complete vocabularies, and using no other for several years. This tendency to originate language is shown in almost every child by the invention of new words or new uses for words. New terms are often formed by imitating the noise made by the animal or thing named, as "bow-wow" for dog, "choo-choo" for locomotive, and sometimes by the repetition of a sound made in performing an act, or an emotional sound made at sight of a new object or act. Any sound thus associated with an object, act, quality, or state of feeling may be used by the child as a word, and, if the parents or playmates accept it as having a certain significance, it becomes fixed as a permanent part of the child's vocabulary.

Baby talk, or the peculiar pronunciation used by children, and frequently imitated in literature, is a subject of considerable interest. How much of what is given as "baby talk" has really been originated by children? How much of the incorrect pronunciation of any particular child is due to his inability to pronounce correctly, and how much to the foolish habit of mispronouncing words when speaking to children practised by so many fond parents? Of still more importance is it to know whether there really is any general law of mispronunciation that may be of practical value to the educator. In only a part of the records sent me was the pronunciation used by the child indicated, hence only the probabilities in regard to the law can be given. In the first place, it must be understood that the ability to pronounce words is entirely independent of the ability to understand their meaning, and either capacity may be developed in advance of the other. However, in the acquirement of new words, difficulty of pronunciation may exercise some influence in preventing the adoption of certain words into the vocabulary. Not all children are influenced in this way; some adopt difficult words but use a sound easily pronounced in place of the one they cannot pronounce, sometimes following a regular system of substitution. The law of mispronunciation proposed by Noble (*Education*, 1888) seems theoretically quite probable, and some of the facts support it, but not enough have been collected to establish it. He reasons that correct pronunciation depends upon clear perception of the sounds to be uttered and a knowledge of the motions necessary to produce them. The knowledge of the proper movements to be made are partly gained by watching the motions made by others in speaking. On imitating the sound the errors in movement are detected and corrected by comparing the resulting sound with the sound heard. The sounds then that are most distinctly pronounced and requiring movements that are the most clearly visible will naturally first be learned and be most clearly pronounced. Those made in the front part of the mouth, such as labials and dentals, fulfil both of these conditions, while those made in the back part of the mouth usually fulfil neither of them. This law, if approximately true, must yet be modified by the fact that children can usually make every one of the elementary sounds used in language before they begin to talk. The difficulty in pronouncing a word is not to utter the elementary sounds of which it is composed, but to properly combine them. As in learning other complex series of motions, it is not a question of making any one motion, but of properly co-ordinating a series of simple motions. No one has any difficulty in pronouncing such words as "three," and "gray," and "geese" separately, but many do in pronouncing them rapidly one after the other. For a similar reason a child who can pronounce perfectly a sound in one word is wholly unable to utter it in another. Besides this, sounds are modified somewhat by the sounds that precede and follow them. Almost every one also slurs some sounds in his pronunciation, and children frequently notice and try to imitate only the most distinctly pronounced sounds. They therefore often mispronounce, not from inability to utter the sounds, but because they have failed to notice some of the less perfectly pronounced ones. Since sounds made at the beginning of words are least modified by other sounds, mispronunciation can best be studied in the initial sounds of words. The letter with which a word begins usually, but not always, indicates the sound. The following is the order for the letters appearing most frequently as initial letters in children's vocabularies: s, b, c, p, t, w, d, m, h, f, r, l, g, n. To understand the significance of this, it must be compared with the order of frequency for the difficult letters in the dictionary (s, p, c, a, t, b, r, m, d, f, e, h, l, g), and in "Robinson Crusoe" (s, c, p, a, f, b, r, m, e, t, w, h, l, i, g). One of the most marked differences is the greater number of words beginning with the dentals *b* and *d* to be found in the vocabularies of children.

Many very interesting questions were suggested by the study of the records already sent me, but a much larger number of vocabularies must be compared before reliable answers can be obtained. I shall be glad to receive such records at any time, or to communicate with any one in regard to methods of carrying on the study of children. Letters directed to Rhodes, Iowa, will always reach me.

E. A. KIRKPATRICK.

Rhodes, Io., Sept. 14.

The Convection Theory of Storms.

