method employed by MM. Grancher and St. Martin was the injection of tuberculosis cultures attenuated in various degrees, and used like the dried spinal marrow in Pasteur's treatment of rabies and hydrophobia. Nine degrees of attenuation have been obtained, the four last being such that the cultivation remained sterile. The injections were made first with the most attenuated cultivations, and then with more and more virulent ones. The authors consider that by this method they have succeeded, on the one hand, in conferring on rabbits prolonged resisting power against the most certain and the most rapid experimental tuberculosis, and, on the other hand in conferring an immunity against that disease, the duration of which remains to be determined.

A Return to Blood-Letting.

M. Crocq, who has frequently written and spoken in favor of the revival of venesection, made a powerful speech dealing with this subject at a recent meeting of the Belgian Académie de Médecine, says the *Lancet* of Aug. 9. Speaking of pneumonia, he declared his disbelief in the cause of the disease being either Friedländer's bacillus or the diplococcus of Fraenkel and Weichselbaum. Inoculation of this latter microbe, he remarked, is said to procure immunity from subsequent inoculations, which is exactly contrary to the effect of an attack of pneumonia, for it rather predisposes the subject to subsequent attacks. Again, M. Crocq injected sputum from pneumonic patients in which the diplococcus had been found, into the lungs of four rabbits, but none of them contracted pneumonia. Lastly, in a doubtful hospital case the sputum was examined, and found to contain the diplococcus, but at the post-mortem examination no pneumonia was discovered. M. Crocq has never met with any cases of contagion in pneumonia, and Finckler's cases he considers were not pneumonia at all. Moreover, Fraenkel's microbe is found in affections which are neither pneumonia nor contagious. The mortality usually reported by other observers in pneumonia varies greatly; that is to say, from 5 to 35 per cent. M. Crocq has no mortality at all. He arrests all his pneumonia cases by bleeding. Rheumatic-fever, and even puerperal metro-peritonitis, he treats in the same way. The latter, he declared (amidst tokens of dissent) can be thus cured in the great majority of cases. "Never," he went on, "have I regretted having bled a patient, though I have often been sorry that I have abstained from doing so. . . . If I were to be forbidden to bleed, I would give up the practice of medicine." He was, of course, careful to explain that blood-letting, to be of any service, must be practised intelligently, and not abused, as he fears it may again come to be after the wave of reaction has once more made it popular.

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.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Professor Hazen and Espy's Experiments.

A CORRESPONDENT has recently called my attention to certain communications of Professor Hazen to *Science* and the *American Meteorological Journal*, in which Espy's experiments are assailed, and thus indirectly my theory of cyclones and tornadoes, and he thinks there should be a reply to them. A reply, so far as they bear upon my theory, if thought necessary, is very easy; so easy, indeed, that I had not thought it necessary. Besides, I have been desirous of avoiding an unprofitable controversy with Professor Hazen on this subject.

Inasmuch as I have never used any of the results of Espy's experiments, any attack upon these experiments does not reach me, except so far as it may bear upon the results of other great physical experimenters. It is true, I sometimes refer to this noted pioneer in meteorological advancement, as any one in this age may still refer to Kepler and Newton, and very properly, but it is not at all necessary. The formula which I have used throughout in my researches, as the basis of the physical part of my theory, and which completely covers the ground of Espy's experiments, is one given by Dr. Hann in a paper published in the *Zeitschrift* of the Austrian Meteorological Society for 1874, and translated by Professor Abbe, and republished in the "Smithsonian Report for 1877." This formula, in a somewhat different form, originated with Sir William Thomson, and has been used, and gradually brought to its present form, by Dr. Reye, Peslin, Clausius, Hann, etc., and so rests upon high authority. The physical constants in this formula have been determined by renowned experimenting physicists. They are the mechanical equivalent of a unit of heat, the specific heat of air, the latent heat of aqueous vapor, the tension of the aqueous vapor of saturated air at any given temperature, etc. From this formula have been computed the rate with which ascending dry air decreases in temperature with increase of altitude, which is 0.99° for each hundred metres, and also the same for ascending saturated air at given temperatures and altitudes. These latter are given in Table III. of the appendix of my "Popular Treatise on the Winds," etc., and range from 0.37° for a high temperature at the earth's surface, up to 0.74° for a temperature of —10° C., the values for all temperatures decreasing with increase of altitude. With these data I have illustrated, by means of the table on p. 232 of the work referred to above, how the temperature in ascending currents decreases with increase of altitude under different assumed conditions, and have shown that it is very much greater than it would be in the case of dry air, and also greater than that of the surrounding air when the lower strata become a little more warmed up than usual in comparison with the upper strata. All these results have been deduced from a formula resting upon the high authorities already mentioned, and having had its origin with Sir William Thomson less than thirty years ago. Yet Professor Hazen makes the astonishing assertion that nothing has been done since Espy's time, more than fifty years ago, and that "the profoundest calculations and speculations upon the development of energy in the free air are based upon a few experiments of the crudest sort made in a small jar."

