tific world, and highly prized by this Anthropological Society of Washington. I know that there was a large body of manuscript Gaelic literature of considerable antiquity and of high value, especially that portion of it devoted to mythology, heroic tales, chronicles, and law tracts. I hoped, also, there might still remain in the minds of the people of the remote districts of Ireland many idioms useful in explaining the language of the manuscripts, and many myths and tales that would supplement and strengthen the recorded mythology. I went to Ireland last year, therefore, for the purpose of settling this question by actual investigation, and my first step was to make the acquaintance of the few Gaelic scholars in Ireland, and examine the manuscripts preserved in Dublin.

These manuscripts fill about two thousand volumes, are kept in the Royal Irish Academy and the University of Dublin, and are of various kinds, — histories, chronicles, treatises on law, medicine, astronomy, etc. Among them, and of chief interest to me, were the manuscripts containing the myths and heroic tales of the Gaelic people. These myths and tales, if printed, would fill about ten thousand quarto pages. This is the greatest collection of myths in Europe. It is perfectly unique, both in quality and quantity. Neither in ancient nor modern times had any nation on the mainland of Europe such a collection; and O'Curry very truly said that the single 'Book of Leinster,' if published to the world, would make the reputation of any nation.

The 'Book of Leinster' is but one of many books of its class, though it is the richest of all in contents; and the 'Book of Leinster' is not yet accessible to the world, though it has, with three other volumes, been placed within the reach of a few Gaelic scholars in the form of some *facsimile* copies of the original manuscript, with all the contractions and abbreviations, of which several hundred were used by scribes in the days before printing. Some of the most important of the Gaelic manuscripts of myths and tales have come to us in unique copies, while a great many others of equal value, known by title or extract, have perished. Merely a wreck, a remnant of the old time, has been saved; but it is a wreck so extensive as to excite real wonder and thankfulness.

It is a matter of deep interest, also, to the scientific investigator, to learn that the chronicles of the country, both lay and ecclesiastical, especially the latter, bring to light a great many phases and forms of thought of pre-Christian times of which we have no record elsewhere. There is no church history in western Europe so valuable in this respect as that of the Church in Ireland; for the conversion of the people was voluntary, and the country at that time, and for some centuries later, was free from foreign pressure of every description. All of the ancient beliefs and practices that could posbly be permitted, were permitted. Some of these lived on parallel with the Church, and others were incorporated into it.

After a brief visit in Dublin, where I found assistance, and a most agreeable hospitality from the members of the Royal Irish Academy, the University of Dublin, and the two Gaelic societies, I set out to visit remote places in the west. Without entering into any detailed account, I may state that I visited some of the characteristic and secluded parts of the west coast, and took down personally a large body of myths and stories, some very long, others not so long. This collection of materials is sufficient to fill a couple of twelvemo volumes, and will give some idea of what yet remains in the Celtic mind of Ireland. It is, however, but a small part of that mental treasure still in possession of the people.

One of the largest and finest groups of Gaelic myths is the Ossianic, or myths of Fin MacCumhal and the Fenians of Erin. Fin has his immediate personal attendants. He and they possess fixed and well-determined characters, and their names and exploits are familiar to all who have heard the tales of the Fenians of Erin. There are no stories more popular, and they are interlaced with a great number of other important myths of various descriptions. Every place in the land has witnessed the activity with which Fin and his men struggled with every manner of obstacle, and fought with every kind of foe. Fin and Oisin, according to the stories, were born in a great many places in Ireland. Scotland is as full of their activity and birthplaces. Glencoe, the scene of the celebrated massacre, is a birthplace of Oisin. The account given of how these Fenian or Ossianic stories were preserved is remarkable enough. The authorship of them all is attributed to Oisin, the son of Fin MacCumhal, who told them to St. Patrick. St. Patrick had them carefully written down; but he found them so agreeable and entertaining, as well as so numerous, that he said people would neglect their work and do nothing but listen to these stories, so he destroyed two-thirds of what was told him by Oisin. From the remaining one-third come all the tales of the Fenians now current in Ireland and Scotland. In one of the stories which I collected is a complete account of how Oisin came back from Tir nan Og (the land of youth), after he had been there three hundred years, and told them to St. Patrick.