DR. HANN of Vienna has published recently an extended discussion of this subject, and one which has the extremest significance (Sitzber. d. kais. Akad. d. Wissensch. in Wien, April, 1891). He reiterates his view that in our storms at heights of 10,000 feet there is a fall in temperature, and a corresponding rise in our high areas. These points have been sufficiently answered already (*Science*, Vol. XVI., p. 136). The remaining discussion merits our attention, as it presents a rather strong attack upon the theories ordinarily accepted. A free translation of the argument is here given. Dr. Hann says:

"How can we think that such extremely flat disks as the great storms of the higher latitudes are can maintain themselves and advance through a rising of air particles. Our whirls have often more than a hundred times greater extension horizontally than vertically. Doberck gives this ratio as 250:1. A chimney, as is well known, draws only when its height is many times greater than its interior diameter. But in our whirls the relation is in a most extreme manner opposite. How such an exceedingly flat air-disk, only through an interior force, that is, through a freeing of latent heat by a local interior moisture condensation, can move itself in the atmosphere, appears to me difficult to understand. The whole height of the atmosphere (so far as it can come into consideration for the condensation theory) at the utmost is small as compared to the horizontal diameter of our whirl (above 25,000 feet is there no moisture). I do not know that the convection theory has seriously considered this objection. This objection does not hold against the theory that correlates the whirl with disturbances in the general circulation currents of the atmosphere.

"A fact which stands out in sharp contradiction with the plain convection theory of our storms lies in the yearly period of their frequency and intensity. If the convection theory is clearly applicable to most of our storms, how can it be that these storms have their greatest intensity and frequency in the winter, even at a time of the year when the conditions, as well for their origin as for their continuance, are most unfavorable?

"In winter the moisture of the air is slight and the thermic equilibrium most stable. Upon the continents the lowest layers are often for a long time the coldest, and the temperature increases above. The heat diminution with height is very small in winter, even less than in a rising air current due to the distribution of moisture. How can a whirl under such conditions of the convection theory reach to the interior of Siberia, where the temperatures are −22° F. to −40° F., and there is no moisture. It is an inevitable consequence of the convection theory that the cyclones of the summer must reach their greatest intensity and frequency, because at this time the moisture of the air is greatest, the heating of the lowest layers the most active, and the heat diminution with height in consequence the most rapid.

"In fact, heat thunder-storms and tropical cyclones, the appearances to which rightly the convection theory can find application, are limited to the warm season. Tropical cyclones reach a maximum of occurrence at a time when the temperature of the sea is highest, or when a generally uniform air pressure and the absence of strong air currents favor largely the development as well as the advance of such whirls, which, perhaps, have for the great part their driving force in themselves. Also the heat thunder-storms or thunder-storm whirls of our summers occur most

abundantly and most intensely, with uniform air pressure, weak winds, a strong heating of the lower air strata, and a high humidity of the air.

"The storms of the temperate latitudes have, moreover, still another peculiarity, outside of their maximum action in the coldest season during a period of the greatest stability in the thermic equilibrium of the atmosphere, which stands in contradiction to the convection theory, namely, a tendency to take the same path one after the other. Upon this peculiarity Köppen has remarked before (Met. Zeit., 1874, Vol. IX., p. 380), and we need only to examine the daily weather charts to find clear examples in abundance.

"This view is wholly contrary to the facts which the true cyclones of the convection theory show, and must show. A cyclone equalizes the temperature above and below in the region through which it passes. The condensation process heats the higher layers, cools off the lower, and makes a more stable equilibrium in the atmosphere. At the same time the moisture of the lower air layers is used up, and at the same place precipitation cannot occur again through pure convection currents. The cyclones of the convection theory must diminish or become extinct, if placed where shortly before another cyclone was in activity which has disposed of the latent energy stored up in the lower layers of the atmosphere in the form of high temperature and great moisture.

"The heat thunder-storms of our summers do not show this peculiarity, and are appearances to which the pure convection theory can find full application. On the other hand, the fact that the cyclones of our latitudes often follow a path behind each other, shows that the convection theory has no application, or only a subordinate one, and that the force upon which their origin and advance depend most importantly is not in themselves, but must be sought outside. We must refer to the conditions of the general distribution of pressure and currents of the general atmospheric circulation for their origin and development.

"If we correlate the origin and forward movement of the cyclones of the temperate and high latitudes with the general circulation of the atmosphere, then the greater frequency and intensity in winter explains itself wholly, as well as all the peculiarities which the application of the pure convection theory contradicts. That also in whirls of this origin the condensation of moisture plays a greater or less secondary *rôle* no physicist can well doubt."

