were really caught at the depth of 1,000 fathoms or near the surface. The fruits of the towing net may have been gathered anywhere in its course.

In the course of this expedition the temperatures of the Gulf Stream were ascertained throughout, from top to bottom, and through the whole area. The fact had been first noticed by Dr. Carpenter that an inclosed sea, such as the Mediterranean, may have a higher temperature for its depths than corresponding depths of the ocean. The difference in that instance is 35°. It is caused by the fact that the ocean water flowing into the Mediterranean has to cross a barrier at Gibraltar; the depth there is about 500 fathoms, and the temperature at that depth is that of the sea to the east of it, the cold water at the bottom of the Atlantic either never rising so as to float over that barrier, or, if it does, being warmed to the higher temperature while in transit. The Caribbean Sea is similarly inclosed by barriers, and its waters at their greatest depths are only as cold as that of the lowest soundings on the barriers. Similar observations are on record about the Soloo Sea and other bodies of water thus marked off by submarine or surface elevations surrounding them.

MEASURING STARLIGHT.

Professor Pickering has devised an instrument for the special purpose of comparing the components of double stars. The images are separated by a Nicoll's prism, and there are various contrivances for preventing error. A chart is in preparation at Harvard of all the double stars north of 40° latitude; at present this work is about half done, 90 stars having been finished and reported upon, requiring 4,000 observations. The probable error in this work is less than the tenth of a magnitude. A star in Cassiopeia gave a great deal of trouble; the discrepancy in the observations upon it amounted at times to half a magnitude; eventually a faint companion was discovered, which accounted for the changes. It was long suspected that Gamma Ceti's companion shines by reflected light. It was a matter of great interest, as no planet has yet been recognized outside of the solar system. The test is, of course, the polarization of light. After forty or fifty observations, the Gamma Ceti case was determined to be no exception to the general rule. A special research to obtain a quantitative estimate of the difference of light in colored double stars has yielded unexpectedly uniform figures from different observers, and shows that such stars yield abundant light, notwithstanding their color. The companion of Sirius is estimated to be of about the ninth magnitude. Investigations to ascertain whether its light is reflected or not are as yet uncompleted. The working of the double star photometer is very satisfactory.

ABRASIONS OF THE NORTHWEST COAST OF AMERICA.

A very long essay was read by Professor George Davidson on the abrasions of the northwest coast of America. It was chiefly occupied with a description of the appearance of the coast ranges and hills that face the Pacific from Mexico to Alaska. Viewed collectively, they present a series of flat-topped rocks, hills, beaches, and plateaus; of terraces cut into such general shapes by an agency of wide application. The various admitted agencies for transforming the terrestrial surface were considered separately, and shown to be inadequate for this result. Professor Davidson ascribes it, in connection with the gradual elevation of the coast, to a great ice belt which followed the shore line and performed this gigantic sculpture.

THE SIZES OF MOLECULES.

Dr. Wolcott Gibbs discussed the question as to what allowance should be made for the molecules of a gas in calculating its contraction under pressure, the contraction applying probably to the spaces around each molecule, and not to the molecules themselves. Some of the results are very curious. If we assume that in hydrogen we have nothing to deal with but the molecular and intermolecular spaces, it will follow that in one entire meter of hydrogen, at a pressure of 0 and temperature of 4° C., the molecular volume amounts to 538·9 cubic centimeters. In other words, the molecules occupy 539 millionths of the whole space. Under a pressure of one atmosphere, a cubic meter of hydrogen contains 545 cubic centimeters of matter. The relation of nitrogen to hydrogen at the same temperature and pressure for the ratio of volumes of molecules is as follows: H divided by N is equal to 1 divided by 2·77; that is, the volume of the molecules of nitrogen in one cubic meter of the gas is 2·77 times as great as the volume occupied by the molecules of a similar quantity of hydrogen. In the latter gas at 4° and one atmosphere, the mean free path of the molecules is 458 times their individual diameters; in nitrogen, 167·4 times. The diameter of an atom of hydrogen is to be expressed in centimeters by 42 divided by 10 raised to the ninth power; an atom of nitrogen, 54, also divided by 10 raised to the ninth power. This is in striking accord with the results obtained through other lines of research. The mean distance of the centers of the molecules of hydrogen will be, in centimeters, 512 divided by 10 raised to the ninth power; nitrogen, 607 similarly divided. Finally, Boyle and Mariotte's law holds good (for certain limiting conditions of pressure), provided it be applied solely to the interstitial spaces and not to the molecular matter of gases.