The latent heat of aqueous vapor in the formula referred to, as determined by Regnault, may be expressed for ordinary temperatures by $r=607-708t$; but according to Hazen it should be $r=0$, for he maintains that there is no latent heat set free in condensation. With $r=0$ in the formula, instead of the numbers in the table referred to above, ranging at the earth's surface from 0.37° to 0.74°, and being still less at high altitudes, we should have for all temperatures and altitudes 0.99°; that is, the rate of decrease of temperature in all cases would be that of ascending dry air, and of course the energy upon which the cyclone or tornado depends would be much diminished. Now, if Regnault has made so great a blunder, and a cloud is thrown over his reputation by Hazen's experiments, it is for the experimenting physicists of the day to take up the matter, and not for me; for I am not an experimenter, and, if I have erred, it is in relying upon insufficient authority.

It has never been claimed, even by Espy himself, that his experiments were of a refined and accurate character, and that his results were any more than rough approximations. They have been regarded as important first steps only. Espy says, "I would not wish to be understood here as saying by implication that the numbers used in this paper are strictly correct. These numbers are introduced chiefly for the purpose of illustrating the theory." He again says with regard to his results, "The grand object, then, for which these experiments were instituted, is established beyond doubt,—that the latent caloric of vapor causes the air to occupy much more space when it is imparted to the air than when it is united with water in the form of vapor." The same is shown by Dr. Hann's formula, but the latter gives quantitative results. Espy inferred from his experiments that when dry air ascends it becomes colder about 1.25° for every hundred yards of ascent. The true amount is 1.6°. He also inferred, that, when air ascends from the earth, it will begin to form cloud when it rises about as many times one hundred yards as the temperature of the air is above the dew-point in degrees of Fahrenheit. The true number is seventy-six yards.

There is a great error in several of Hazen's papers with regard

to the amount of heat arising from compressing the air, which may be noticed here. He says (*Science*, June 27) that if air is compressed 10 inches, that is, from a barometric pressure of 30 inches to 40 inches, the temperature is increased 163°. The formula for computing this, as given by Poisson, is

$$\frac{T'}{T} = \left(\frac{p}{p'}\right)^{0.291},$$

in which T and T' are the temperatures corresponding to p and p' respectively. If we put $T'=490°$, and $p'=30$ inches, this formula gives, for $p=40$ inches, $T-490°=43°$ instead of 163° as stated above. Hazen, by his method of experimenting, was able to get a heating of the whole jar of only 4° in compressing to 10 inches, or one-third of an atmosphere. This, he says, is only about one-fortieth of the theoretical value; but it is not so much in error as that, for it is about the eleventh part of the theoretical value. But Espy, in compressing to 10 inches, obtained 36° as indicated by the rise in the gauge after explosion. The theoretical value in this case given by Poisson's formula, the temperature at which Espy operated being 64°, is 45°. This, unless Poisson's formula is erroneous, indicates that the method of getting the amount of heating from the amount of rise in the gauge after explosion, is much more accurate than that of Hazen's. WM. FERREL.

Martinsburg, W. Va., Sept. 24.

BOOK-REVIEWS.

Belief in God; its Origin, Nature, and Basis. By J. G. SCHURMAN. New York, Scribner. 16°. $1.25.

THIS book consists of a series of lectures delivered at the Andover Theological Seminary during the present year. The author's object is partly to justify the belief in God, and partly to set forth his own conception of what God is. In discussing the grounds of our belief in the Divine Existence, Professor Schurman makes some excellent points against the agnostics, but fails to present any new or conclusive argument of his own. Indeed, he admits that in his view the existence of God cannot be demonstrated, but holds it to be a necessary assumption to account for the universe. He gives a brief but philosophical sketch of the history of religion, which forms the best chapter in the book. When, however, he comes to state his own view of the nature of God, he takes a position that few theists will be inclined to adopt. His doctrine is an extreme pantheism, essentially the same as that of Spinoza,—a doctrine that denies all reality to finite things, and maintains that they are only modes or functions of God. He says, "Nothing remains for us, therefore, but to surrender the vulgar belief in the existence of a multiplicity of independent things. There *is* but one real being; and of it A and B and all existing things must be conceived as parts, moments, or functions" (p. 166). If this theory is true, it is obvious that there is no room left for human personality; and Professor Schurman's attempt to save personality can only be characterized as sophistical. We are obliged to add that some parts of the book are too dogmatic for a philosophical work, being characterized by sweeping assertions of which no proof is given or even attempted. On the whole, we cannot see that Professor Schurman has helped us any toward solving the problem of theism.