The time is coming when mythology may become a science, if scholars will work to that end, but mythology is far from being a science yet. There are many theories and loose statements current about mythology, — 'disease of language,' 'sun myths,' 'serpent myths,' etc., — but there is no science in all this. It is fancy, guess-work, efforts of men dealing with insufficient and unsatisfactory materials, collected, in many cases, by incompetent hands or by persons who tamper with materials for the purpose of improving them, or fitting them to some theory.

There is probably no more striking or interesting case of error than that of Max Müller, who has founded a whole theory of mythology on what he calls a 'disease of language.' Now, Max Müller's 'disease of language' is merely an incident in the history of mythology, instead of being, as he makes it, the great central and germinal factor, the parent instead of attendant of mythology. Müller's error is one that could never have been made by a man having proper and sufficient materials at hand from mythologies still intact. The things we need, above all, at present, to advance mythology on the way to becoming a science, are *facts*, and facts in mythology are well-preserved myths. These we need in great number, and in all the variants attainable in each linguistic stock of people.

Among the different branches of the Aryan race in Europe, there is none, as I have already stated, having so extensive and well-preserved a mythology as the people of Ireland. This mythology is to be found in two places, — in Gaelic manuscript, and in the minds of the people of the more secluded parts of the island. Only very small portions of the Gaelic manuscripts have been translated, and still smaller portions published; so that practically this body of material for science is unknown to the world. The work of utilizing it remains to be done. Now, it will be found that the manuscript material can never be properly translated and explained without a knowledge of the words and idioms of the language, as well as the ideas and myths that are in the minds of the Gaelic-speaking people of Ireland.

The Qualities of Fats.

The chemist and microscopist of the Department of Agriculture are engaged in an examination of samples of the lard of commerce, for the purpose of determining its constituents, and also of discovering the best tests for adulteration. Professor Wiley has employed all of the ordinary tests, but gets the best results from one suggested by an Italian chemist, Bechi, in which nitrate of silver is used. Cottonseed-oil, when brought in contact with nitrate of silver, reduces the latter to a metallic state. Professor Wiley has also begun an interesting series of experiments to determine the refraction of different oily substances. The instrument used is Abbé's refractometer, which shows the index of refraction upon a scale upon its side. There is no literature on this subject, and the tables which Professor Wiley proposes to make will be an interesting contribution to the present knowledge of the qualities of fats. X.

Washington, D.C., March 1.

HEALTH MATTERS.

Transmission of Infection by Rags.

THE 'Eighteenth Annual Report of the State Board of Health of Massachusetts' contains a valuable report by Dr. C. F. Withington, who was requested by the board to investigate the question of the transmission of infectious diseases by means of rags. Dr. Withington's report is very full and complete, and is a very fair and unbiassed statement of the facts as we understand them. His conclusions are as follows: —

1. Small-pox has been transmitted through the medium of rags in a certain number of cases, small in proportion to the whole number

of persons who handle rags, but absolutely numerous enough to show that unvaccinated workers in rags are exposed to an actual, if not imminent, danger of infection from this source.

2. The source of this infection is more frequently domestic than foreign rags, though the disease has been caused by the latter. This possibility of infection through imported rags accords with what is known of the tenacity of life of the variolous poison.

3. Among the rarer means whereby cholera is transmitted are textile fabrics infected with choleraic discharges. There is evidence that clothing from cholera patients, and possibly clothing merely packed in an infected locality, has, when transported to a distance and there unpacked, caused the disease in those who have handled it, thus starting a fresh cholera focus. A proper distinction exists between clothing, on the one hand, recently removed from the body, and again, not long after, put on to the body; and rags, on the other hand, which, if transported to this country, are certain to have undergone a carefully discriminative sorting and drying, and to have spent a considerable time in warehouse and on ship-board.

4. The statement that cholera has been transmitted by paper-rags rests upon a solitary case, of which the details are not complete, and on the reliability of which some of the highest authorities on cholera have cast doubt. If the case be accepted, it is one of infection by *domestic* rags, carried only fifty miles from their place of collection.

5. An epidemic affection, known as 'rag-sorters' disease,' appears to have broken out on three or four occasions in European paper-mills. It was probably, though not certainly, the disease called 'anthrax.'