Professor S. P. Langley called the attention of the Academy to the strange similarity between the A and B lines of the spectrum. The likeness of the A group of lines is so very marked as to indicate that they, too, are of telluric, not solar, origin.

Professor Henry communicated the closing address, mainly relative to the work of the Academy and the ground of selection of its members, which, he said, must be actual scientific labor in the way of original research; that is, positive addition to the sum of human knowledge; and this qualification of a candidate must be united with unimpeachable moral character. Not social position, popularity, extended authorship, or success as an instructor can entitle to membership; this is due alone to actual new discoveries: nor are these sufficient if the reputation of the candidate is in the slightest degree tainted with injustice or want of truth.

At the election of officers, Professor O. C. Marsh was elected Vice President and Professor J. H. C. Coffin, Home Secretary.

The meeting adjourned on April 19th.

Julius Robert von Mayer.

On the 20th ult. died Julius Robert von Mayer, of Heilbronn, in Würtemberg, a man whose labors in physical science have won for him an undying renown.

"The mechanical equivalent of heat" is an expression which was introduced into science by Mayer, who must always be regarded as having stood in the front rank of the founders of the dynamical theory of heat. In 1842, while practicing as a physician in his native town of Heilbronn, he published a paper in which the relations which subsist between heat and work were defined, and a computation of the mechanical equivalent of heat was given. With no means to make experimental research, he calculated the value of the mechanical equivalent, by the help of the best data procurable at the time, on the assumption that when a body is heated by compression the heat developed is the equivalent of the work expended in compressing the body. Subsequent researches have shown that this assumption is true in the case of air, the substance from the properties of which Mayer drew his conclusions. It is not surprising, however, that the value that he obtained for the mechanical equivalent of heat was far from being the true one, for in 1842 the specific heat of air at constant volume, and the ratio of the specific heats at constant volume and constant pressure, were very imperfectly known. Yet, when corrected in accordance with the results of more recent experiments, his calculation does not differ much from the value of the mechanical equivalent obtained by others by totally different processes. In 1845 appeared Mayer's paper on "Organic Movement in Connection with the Transformation of Matter"—a *brochure* of 100 pages—in which he speculates fearlessly and acutely on the agency of the so-called vital force, establishing the principles that all the so-called forces are interchangeable forms of energy—the one sole force; that energy is never created or destroyed, and that all natural phenomena are accompanied by a change of the form of energy. In 1848 was published one of his most notable papers, under the title of "Celestial Dynamics." In this paper he calculates the heat that would be developed by the collision of the earth with a target strong enough to stop its motion, and propounds the hypothesis that the sun's heat is maintained by the falling of innumerable meteorites on its surface. One point especially worthy of note in this paper is his statement of the effect of tidal friction in dissipating the energy of a planet's aërial rotation—an effect which was proved by Adams and Delaunay to exist in the case of the earth.

Mayer's last paper "On the Mechanical Equivalent of Heat" was published in 1851. It possesses the same fullness of original ideas as its predecessors, and in point of clearness of conception and definition can only be rivaled by Tyndall's "Heat as a Mode of Motion."

Soon after the publication of his last work his mind became affected in consequence of severe labors and disappointments he had suffered, and the rebuffs he had met with from scientific cotemporaries; and though at a later period he partially recovered, he was never able to resume his scientific investigations.

It must be claimed for Mayer that, in an obscure German town, without the means of making experiments, entirely isolated from scientific companionship, and with only the time that he could spare from his professional duties, he evolved in a remarkably short period a succession of theoretical views which, in point of originality, boldness, and comprehensive grasp of facts, stand among the foremost in the history of physics.

Auguste Lamy.

We have to record another loss to science in the death of the distinguished chemist, Professor Auguste Lamy, whose researches in organic and more especially inorganic chemistry have contributed not a little to the advancement of that branch of science. M. Lamy will be especially remembered for his isolation, examination, and description of the properties of the metal thallium; his results having been published at about the same time (1861) that Mr. Crookes announced the discovery of the new element. M. Le Verrier and M. Dumas endeavored at the time to claim for M. Lamy the discovery of thallium, and the claim was founded on a communication which the latter made to the Imperial Society of Sciences, Agriculture, and Arts, of Lille, May 16, 1862. The International Exhibition was opened on May 1, 1862, and there, in a case which had been opened some days before and arranged for the inspection of scientists, Mr. Crookes displayed several grains of the new metal and some of its compounds. Mr. Crookes had previously announced (March, 1861) the discovery of the new element, which he at first thought to be a member of the sulphur group. His specimen at the International Exhibition was in the form of a black powder. M. Lamy seems to have hit upon a more abundant source of the newly discovered element, and in June, 1862, he exhibited to a jury of chemists in London a beautiful ingot of the new metal. The discovery of Mr. Crookes, however, was deemed to have the priority, and the name that he had proposed for the metal was adopted. In 1864 M. Lamy described thallic alcohol, and in the following year published the results of his investigation of the phosphates of thallium. In 1869 Lamy invented the two valuable pyrometers associated with his name. In physics he studied the electric properties of sodium and potassium, and was the first to produce induction currents by means of terrestial magnetism. His death occurred on the 20th ult., at Paris, where for a number of years he had occupied the chair of Industrial Chemistry at the Ecole Centrale.

