall be recognized if composed of more than one word," is not merely arbitrary, but has nothing in its favor and much against it. Frequently a class-name compounded of two words is particularly useful, as conveying a much wider idea than a single word. This is fully recognized by the best linguists of the day. Thus, Friedrich Müller employs the terms "Indo-Germanic," "Ural-Altaic," etc. The reasons assigned for rejecting such compounds are quite inadequate, and contrary to the practice of the highest authorities.

The adoption of the termination *an* or *ian* to denote families or stocks of languages is not original with our Bureau of Ethnology, though the article might lead the reader to suppose it a new device. Some writers adopted it long before the bureau was organized, but the plan did not meet with general approval. The cacophony of such words as "Eskimauan," "Muskhogean," etc., in Major Powell's list is apparent to every one who has not had the advantage of that training by the bureau to which he refers with pride as destroying all sense of euphony.

But the portion of the article in question which will most completely "knock the wind" out of those old-fogy linguists in Europe, and those in our own country who have been reared on Aryan and Semitic tongues, is Major Powell's declaration that "grammatic similarities are not supposed to furnish evidence of cognation;" that in his classification grammatic structure has been neglected, and lexical elements only considered.

Now, if it were said that in most instances we are obliged to depend on lexical elements because the grammatic structure has not been ascertained, the position would be sound and in accord with the recognized principles of the science of language; but to place the words of a tongue above its grammar in instituting comparisons is a feat of such daring or of such ignorance, that it requires a man long accustomed to frontier life to venture it. If there is any one principle in modern linguistics which we may look upon as thoroughly established, it is that the grammatic framework of a language is incomparably more stable than its lexicon. If there has ever been an instance where a language of agglutination has changed into one of inflection, it is not recorded "in the books." It is precisely the grammar which is the permanent part of a language, and not its vocabulary. Modern Turkish has borrowed three-fourths of its words from Arabic, Greek, Persian, etc.; but its grammar remains almost precisely that of the pure stock, the Yakut of the delta of the Lena. This principle is as true of American tongues as of others, and the evidence of it has been abundantly set forth by Friedrich Müller and Lucien Adam. D. G. BRINTON, M.D.

Philadelphia, Penn., Feb. 20.

The Food of Moles.

IT is stated in the "Encyclopædia Britannica" that moles are entirely carnivorous, are exceedingly rapacious, and will die if left longer than eight or ten hours without food. I recently kept a living mole for a time to study its habits. I shut it in a ventilated wooden box, giving it a tin lid full of water, and some grains of corn. It drank the water, refused the corn, and, while kept strictly in the dark, was quiet. After twelve hours' captivity I offered it boiled rice, which it refused. After sixteen hours' fasting, it ate bread and milk, though not freely. When I had had it twenty hours, I gave it cracked oats, soaked well in milk, but uncooked. This it ate ravenously. I then released it in the room, and it travelled about, seeking a place to burrow, and made itself troublesome tearing at the carpet and upholstery. I threw down a large thick woollen mitten, which it speedily found and entered, thrusting its head into the thumb. If undisturbed, it would hide in this way for hours, the light and warmth of the room seeming greatly to annoy it. It lived in the mitten for three days, coming out to eat oats soaked in milk, but refusing cooked oats. It was given one small meal of raw meat. At the end of four days it was killed, being apparently in a healthy condition, and not having lost any flesh.

JULIA MCNAIR WRIGHT.

Fulton, Mo., Feb. 20.

Cold and Warm Waves.

TWO rival theories have been propounded recently regarding the origin of the waves or masses of cold air which appear to traverse the country toward the east. One of these finds the source of cold in the upper regions of the atmosphere, and considers that the cold air above mixes with that below, and thus gradually approaches the earth's surface. Those supporting the other theory, however, deny that any considerable cold can be brought down in this way, because the compression to which the air would be subjected would heat it, but they claim that the cold is due to the radiation of heat through the very clear sky which is a well-nigh invariable accompaniment. Without expecting to establish the exact truth in this matter, it has yet seemed a subject of much importance; and it may be well, at this stage in the discussion, to set forth a few facts that may be of use in the final solution of the problem.

Those who have been making forecasts of the weather have recognized for more than a dozen years three great classes of temperature falls: 1. Those which come with the advance of areas of high pressure; 2. Those which follow immediately in the rear of great storms independently of any high area; 3. Those which occur under a combination of these two causes. It should be noted that the first two classes do not invariably occur even when the conditions seem favorable, and great care is needed in examining other conditions, which, though apparently remote, may yet become exceedingly important factors in the development of the cold wave. The occurrence of the cold is independent of the wind, though the extent of the wave is markedly dependent on the rapidity of its advance, and a rapid motion has a tendency to increase the wind. Some have thought that the wind brings the cold; but this cannot be the case, for often there is no wind, or at least it rarely attains fifteen miles per hour, while the cold wave advances at double that velocity. One of the essential conditions needed for a cold wave is an elimination of the moisture in the air, and this removal of moisture is oftentimes very remarkable. In one case three-fourths of this moisture was removed in 110

minutes. This action may precede the fall in temperature by several hours, or the two may be very near each other, but it is very rarely that the diminution of moisture does not take place with sufficient rapidity to prevent the formation of fog from the lowering of temperature to the dew-point. The cause of this marked drying it is not easy to find; but it is not due to a drying wind along the earth's surface, though it may be due, in part, to a settling of dry air from above.

