and the writer gives with considerable detail the natural phenomena which lead him to the conclusion that the locality was a forest, probably a valley overgrown with conifers and oaks. The subsoil of this forest was a coarse boulder or drift. By excess of water, either by flood or changes of level, the trees were in time killed, their leaves shed and buried in the mud and their trunks rotted to stumps. Then a tumultuous and rapid deposit of coarse drift, containing drift wood, covered up the forest ground and the still remaining stumps to the depth of perhaps several hundred feet, the surface thus formed eventually becoming eroded into hills and dales. Over a long period following came the outbursts of lava in successive flows, with the silicification of the wood, and the cementation of the drift by the percolation of hot alkaline waters containing silica, as happens so commonly in sub-lava drifts. Finally succeeded the process of erosion by which the present stream channels, whether main or tributary, have been cut to their enormous depth.

In referring to the age of the Cascade range, Professor Le Conte concludes that it was first born of the sea, by horizontal washing and vertical swelling, probably at the end of the jurassic, though only as a low range, continuing the sierra northward; its subsequent increase took place at the end of the miocene, by the outpouring of the great lava flood above described.

SCIENTIFIC RESULTS OF THE POLARIS EXPEDITION.

The report of the voyage of the Polaris, now issuing from the Government printing office, contains a memorandum by Dr. Bessel on the scientific results and discoveries of the expedition. Large numbers of astronomical observations were made, but the records were all lost, with the exception of a few of little value. Soundings were taken along the coast of Grinnell Land, which proved that the hundred fathom line follows the coast at a distance of about fifteen miles from Smith's Sound. One of the casts brought up an organism of still lower type than the *bathybius* discovered by the English dredging exposition. It was called the *protobathybius robesonii*. The aurora was frequently observed, but it never appeared with sufficient brilliancy to produce a spectrum. The most careful examinations failed to show any electricity in the atmosphere. The land was covered by drift, the main line of which, indicating its motion, runs from north to south.

Although the details of the discoveries are very meager—and, owing to the loss of specimens as well as records, nothing can be done to amplify them—Dr. Bessel believes that the voyage has not been without results of the highest importance. These he summarizes as, first, the fact that the Polaris reached 82° 16′ N., a higher latitude than has been attained by any other ship; second, the navigability of Kennedy Channel has been proved beyond a doubt; third, upward of 700 miles of coast line have been discovered and surveyed; and fourth, the insularity of Greenland has been demonstrated.

NERVE FORCE.

Dr. Brown Séquard is delivering, in Boston, a course of lectures on a topic regarding which little is positively known to the world in general, and which, so far as popular ideas are concerned, is so enshrouded with fogs of animal magnetism, electro-biology, power of the will, psychic power, and kindred theories, that there are few who can definitely and clearly lay down the certain facts which modern investigation has proved to be true. There are not probably many physicians who have made the matter one of such deep and extensive research as has Dr. Séquard; and hence the discourses and opinions emanating from so high an authority are especially welcome, and the very curious and instructive information contained in them will, from the very circumstance of its being so little understood, have the additional charm of new revelations in science.

There are two elements in the nervous system, which, united together, are nevertheless absolutely distinct. One is the nerve cell with its filaments or prolongations, the other the fibers. Within the nervous centers, that is, the brain and spinal cord, there is but one of these fibers united with the cells. In other parts of the body there are cells which have two real fibers starting from them, besides the ramifications. Produced in these elements is the force which manifests itself in nervous actions, but it is proved that nervous force can nevertheless exist without the elements. In some low forms of creation, there are tissues which do not represent at all the known elements of the nervous system, and by disease the latter organization in man may be transformed beyond recognition, and yet the nervous force still manifests itself. There is no likelihood, however, that nervous force can show itself outside the boundaries of the system, no facts in proof of such an idea and hence at the very outset, Dr. Séquard deals a crushing blow at the fundamental theories of animal magnetism. The transformation of nervous into motor or other forces is, however, possible, and is constantly exemplified in the actions of our bodies. Certain animals evolve light as a transformation of the force, others electricity; and Dr. Séquard tells us that, in severe cases of consumption, patients in a high state of nervousness evolve visible illumination from the lungs. The chemical changes occurring in the body take place under this influence; there seems to be, although the circumstance is not definitely decided, a transformation of light, acting upon the retina, into nervous force, and motion such as shampooing or kneading of the limbs all increases its quantity, as does also heat. The application of heat to children, the lecturer considered, is exceedingly useful to help their development. If the air they breathe is cool, and warmth is applied to their limbs, but not so much to the body, they certainly grow faster.