This is a most significant utterance and important attack upon the convection theory. Heretofore this theory has been assailed in England and this country from outside, but now the attack is from within the camp and by one of the foremost of its former defenders. The arguments, to be sure, are rather old, but they are put in a fresh dress. We welcome Dr. Hann to our side of the controversy. It should be noted that, as Miss Clerke has said, the original convection theory has been so added to and corrected it can hardly be recognized. Dr. Hann takes up only one view, and the one applicable to the summer season; but there is another view which applies to the winter, namely, that an unstable equilibrium in the atmosphere may occur whenever, through any reason, a central core becomes heated above its surroundings. This gives a less diminution of temperature with height, instead of greater, as in the other view, and at the same time causes a rising tendency in the air; this has been called the "balloon" effect. Dr. Hann will find that the "chimney" effect has been relegated to the tornado, in which the height is very much greater than the breadth.

There would seem to be no greater difficulty in accounting for the moisture and generation of a storm which follows another than in accounting for these conditions in the first. It is not supposed that a storm carries away very much from any region, but each one may feed upon the conditions which surround it. In fact, there is probably a good deal more moisture in sight and usable after a storm has passed than before, unless the first storm is followed directly by a high area, which is contrary to Dr. Hann's supposition. It does not seem as though these and other more serious objections to the old theory can longer be ignored by convectionists.

H. A. HAZEN.

Washington, D.C., Sept. 21.

BOOK-REVIEWS.

A Girl in the Karpathians. By MENIE MURIEL DOWIE. New York, Cassell. 8°. $1.50.

THAT this is an entertainingly written book of travel few will deny. The region described is one visited little, or we might say not at all, by the ordinary tourist, and the author abandoned herself to a life with the natives for the several months she was in the Karpathians.

That there are many girls like Ménie Muriel Dowie may well be doubted, and perhaps it is as well that there are not. She is certainly bright, but independent almost to a fault. In answer to those asking why she went alone, she writes: "I gaze at their indulgent, smiling eyes, and their self-satisfied faces, and I dare not tell them that I do it from sheer bold preference. I couldn't have the heart to wound and shock them so, and I say, what is perhaps also true, that I am driven to it, for nobody cares to come to the places I care to go to." That there must be a little of self-satisfaction in Miss Dowie's face, one cannot help thinking. There must be some self-reliance at least in a girl of twenty-five, as the author describes herself, who, armed with a revolver and dressed in knickerbockers, plunges into a thinly-settled region for a sojourn of months. She hails from Scotland, but a love for cigarettes does not at all conform with the general conception of a Scottish lassie's character.

But eccentricities can be overlooked in one as clever as Ménie Muriel Dowie, and the interest in her personality adds to the charm of her book. She shows her youth occasionally in the earnestness of her self-communing over the problems of life, but her account of the people she lived with is well worth reading. To be sure she tells us inadvertently that it is the way of returning travellers to swap lies, but the book shows little sign of its being a work of fiction.

AMONG THE PUBLISHERS.

THE next volume of the Contemporary Science Series, published by Chas. Scribner's Sons, will be "The Man of Genius," by Professor Lombroso. This volume, which will be issued on September 25, will be copiously illustrated.

— Messrs. Smith, Elder, & Co. have in preparation "Vertebrate Embryology," by A. Milnes Marshall, F.R.S., professor in the Victoria University, Beyer professor of Zoology in Owens College, late fellow of St. John's College, Cambridge; new, revised, and cheaper edition of Finlayson's "Clinical Manual;" new edition of Farquharson's "Guide to Therapeutics;" new edition of Part I. of MacCormac's "Surgical Operations."

— This year's volume of the Annual of the Office of Naval Intelligence, just issued from the government printing office at Washington, is the tenth in the series of general information from abroad, and retains the title of last year's number, "The Year's Naval Progress." It has a chapter on ships and torpedo-boats, one on machinery, and one each on ordnance, electricity on shipboard, and the naval manœuvres of 1890. Chapter VI. treats of the armor question in its present aspect, as viewed in the light of recent practical tests; and Chapter VII. presents a view of the different systems of coast defence of the various European States. Other chapters are devoted to high explosives, torpedo vessels, and promotion in European navies; and the final chapter gives a list of books on professional subjects.

— Messrs. Sampson Low, Marston, & Co announce: "Theory and Analysis of Ornament," applied to the work of elementary and technical schools, by Francois Louis Schauermann, for eight years head master of the wood and carving department, Royal Polytechnic, Regent Street, with 263 illustrations; "Answers to the Questions on Elementary Chemistry," theoretical and practical (ordinary course), set at the examinations of the science and art department, South Kensington, 1887-91, by John Mills, formerly of the Royal College of Science, London, author of "Alternative Elementary Chemistry," fully illustrated; "Chemistry for Students," consisting of a series of lessons based on the syllabus of the science and art department, and especially designed to facilitate the experimental teaching of elementary chemistry in schools and evening classes, by John Mills, author of "Alternative Elementary