THE CAUSE OF BRICK INCRUSTATIONS.

We have before us two essays on the subject of incrustations on brick walls, one in the form of a report to the Philadelphia County Medical Society, by Joseph G. Richardson, M.D., the other an article in the *Journal of the Franklin Institute*, by Mr. William Trautwine, a well known engineer. Both papers will be found in full in our SUPPLEMENT of this week, and we allude to them here chiefly to point out the curious divergence of views between the physician and the engineer when the same subject is regarded by each from the standpoint of his respective profession.

Dr. Richardson thinks that the grayish white efflorescence is due to the sulphuric acid which comes from gas burners and coal stoves, being absorbed by moisture deposited during the evening upon the front walls of houses facing the east. The extremely dilute acid then combines with magnesia contained in the bricks, or possibly in the mortar, and when the water is evaporated by the morning sun crystallizes in the incrustation. He thinks that the latter has no injurious effect on health, but is rather evidence of the fixation of a deleterious product from coal and gas combustion, and hence it aids in producing pure air.

Mr. Trautwine points out that the coal with which bricks are burned contains diffused particles of iron pyrites, which are decomposed, yielding sulphurous acid gas. This acting at a high temperature, together with air moisture, upon the silicates of lime and magnesia already in the clay, the last are decomposed, and sulphates of lime and magnesia are formed, which impregnate the bricks. "When the bricks become wet these compounds dissolve, and in dry weather, succeeding storms, the solution evaporating from the surface of the bricks leaves them coated with the white compounds."

The reader is quite free to take his choice between these remarkably contrasting theories, which, while agreeing as to the nature of the incrustation, radically differ as to how it got there. It may be satisfactory to remember that there is no logical middle ground, and that if it did not come through outside causes, as advocated by Dr. Richardson, it must have come from the inside of the brick, as maintained by Mr. Trautwine.

Transparency of Metals.

That gold may be beaten to such a state of thinness as to readily transmit a greenish light is a fact that has been long known; and this property has been used by the gold beater as a practical test of the purity of the precious metal, inasmuch as the smallest admixture of silver with the latter causes a perceptible change of tint in the transmitted light. At a recent meeting of the New York Academy of Sciences, there was exhibited a film of gold (mounted between two plates of glass for protection against injury) which was stated to be the thinnest "leaf" of this metal that had as yet ever been produced. The method by which this remarkable result was obtained was very simple, yet one that required considerable delicacy of manipulation. An exceedingly tenuous film of gold having been, by means of a galvanic battery, deposited on the surface of an ordinary daguerreotype plate of copper, the latter metal was afterwards dissolved away by the action of nitric acid, and the gold film caught on a plate of glass.

The property of translucency, when in thin films, has until a comparatively short time ago been regarded as one peculiar to gold alone; the reason being, perhaps, that but few metals besides gold can be successfully hammered to the necessary degree of tenuity. In this respect, indeed, no metals but silver and platinum have been found to approach to gold. The interesting discovery has been made, however, that by means of electricity thin films, not only of gold but of the other metals, can be obtained which transmit light very readily. The method of obtaining these tenuous sheets of metal is by causing electric sparks to pass from wires of the required metals passing into tubes of rarefied air or other gases, when the particles of metal, detached from the wires by the sparks, become deposited on the sides of the glass, forming an excessively thin film, quite continuous under the microscope. Of the metallic films thus produced gold transmits a fine green light; silver gives a fine blue color; copper, a dull green; platinum, a bluish gray; zinc, a deep bluish gray; iron, a tint nearly neutral, but inclining to brownish; and cadmium, like zinc, a bluish gray.

MANGANESE IN THE BLOOD.—Richet has executed some quantitative determinations of this element by incinerating large quantities of blood, or destroying its organic constituents with chlorine, and then precipitating the manganese in the form of dioxide by the galvanic current. He regards its presence as accidental, not normal.