6. Authenticated instances are not to be found in which the other infectious diseases — typhus and typhoid fevers, scarlet-fever, measles, and diphtheria — have been transmitted through rags; though it is to be said that such evidence, supposing the fact to exist, would be very difficult to get. Neither do the mortality tables, as shown by registration reports, show a preponderance of deaths from these diseases in the paper-making towns.

7. There is no evidence to show that rag-sorters as a class are, except for occasional cases of small-pox and a certain amount of pulmonary irritation from the dust of improperly ventilated rooms, less healthy than other persons engaged in in-door manual occupations.

8. Despite the fact that cholera is not known to have ever been conveyed to this or any other country in foreign-baled rags, it is a reasonable precaution to prohibit the landing in any United States port of rags gathered in epidemically infected localities, in view of the possibility that among such rags there may have been thrown articles of infected clothing which have not been sufficiently dried and aired, or have not occupied enough time in their transportation to be devoid of danger. Such prohibitions should be limited to the time and place of epidemic infection; but all necessary precautions should be taken to make sure that rags shipped from a healthy port were not gathered or baled in an infected place.

9. As the only safeguard against the occurrence of small-pox among operatives, paper-mill owners, whether 'incorporated companies' within the purview of the statute or not, should make evidence of successful vaccination an absolute prerequisite to the employment of any person in the mill, and a re-vaccination at regular intervals (not merely on the occurrence of an epidemic in the neighborhood) a condition of being retained in their employ.

10. As the contagion of small-pox, phthisis, and perhaps other diseases, is capable of being inspired when the particles carrying it are suspended in the air in the form of dust; and as dust, even when it carries no contagion, is irritating to the respiratory passages, — every mill should have, in connection with each table in the rag-room and in the dusting-room, a ventilating system, preferably consisting of flues connected with an exhaust-fan, so that the dust, as fast as it is disengaged, may be withdrawn from the air. The success which attends the working of such an apparatus, in some mills where it is in use, is a sufficient warrant for its general introduction.

11. A law similar to that of Great Britain (Section 125 of the Public Health Act of 1875), imposing a penalty on the selling or giving-away of infected rags from persons sick with any dangerous disease, seems desirable. Public institutions and private householders should be obliged (and not, as at present, simply advised) to insure the disinfection of the more valuable articles, and the destruction by fire of all rags, that have been thus exposed.

12. As domestic rags comprise more than half those used, and represent a still larger proportion of the infection likely to be carried, it follows that they should participate in whatever disinfection is thought necessary. This fact points to the paper-mill as the proper place for making such disinfection. The sulphur process would doubtless afford the least embarrassment to the manufacturer; the bales being opened in a tightly closed room, the rags being spread on racks, and sulphur burned in the proportion of two pounds to each one thousand cubic feet of space. The introduction of steam under pressure, the rags being similarly disposed, would be the most effective disinfection possible, but would dampen the rags to their injury, unless the moisture were dried out at once with a current of hot air.

ELECTRICAL BULLET-PROBE. — At a recent meeting of the New York Academy of Medicine, Dr. Girdner of New York exhibited his telephonic bullet-probe. The interesting feature of this probe is that it is operated by a current of electricity extracted from the body of the patient himself, in whom it is desired to locate a metallic missile. The construction of this probe is as follows: to each of the two terminals of a telephone-receiver, an insulated flexible wire about four feet long is connected. At the free end of one of these wires a hollow, bulbous piece of steel is attached. At the free end of the other wire is a suitable handle in which a probe may be placed, and held by a clamp-screw. The internal arrangement of the handle is such that a perfect electrical contact exists between the end of the probe and that of the wire which terminates in the handle: the same is true for the end of the other wire and the steel bulb. When a current of electricity is passed through the coil in the receiver by means of the bulb and the probe, each time that the current is made and broken a clicking or rasping sound is heard in the receiver held to the ear. All sounds are shut out except that heard when the bullet is touched; and the apparatus is so constructed that both hands are left free. In describing the application of this probe, Dr. Girdner mentioned a case seen in practice, in which a musket-ball had lain between the bones of the leg for twenty-two years. When an ordinary probe was passed, hard substances could be felt in many places, but it could not be told whether they were bone or bullet. The porcelain probe, invented by the distinguished French surgeon, Nélaton, was of no use, as the bullet was so covered by a thick crust of salts of lead as not to be marked when it was rubbed against the bullet. When the telephonic probe was passed, no response came so long as bone and other tissues were touched; but, the moment the probe came in contact with the bullet, a clicking and rasping sound was heard in the telephone. During this test the steel bulb was held in the patient's mouth. A more detailed description of the probe, with illustrations, may be found in the *New York Medical Record* of Feb. 4, 1888.