The blood is necessary to the production of nerve force itself, but oxygen alone can supply some power. Strychnin has also a remarkable effect. The influence of the will is very slight, and this is a wise provision of Nature to prevent foolish waste. Dr. Séquard considers that moderate exercise will lead to a production of nerve force and facilitate the employment of our brain power: but there is no question that if we draw away more of the nerve force from our system than can be reproduced in a given time, if we walk very fast, for instance, for five or six hours, we become unfitted for mental work. We are weakened in every organ depending upon nervous force, the heart and the lungs especially, and hence it appears that the same focus supplies the force both for physical and mental action. The power is distributed as is galvanism on a cylinder; and if a cause operates to divide the system into halves, each half has only the amount of nerve force it had before. The fact of our really having two brains is no objection to the unity of the force, because every part of our nervous system is in close communication. We cannot touch a part of the skin or any other portion of the organization without producing a commotion all over the nervous system.

Excitability and nerve force are two very distinct things. Strong persons will generally not be moved by the former cause, while on the contrary persons who have but little nerve force will react under it, however slight, without giving the mind time to think what it is. In health, nervous power and electricity are both present, but they are clearly not the same; for the speed of the former is only from 80 to 200 feet per second, while the latter travels a distance thousands of times greater. There are two great influences of nerve force, the production of activity either normal or morbid, and the cessation of the same. The brothers Weber discovered that when the big nerve in the neck which goes to the heart is galvanized, the organ stops passively and not actively as do the muscles of the arm when similarly influenced. It is believed that all such phenomena occur through the same mechanism. An irritation starts from a part which can convey nervous force, and the latter, reaching the cells of gray matter which were active, immediately stops them. Dr. Waller has found that, by pressing the same nerve, called the *par vagum*, that the motion of the heart is arrested to a certain extent, and relief afforded in cases of headaches, neuralgia, and similar maladies.

Dr. Séquard says that experiment has shown that there is much greater vitality in animals in America than in Europe. People can withstand more terrible injuries, and the animals of this continent seem to have a less tendency to death by hœmorrhage than those across the Atlantic. In addition to those already cited, there are many other causes which will often stop the heart's action; a severe blow on the abdomen, a sudden douche of cold water, chloroform, and carbonic acid in the larynx are cited as examples. Galvanization of the cervical sympathetics, often resorted by physicians as a cure for headache is very dangerous for a similar reason.

There is no doubt that the respiratory movements are all due to the activity of cells of gray matter, just as the movements of the heart are; the cells of gray matter, as regards respiration, being placed on the base of the brain and in a part of the spinal cord. The same nerve, the *par vagum*, which goes to the heart, has a set of fibers which, instead of going down, go upward and toward those cells of gray matter in the base of the brain and spinal cord. So that if you divide the *par vagum*, having one hand by which you can act on the heart, and another by which you can act on the brain, you can at will, at one moment, stop the heart's action, and in another stop the respiratory movements. The stopping of the respiratory movement is very peculiar, and two kinds of fibers are able to do it. One goes to the larynx, acting by the superior laryngeal nerve, and acts by the cessation of the diaphragm, which is a muscle of the chest. The other need not here be described. Respiration can also be stopped by carbonic acid in the larynx. Palpitation of the heart may be diminished by breathing in forcibly as much air as possible. In health, therefore, every act of breathing is a moderation of the heart's action. The morbid phenomenon of respiration can also be stopped by the influence of arrest.

Coughing, for instance, can be stopped by pressing on the nerves of the lip in the neighborhood of the nose. A pressure there may prevent a cough when it is beginning. Sneezing may be stopped by the same mechanism. Pressing also in the neighborhood of the ear, right in front of the ear, may stop coughing. It is so also for hiccough, but much less so than for sneezing or coughing. Pressing very hard on the top of the mouth inside is also a means of stopping coughing. And the will has immense power there. There was a French soldier who used to say, whenever he entered the wards of his hospital, "the first patient who coughs here will be deprived of food today." It was exceedingly rare that a patient coughed then.

ACOUSTIC DARKNESS AND MENTAL LIGHT.