What causes the cold wave? The simplest explanation would be that the air radiates its heat to the abnormally clear sky; but such radiation from the air, it is generally recognized, would produce a very slight cooling. That this cooling is slight can often be determined when no cold wave is in progress. It is a significant fact that the cold wave strikes the high mountain summits before it does the base; for example, it has been shown that the temperature change at Mount Washington (6,279 feet) occurs from five to ten hours earlier than at the base. The same effect has been noted at Pike's Peak (14,134 feet), and there is no reason to doubt that it may be due to changes in the upper atmosphere many miles above our highest mountains. Does the cold air sink by gravity? The most serious objection to this view is that such action would seem to call for a displacement of the warm air beneath, or an admixture of the cold and warm air, at a much more rapid rate than can be accepted. The objection that such action would warm up the air from compression does not seem to be well taken. Certainly the appearance of the temperature fluctuation, which is precisely the same below as above, at Mount Washington, for example, shows no marked heating at the base. If we increase the density of air by pressure from outside, it would undoubtedly be warmed, but it is plain that air could not descend by gravity into other air (whether by displacement or admixture) unless it were denser than that below, and in such case the natural expansion would tend to slightly cool the air. Some have advanced such an idea in accounting for increased cold in the outskirts of an expanding cold wave, but it is very evident that such an effect would be well-nigh inappreciable. There is one fact that seems to show a tendency to a settlement of the upper air, in that the removal of the moisture occurs before the fall in temperature. This would seem to corroborate the view that the cool, dry air from above is slightly heated at first by contact with the lower air, and possibly by compression, and hence the drying process may anticipate the great cooling, though, according to my belief, such action is not at all needed to dry the air.

Both of these causes are concerned in some degree in our cold waves, but they do not seem to account for all the facts. Whatever the ultimate cause may prove to be, it is unquestionably related in a marked degree to the removal of moisture from the air; and until we can satisfactorily explain that, we cannot hope to explain the other. The intensity and extent of the cold wave are dependent upon the rapidity of the advance of this drying condition; and it is safe to say that this advance, whether in the front of a high-pressure area or in the rear of an area of low pressure, is entirely independent of the motion of a mass of air. The best proof of this is to be found in the fact that the high area, storm, and drying condition all advance at thirty, forty, or more miles per hour, while the air moves at less than half that velocity.

This brings us to the most important deduction to be made from this discussion. If there is no horizontal transfer of air in our cold waves, we may conclude that there is none in our warm waves. I am well aware that this proposition, already fully set forth in the *Scientific American* for Nov. 15 of last year, will call forth most serious opposition, as it strikes at the very heart of present theories of storm-generation. If the sun heats a limited portion of the earth's surface, and thus starts up an ascending column of warm, moist air, then our storms may be due to the forward motion of this column of ascending air which rotates at the same time that it advances; but, if there is no motion of air-particles in our storms, this theory falls to the ground. There have been set forth from time to time most serious objections to the ordinary theories, but it seems to me none have had the weight of this one here presented. This rise in temperature occurs in the upper air before it does at the earth, and is due, in part, to a condition of the atmosphere which seems to intercept the heat of the sun. This condition is exactly contrary to that in a cold wave, and is brought about by a marked aggregation of moisture in our storms. This aggregation seems to take place far above our highest mountains.

We may conclude as follows:—

1. High-pressure areas and storms (or low-pressure areas) are conditions brought about by some effect other than the abstraction or addition of heat. Possibly they are produced by some form of electric energy, and are transported or transferred through the air without the motion of air-particles.

2. A portion of the cold in our cold waves is due to radiation, and another portion to the cold of the upper atmosphere, while possibly a larger portion cannot yet be accounted for.

3. A portion of the heat in our storms is due to a peculiar condition of the atmosphere which intercepts the heat of the sun, and this heat gradually works down from the upper atmosphere to the earth.

H. A. HAZEN.

Washington, D.C., Feb. 23.

The Instruction of the Deaf.

I DO not desire to take part in the discussion now going on in *Science* concerning the comparative excellence of the various methods of instructing the deaf. The truth with respect to these methods has recently been happily expressed by Miss Yale, the able principal of one of our best oral schools ("Twenty-third Annual Report of the Clarke Institution for Deaf-Mutes," 1890, p. 15): "Each system claims for itself distinctive merits and special adaptation. The justice of these claims is now generally conceded by the great body of those engaged in teaching the deaf."

I wish merely to correct an erroneous statement in Dr. Alexander Graham Bell's open letter to the Hon. William B. Allison, published in the last number of *Science*, with respect to the Columbia Institution for the Deaf, with which I have been connected for twenty-five years. Dr. Bell says, "3. In the Columbia Institution a foreign language (the sign-language) is used as the medium of instruction, whereas the rival methods employ the English language alone for this purpose."

In the Columbia Institution the sign-language is not used as *the* medium of instruction. In some classes it is used as *a* medium of instruction, being employed to communicate with deaf children at the beginning of their course, when they have no other means of communication whatever, and to promote their mental development, with respect to which Dr. Bell himself has said ("Proceedings of the Fifth Conference of Principals of Schools for the Deaf," 1884, p. 195), "In regard to mental development, undoubtedly nothing could reach the mind of a child like the language of signs;" it is also used, but very sparingly, in the earlier part of the course of instruction in connection with the English language, to explain and illustrate the meaning of words, where otherwise the explanation could not be given at all; and it is used throughout the whole course for public lectures and devotional exercises, no means of using the English language having yet been discovered which will satisfactorily take its place for this purpose.

Under all other circumstances — and these comprise the great part of the teaching given in the institution — the English language is the medium of instruction. There are classes in both the Kendall School and the National College — the two departments of the Columbia Institution — in which the English language is the only medium of instruction. I do not think that any of the schools following "rival methods" use the English language as a medium of instruction more than the Columbia Institution does.

EDWARD ALLEN FAY.

National Deaf-Mute College, Kendall Green,
Washington, D.C., Feb. 23.