AMONG THE PUBLISHERS.

"THE Story of a Magazine," a most interesting story of the conception and growth of *The Ladies' Home Journal* of Philadelphia, with portraits and sketches of its proprietor and editor, has been prepared by that magazine in pamphlet form, and will be sent free to any who will write for a copy.

— Civilization; an Historical Review of its Elements," in two volumes, will soon be issued by S. C. Griggs & Co., Chicago. The author is Charles Morris of Philadelphia. This work promises to diverge from the course usually pursued by historians on this subject. It seeks to set forth, in clear and simple language, the evolutionary steps by which the human race has passed upward from primitive savagery to modern enlightenment, and in this way to discover the true philosophy of human progress. With this end in view, the topical method is adopted, and the facts of history are used to illustrate and embellish, rather than to form the ground-work of the structure.

— *Harper's Weekly* of Oct. 4 devotes four full pages—two of text and two of illustrations – to the recent Mississippi River improvements.

—Andrew Lang is the subject of the engraved portrait in the October *Book Buyer*. The sketch gives an idea of the personality of the man as well as of his career as an author. Rudyard Kipling, whose portrait appears also in this number, is described in an article from which one can learn a good deal about this new and brilliant writer and his books.

—Professor Darwin of Cambridge, England, a son of the world-renowned Darwin, contributes to *The Century* for October a paper of high and original value on "Meteorites and the History of Stellar Systems." A striking photograph of a nebula, in which a system like our own solar system seems to be in actual formation, accompanies this paper. "Prehistoric Cave-Dwellings" is an illustrated paper by F. T. Bickford, on the prehistoric and ruined pueblo structures in Chaco Cañon (New Mexico), the Cañon de Chelly (Arizona),—the ancient home of the most flourishing community of cave-dwellers,—and other extraordinary cave villages.

— Mr. G. J. Smith has prepared "A Synopsis of English and American Literature," which issues from the press of Ginn & Co. of Boston. It gives first a list of English authors, with the names of their principal works, and accompanied by a chronological view of contemporary history. This is followed by a list of American authors, arranged on a similar plan. The work is in no sense a history, but a mere tabular list, but as such it has some merits. Its principal fault is the exaggerated importance attached to American literature, which is accorded nearly as much space as that of England. The authors in both tables are arranged as far as possible in classes, according to the kind of literature they produced, and reference is further facilitated by two indexes.

— *Babyhood* for October contains an article on the "Common Disorders of Teething Time," which the writer, Dr. John Dorning, contends are in most cases not related to the process of teething. He exposes very strikingly some of the fallacies entertained on this subject, while giving useful hints to the mothers of teething infants. "Massage," by Dr. Sarah E. Post, is probably the first popular article that has appeared on this subject, which is attracting increased attention, especially in connection with certain disorders of infancy. The article is illustrated, and gives directions as to the various kneading motions.

— An article in *Lippincott's Magazine* for October upon "Electric Lighting," by the English scientist Sir David Salomons, will find many readers; for, though electric light has come into such general use, it is but little understood by the general public. The article treats also of electric motive power, which is as little understood as electric lighting. A thoughtful paper upon "University Extension" is from the pen of Professor Skidmore. He advocates the idea of broadening the scope of the university so that the educational advantages it affords may be extended to the masses, and holds that schools should be brought into parallelism with life, instead of serving as introductions to it. In "Book Talk," Julian Hawthorne has an essay upon Rudyard Kipling.

— "Health for Little Folks" is the title of No. 1 of the Authorized Physiological Series, just published by the American Book Company. The book is intended for use in primary schools. The method and language are such as to make the matter easily comprehended by the young people for whom it is intended. Some may ask why the subject of physiology is introduced at all in the course of study of the primary schools, and the answer is to be found in the desire of the total abstainers to inculcate their ideas about alcohol in the minds of all pupils of the public schools; and, as many a child does not pursue his schooling far, it is necessary for their purpose that the doctrine that alcohol is a poison should be inculcated while the schools still have possession of the pupil.

— A popular work on the literature of India, entitled "Hindu Literature, or The Ancient Books of India," by Mrs. Elizabeth A. Reed, will soon he issued by S. C. Griggs & Co., Chicago. This volume treats of Hindoo literature from the earliest songs of the