Professor Tyndall, in the course of a recent investigation into the performance of the signals which, by loud sounds audible at considerable distances, serve to warn vessels approaching dangerous coasts during foggy weather, has been led not only to the determination of some important facts regarding the acoustic transparency and opacity of the atmosphere, but to the exemplification of how the imagination may be scientifically employed in the solution of apparently unanswerable problems. The sound producing apparatus consisted in two large brass trumpets, 11 feet long and blown by an air pressure of 18 pounds, two locomotive whistles, and an 18 pounder gun fired with a 3 pound charge of powder. Professor Tyndall embarked aboard a small steamer, which, under his direction, was moved from point to point from the locality of the sounding instruments, South Foreland Cliff, near Dover. The observations were carried on over several days, with varying results, some of which the investigator found himself at a loss to explain. Thus, on one day the distance at which the sound could be heard was 5½ miles; on the next day, 10 miles. The former day the wind was in the direction of the sound; on the latter, the wind was opposed. Again, on another occasion it was noted that the sounds were not impaired during the continuance of rain; though this state of the atmosphere, according to expressed opinions, should have deadened them. A clear atmosphere has been extolled as the best for sound; but the noise of the horns, says Professor Tyndall, was heard 12¾ miles dead to windward of the cliff, and while the latter was obscured by a thick haze. It was a curious and incomprehensible fact that, under these conditions, the sound ranged at least twice as far as it had done on days when neither haze nor wind was there to interfere with it. To add to the perplexity of the investigator, subsequently to the observation of the above phenomena, on a perfectly bright, clear day, with smooth sea and no wind, not a vestige of sound of either horn, whistle, or gun could be detected at a distance of two miles. He says he stood "amazed and confounded," for he saw no palpable clue to the solution of the problem. It was a case where one's senses are of no use, where they and all the philosophical instruments in the world cannot be of the least assistance. How, then, is it to be answered? There is the least shade of exultation in Professor Tyndall's crisp sentences when he announces that by the scientific use of the imagination—a process of reasoning of which he is the firmest advocate, although many have deemed his masterly treatise on the subject loose and illogical—he was led to a satisfactory explanation. His mind sets itself at work. Sulphur, reasons he, is exceedingly transparent to radiant heat, whereas the ordinary brimstone of commerce is highly impervious to it. Why? Because the brimstone does not possess the molecular continuity of the crystal, but is a mere aggregate of minute grains, not in perfect optical contact with each other. When this is the case, a portion of the heat is always reflected on entering and quitting the grains. Hence, when the grains are minute and numerous, this reflection is so often repeated that the heat is entirely wasted before it can plunge to any depth in the substance. A snowball is not optically continuous ice, but an aggregate of grains of ice; and the light which falls upon the snow, being reflected at the limiting surfaces of the snow granules, fails to penetrate the snow to any depth. Thus, by the mixture of air and ice—two transparent substances—we produce a substance nearly as impervious to light as a really opaque one. And this is equally true of foam, clouds, and all transparent substances in powder. But to proceed further. Humboldt, in his observation of the falls of the Orinoco, found that the noise was three times louder by night than by day. The plain between him and the water consisted of grass and rock intermingled. In the heat of the day, the temperature of the rock was 30° higher than by night. Hence, he inferred that over every heated rock rose a column of air rarefied by heat, and he ascribed the deadening of the sound to the reflections which it endured at the limiting surfaces of the denser and rarer air. Thus he proved that a non-homogeneous atmosphere is unfavorable to the transmission of sound.

Professor Tyndall says that, as he thus reasoned and stood on the deck of the steamer pondering the question of what could so destroy the atmosphere over a calm sea as to enable it to quench in so short a distance so vast a body of sounds, he became conscious of the exceeding power of the sun beating against his back and heating near objects. Here was a clue, and the rapidity with which he followed it is well shown in the short, terse sentences which sum up a complete explanation of the mystery. "Beams of equal power," says the Professor, "were falling on the sea, and must have produced copious evaporation. That the vapor generated should so rise and mingle with the air as to form an absolutely homogeneous mixture, I considered in the highest degree improbable. It would be sure, I thought, to streak and mottle the atmosphere with spaces in which the air would be, in different degrees, saturated or, it might be, displaced by the vapor. At the limiting surfaces of these spaces, though invisible, we should have the conditions necessary to the production of partial echoes and the consequent waste of sound."

Following up this mental conclusion with experimental test, it was found fully verified. A cloud coming before the sun checked the production of vapor so that sounds, before inaudible at three miles distance became clearly heard. Again, as the sun went down, the signals became louder and further recognized to such an extent, it is stated, that at 6 P.M. the sound had risen to more than fortyfold the intensity which it possessed at 2 in the afternoon. And thus, by a simple use of the imagination, by conceiving of a state of nature which the senses could not indicate, the investigator was led to a result susceptible of the clearest material proof.

TAKE CARE OF THE MATCHES.—A Great Barrington (Mass.) merchant found a box of parlor matches on the store floor the other morning, which had been knocked off the shelf by a rat or mouse overnight. On opening the box the discovery was made that by the concussion every match in the box had been lighted, and the wood of which they were made was charred and turned brown. Fortunately the box was so tight as to smother the fire, and no harm resulted. It was a narrow escape; and if a fire had taken place, its cause would have been a perpetual mystery.