MEDICAL COLLEGES IN THE UNITED STATES. — The last annual report of the State Board of Health of Illinois contains some very interesting statistics in reference to medical education in the United States. Since 1886 there have been two new medical colleges established, and two have ceased to exist. There are now 114 colleges which exact an educational requirement of intending matriculates, as against 45 formerly, there being no change in this respect from the previous year; 43 colleges now exact attendance upon three or more courses of lectures, as against 22 formerly, — being a gain of two over 1886, — and 57 others make provision for a three or four years' graded course. Hygiene in now taught in 114, and medical jurisprudence in 112 colleges, as against 42 and 61 respectively prior to 1883. There is an increase in the average of lecture-terms from 23.5 weeks to 24.9 weeks during this period; and 114 colleges now have terms of five months or over, and 63 have terms of six months or over, as compared with 101 and 42 respectively. There is only one medical college that has a course less than twenty weeks, the Medical College of Georgia. In 1882–83, out of every 1,000 matriculates, 322 were graduated, taking both the United States and Canada and all schools of practice into the account. In 1886–87 only 294 out of every 1,000 matriculates

were graduated. In the United States alone, in 1882–83, out of every 1,000 matriculates, 331 were graduated, while in 1886–87 only 305 out of every 1,000 matriculates were graduated.

THE FUTURE OF MEDICAL GRADUATES. — Of some one thousand graduates from collegiate institutions, says the *Pacific Record*, seventy-five only make for themselves a name and prominence in their calling. About two hundred, having business qualifications, become rich by their practice and by judicious investments. Four hundred abandon, in whole or in part, their profession for some more lucrative business; and the balance struggle with mediocre ability for a bare subsistence, and a wearying effort to keep up an appearance before the people.

ALCOHOL AND FEVERS. — Dr. Kretzschmar of Brooklyn read a paper at the recent meeting in Albany of the New York Medical Society, on the use of alcohol in certain forms of fever. He believed that in some diseases alcohol, if properly administered, was not only instrumental in prolonging life, but was frequently a most potent factor in preserving it. Alcohol possesses the qualities of both food and medicine. It is one of the best antiseptics, and the most reliable remedy we have in the treatment of diphtheria. He regarded alcohol as beneficial in the treatment of phthisis, especially when the temperature of the patient was increased. In the discussion which followed, Dr. Castle advised that stimulants be kept in several small bottles, as, when exposed to the air, they lost valuable medicinal properties.

BOVINE TUBERCULOSIS. — Dr. Brush of Mount Vernon discussed at the Albany meeting the subject of bovine tuberculosis. Of all domesticated animals, the bovines are the most subject to tuberculosis. Five per cent of the cattle in England are affected with tuberculosis, and it is said that twenty per cent of the cattle in some of the thoroughbred Jersey herds in the Northern States are similarly affected. He believed that more human beings were not infected, because the normal temperature of the human race was so much lower than that of the bovine, — 98.5°F. in the one, and 101° to 103° F. in the other; this latter temperature being necessary for the growth of the germ of the disease. The cultivation of tuberculosis in animals confirms this view, as resistance to the disease decreased as the normal temperature of the animal increased. Thus, in the dog, resistance was good, while in the common fowl it was *nil*. Dr. Brush thought that the Federal Government would do better to spend its money in the investigation and suppression of this disease, than to appropriate five hundred thousand dollars to stamp out pleuro-pneumonia, which did not affect the human race. He believed, that, if bovine tuberculosis were eradicated, it would soon become eliminated from the human race, and he thought that physicians should strive to procure laws which would accomplish this.

ELECTRICAL SCIENCE.

Secondary Batteries.

IT has been for many years the dream of inventors to perfect some apparatus by which energy could be stored, to be used when occasion required. The secondary battery accomplishes this better than any thing else that has been invented, but it has limitations and defects that it is well to point out.

