of his results, we are sorry to say, add nothing to our gross experience of the matter. Here, as in the case of the saints, heroism seems to be its own reward. But the incidental results are usually the most pregnant in this department; and two of those which Dr. Ebbinghaus has reached seem to us to amply justify his pains. The first is, that, in *forgetting* such things as these lists of syllables, the loss goes on very much more rapidly at first than later on. He measured the loss by the number of seconds required to *relearn* the list after it had been once learned. Roughly speaking, if it took a thousand seconds to learn the list, and five hundred to relearn it, the loss between the two learnings would have been one-half. Measured in this way, full half of the forgetting seems to occur within the first half-hour, whilst only four-fifths is forgotten at the end of a month. The nature of this result might have been anticipated, but hardly its numerical proportions.

The other important result relates to the question whether ideas are recalled only by those that previously came immediately before them, or whether an idea can possibly recall another idea, with which it was never in *immediate* contact, without passing through the intermediate mental links. The question is of theoretic importance with regard to the way in which the process of 'association of ideas' must be conceived; and Dr. Ebbinghaus's attempt is as successful as it is original, in bringing two views, which seem at first sight inaccessible to proof, to a direct practical test, and giving the victory to one of them. His experiments conclusively show that an idea is not only 'associated' directly with the one that follows it, and with the rest *through that*, but that it is *directly* associated with *all* that are near it, though in unequal degrees. He first measured the time needed to impress on the memory certain lists of syllables, and then the time needed to impress lists of the same syllables with gaps between them. Thus, representing the syllables by numbers, if the first list was 1, 2, 3, 4 . . . 13, 14, 15, 16, the second would be 1, 3, 5 . . . 15, 2, 4, 6 . . . 16, and so forth, with many variations.

Now, if 1 and 3 in the first list were learned in that order merely by 1 calling up 2, and by 2 calling up 3, leaving out the 2 ought to leave 1 and 3 with no tie in the mind; and the second list ought to take as much time in the learning as if the first list had never been heard of. If, on the other hand, 1 has a *direct* influence on 3 as well as on 2, that influence should be exerted even when 2 is dropped out; and a person familiar with the first list ought to learn the second one more rapidly than otherwise he could. This latter case is what actually occurs; and Dr. Ebbinghaus has found that syllables originally separated by as many as seven intermediaries, still reveal, by the increased rapidity with which they are learned in order, the strength of the tie that the original learning established between them, over the heads, so to speak, of all the rest. It may be that this particular series of experiments is the entering wedge of a new method of incalculable reach in such questions. The future alone can show. Meanwhile, when we add to Dr. Ebbinghaus's 'heroism' in the pursuit of true averages, his high critical acumen, his modest tone, and his polished style, it will be seen that we have a new-comer in psychology, from whom the best may be expected. W. J.

NOTES AND NEWS.

THE articles of scientific interest in the general English and American magazines for August are neither numerous nor interesting. Two topics seem to have monopolized the popular scientific mind during the midsummer months, — dogs and cholera.

There are two articles on dogs worth mentioning. One is a paper in *Bailey's monthly magazine* on 'The descent of the foxhound,' in which the writer attempts to show that the foxhound was produced about the beginning of the eighteenth century by a process of careful selection, and not, as some have supposed, by crossing a swift-footed hound with some dog of keener scent. In the *Century* appears the second part of Mr. John E. Thayer's beautifully illustrated account of 'Typical dogs.' A clear and concise account is given of the appearance, traits, etc., of the water spaniels, collies, and fox-terriers.

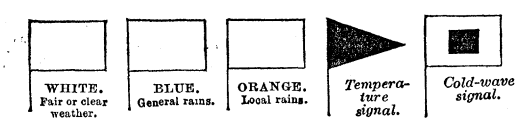
Six gentlemen of the medical profession have taken occasion to express themselves on the cholera question.

In the *Nineteenth century*, Dr. Charles Connor, in an article entitled 'Anti-cholera inoculation,' attempts to show statistically that Dr. Ferran's experiments have been more successful than those of Jenner were; and that by the anti-cholera vaccination process the danger of dying from cholera is made about six times less than it would be under normal circumstances. Dr. J. Burdon Sanderson, in the *Contemporary review*, gives his views on the causes and prevention of cholera. This writer gives a brief sketch of the history of cholera, shows to his own satisfaction that Koch's comma bacillus has nothing to do with cholera, and then goes on to say the ordinary things about good drainage, careful diet, etc. But it is in the *North-American review* that the greatest number of articles, and the least amount of information, is to be obtained on the subject of Asiatic

cholera. Four gentlemen, Dr. John B. Hamilton, Dr. H. Rausch, Dr. C. Peters, and Dr. H. C. Wood, have each tried to answer the question: Can cholera be averted? In these papers the germ origin of cholera is admitted, but no particular bacillus is fixed on as the cause of the disease. The best methods of disinfection, etc., are spoken of, isolation of the sick recommended, and the necessity of cleanliness is urged; but no facts or theories are set forward of which the public are not already in possession.