The two principal uses, with a great number of minor applications, to which secondary batteries can be put at present, are the distribution of energy for electric lighting, and their use in driving street-cars. As for the first of these, it is well known that the direct system of constant potential distribution cannot be employed at any considerable distance from the central station, owing to the heavy investment in copper necessary. If storage-batteries could be economically used, however, they could be distributed at different points through the district, to be lighted and charged by a high potential current, allowing comparatively small conductors to be used, and employing the electric plant during the day, when it would otherwise be idle.

The advantages for street-car work are apparent: each car carries within itself the energy necessary for running it; a break-down of one car does not affect the rest of the system. Compared with other electrical systems, the advantages are, that it can be used in crowded streets with no danger from high potential currents; and where a large number of cars are used, it is much simpler than any other plan. Compared with cables, it gives a greater economy of power, a less first cost, and the impossibility of one accident disabling the whole line.

The disadvantages of secondary batteries are the cost, the waste of energy, the deterioration, and the weight for a given capacity and rate of discharge.

The type of storage-cell most generally in use is some modification of the Faure cell, generally of the Faure-Sellon-Volkmar type. In it the plates are made of cast lead supports or 'grids,' into which is pasted a mixture of red lead and sulphuric acid. The 'grid' has in it square hour-glass shaped holes, the contraction in the middle being intended to prevent the active material from falling out. The plates pasted with red lead are put into dilute sulphuric acid, alternate plates are connected together, and an electric current is sent between the two sets, changing them into pure lead and lead peroxide. Plates thus 'formed' are put into cells with dilute sulphuric acid, a number of lead or negative plates, and peroxide or positive plates, in each cell. This is, very briefly, the general method of manufacture.

Now, suppose we have one of these cells fully charged, — all of the positive plate peroxide, all of the negative plate lead, — and discharge it through a resistance. At first the electro-motive force is over 2 volts. This will rapidly run down to about 1.95 to 2 volts, where it will remain constant (provided we do not discharge the cell too fast) for a considerable time, when it will begin to fall, and, if we continue the discharge, it will finally become zero. If, now, the plates be analyzed, it will be found that the positive plate has in it peroxide and sulphate of lead, the latter perhaps fifteen to twenty per cent of the whole active material. The negative plate will consist of pure lead and sulphate. If we charge the cell, the plates will be changed to pure lead and peroxide again, the electro-motive force will gradually rise to 2.25 volts, and, when the charge is nearly complete, oxygen will be given off from the positive plate. There are two very important things to be noticed. If we charge and discharge the cell a number of times, we will find that the energy we get out of the cell is less than the energy we put in by an amount that varies with the rate of discharge, the efficiency being less as the discharge rate is greater: the average efficiency for the present storage-cell is something near seventy per cent. Another point even more important than the first is, that, if we greatly increase the discharge rate, the electro-motive force of the cell will fall rapidly; and if we persist in this, the plates will corrode and buckle, and the plugs of active material will fall out of the holes in the plates. There is one more disadvantage besides these, and that is the fact that the life of the cell, especially that of the positive plates, is limited. Under favorable conditions, the positive plates will last, on the average, two years: the negative plates will last much longer.

For lighting, the most important disadvantages are the cost, the loss of energy, and the deterioration. The fact that the cells cannot be discharged at more than a certain rate does not greatly affect their usefulness in ordinary cases. And storage-batteries have reached such a state of development that it is safe to say, that, if they were sold and repaired at reasonable prices, they would have at once a great field of usefulness for electric lighting, even with their present defects. The principal cost of a storage-cell is for material: the cost of the labor is comparatively small, and, when the plates have given out, at least a part of the material is left.

But for traction-work the greatest disadvantage is in the slow discharge rate permissible. At present from three thousand to four thousand pounds of storage-batteries are required to drive an ordinary car, the storage capacity being enough for a run of from forty to sixty miles. This great weight increases the power necessary to run the car, the wear of the track, and the deterioration of the car. Besides, it means a considerable first investment, and a large battery to be kept in repair. If we could discharge the battery at any rate we wished, we could make a round trip with seven hundred and fifty to one thousand pounds of battery. We would have to charge our batteries oftener, of course, but we would greatly decrease our items of first cost, depreciation, wear of road-bed and cars, and even of power expended.

It has been variously estimated that the difference of expense be-