Besides the notes on dogs and cholera, there have also appeared one or two other articles which might be called semi-scientific. In the *Gentlemen's magazine*, there is an interesting and well written paper on the wild cattle of North America, by C. F. Gordon Cummings, describing the appearance, distribution, and extinction of the American bison; and the *Cornhill magazine* has a very popular article on the 'Birth of mountains.'

— The Alabama state signal-service found it impracticable to use the same signals employed by the Ohio service, for three reasons : 1°. Because the railroad refused to allow red to be used on their lines. 2°. On account of the considerable cost of the Ohio set of signals (eighteen to twenty-four dollars); and 3°. From the fact, that, in a calm, it was found impossible to distinguish between the star, the crescent, and the sun. After correspondence with the U. S. chief signal-officer, five flags were determined on according to the accompanying illustrations. Their



cost when made of bunting is something less than that of the Ohio flags: and when made of cotton cloth, the outlay is only a few cents each; while the solid colors allow the predictions to be read at a considerable distance. The railroad authorities have entered cordially into the system, and telegraph the predictions free of charge; except in the case of two or three companies not owning their telegraph lines, who expose the signals on their trains. In most cases they are hung on poles. The black triangular flag when placed above indicates rising temperature; when placed below indicates falling temperature; if absent, indicates stationary temperature.

— On account of the lack of funds necessary to maintain its activity, the astronomical observatory of Beloit college, Wisconsin (Prof. J. Tatlock, jun., director), has been closed.

— The annual meeting of the American forestry congress will be held at Boston, beginning Sept. 22, under the auspices of the local societies of horticulture and agriculture. Mr. W. C. Strong of the Horticultural society is chairman of the local committee, and Mr. Daniel Needham of Boston is the chairman of the sub-committee of accommodation; and to the latter, requests for special arrangements for board should be sent. The hotel headquarters will be at the Adams House. Three sessions daily will be held at Horticultural Hall. Monday, Sept. 22, will be given up to addresses, reports, and general business; Wednesday, to the reading of papers and discussions; and Thursday, to excursions, — among others, to the Arnold Arboretum. Over twenty papers have already been promised, and many others are expected. The discussions will be conducted as far as possible under the following heads: 1°. Importance of forests in climatic and hydraulic respects, and in regard to other industries. 2°. Duties and rights of the state to protect her forest resources. 3°. Forest fires: causes; laws and methods for their restriction. 5°. Education and research in forestry matters: arbor days; schools; lectures; exhibits; experiment stations; press; associations. 5°. Practical forestry: prospects, methods, profits, etc.

— If any indication of the mathematical activity of different nations is afforded by the number of those who have published contributions bearing upon one of the most notable of recently developed branches of mathematical investigation, England is at this moment occupying a very subordinate position in the advancement of pure mathematics. A bibliography of the modern theory of linear differential equations, which appeared in the last number of the *American journal of mathematics* (vol. vii., No. 4), gives in all sixty-eight writers, of whom only two are English, while twenty-seven are French, seventeen German, nine Italian, and the rest are divided among eight different nationalities, there being one American. This disproportion between the English and the French or Germans, is greatly increased, when the number and importance of the memoirs contributed by the various writers are taken into account.

— We learn from *L'astronomie* that the crown disk for the great thirty-six-inch refractor of the Lick observatory, referred to in an earlier column, has recently been delivered to Alvan Clark & Sons, by Feil, the celebrated Paris manufacturer of optical glass. The elder Feil has reorganized the establishment, associating with himself his son and M. Mantois. The two disks for the thirty-inch Nice refractor have been placed in the hands of the Henry brothers, who take charge of the optical work; and it is hoped that the glass will be finished in October.

— The American philological association will hold its next meeting at Cornell University, Ithaca, N.Y., on July 13, 1886. The presiding officer will be Professor Tracy Peck of Yale college.

— *Nature* states that it has been decided to withhold from publication the report of Drs. Klein and Gibbes upon Dr. Koch's discoveries in relation to the germ theory of cholera, until the conclusions of a committee appointed by the secretary of state for India with reference to that report are also ready.

— *Ausland*, a German weekly published at Stuttgart, is now printing an interesting serial upon the influence of the glacial period upon the formation of the physical surface of Lower Germany, by Th. Overbeck, in which Torell's hypothesis is subjected to criticism. This weekly is now in its fifty-eighth year.