three parts are fully recovered and at once ready for reutilization, as will be described hereafter. In the usual process—understanding thereby, here and in the following, the process practiced at the United States mints, for instance—two parts of acid are employed for one of bullion; all of this is lost, partly through the dissolving and partly in being afterward mixed with water, previous to the precipitation of the silver by copper. Economy in acid being therefore imperative, the silver solution finally becomes much concentrated, and it requires high heat and careful management to finish the solution of the bullion. Bars containing more than about 10 per cent. of copper cannot be dissolved at all, owing to the separation of copper sulphate insoluble in the small amount of free acid finally remaining. The advantage gained by dissolving bullion with abundance of free acid in the improved process is so evident that it merely requires to be pointed out. For bullion containing 20 per cent. of copper the author employs six parts of acid to one of bullion; for baser metal still more acid, and so on, never losing more than the stoichiometrical percentage of acid and recovering the remainder. In this description he, however, confines himself to the treatment of ordinary silver ore with less than 10 per cent. of copper.

In the diagram A A represent two refining pots, 4 ft. in diameter and 3 ft. in depth, each capable of dissolving at one operation as much as 400 pounds of bullion. The acid is stored in the cast iron reservoir, B, which is placed on a level sufficiently high to charge into A by gravitation, and is composed of fresh concentrated acid mixed with the somewhat dilute acid regained from a previous operation. After the bullion is fully dissolved all the acid still available is run from B into A A. The temperature and strength

are thereby reduced, the fuming ceases, any still undissolved copper sulphate dissolves, and the gold settles. In assuming that the settling of the gold takes place in A itself, the author follows the practice of the United States mints. In private refineries, where refining is carried on continuously, the settling may take place in an intermediate vessel, and A A be at once recharged. Owing to the large amount of free acid present, the temperature must fall considerably before the separation of silver sulphate commences, and sufficient time may be allowed for settling if the intermediate vessel be judiciously arranged.

Separating the Silver Sulphate.—The clarified solution is siphoned off the gold from A A into C, which is an open cast iron pan, say 8 ft. by 4 ft. and 1 ft. deep. It is supported by means of a flange in another larger pan—not shown in the diagram—into which water may be admitted for cooling. Steam is blown into the acid solution, still very hot, as soon as C is filled. The steam is introduced about 1 in. below the surface of the liquid, blowing perpendicularly downward from a nozzle made of lead pipe through an aperture $\frac{1}{8}$ in. in diameter. Under these circumstances the absorption of the steam is nearly perfect, and takes place without any splashing. The temperature rises with the increasing dilution, and may be regulated by the less experienced by manipulating the cooling tank. An actual boiling is not desired, because it protracts unnecessarily the operation by the less perfect condensation of the steam. No separation of silver sulphate occurs during this operation (and, consequently, there is no clotting of the steam nozzle), the large amount of free acid, combined with the increase of temperature, compensating for the diminution of the solubility of the sulphate by the dilution. The most important point in this procedure is to know when to stop the admission of steam. To determine this, the operator takes a drop or two of the solution upon a cold iron plate by means of a glass rod and observes whether after cooling the sample congeals partly or wholly into a white mass of silver bisulphate, or whether the silver separates as a monosulphate in detached yellow crystals, leaving a mother liquor behind. As soon as the latter point has been reached, steam is shut off and the solution is allowed to crystallize, cold water being admitted into the outer pan. The operator may now be certain that the liquid will no longer congeal into a soft mass of silver bisulphate, which on contact with water will disintegrate into powder, obstinately retaining a large amount of free acid; but the silver will separate as a monosulphate in hard and large yellow crystals retaining no acid and preserving their physical characteristics when thrown into water. After cooling to, say, 80° F., the silver sulphate will have coated the pan C about 1 in. thick. There will also be found a deposit of copper sulphate when the mother acid, after having been used over and over again, has been sufficiently saturated therewith. Lead sulphate separates in a cloud, which, however, will hardly settle at this stage.

The whole operation just described, which constitutes the most essential feature of the author's improvement upon his old process described in Dr. Percy's work, is a short one, as the acid requires by no means great dilution. The steam has merely to fur-

nish enough water to dilute the free acid present to, say, 62° B. Areometrical determination is, of course, not possible, on account of the dissolved sulphates.

Reducing the Silver Sulphate to Fine Silver.—The mother acid is pumped from C to the reservoir, B, for this purpose an iron pipe connecting the top of B with a recess in the bottom of C. The tank, B, is cast as a closed vessel, with a manhole in the top, which is ordinarily kept closed by an iron plate resting on a rubber packing. The air is exhausted from B by a steam injector, and the acid rises from C and enters B without coming in contact with any valves. The volume of fresh commercial acid necessary for another dissolving operation, say 800 pounds, more or less, for refining 800 pounds of bullion in A A, is lifted from some other receptacle into B in the same manner. The mixture of the two acids in B now represents the volume of acid to be employed for dissolving and settling the next charge of 800 pounds of bullion in A A. In this reservoir, B, the cloud of lead sulphate mentioned above finds an opportunity for settling.

The crystals of silver sulphate are detached from C by an iron shovel and thrown into D. D is a lead lined tank about 4 ft. by 4 ft. and 3 ft. deep. It is divided into two compartments by means of a horizontal, perforated false bottom made of wood. From the lower compartment a lead pipe discharges into the lead lined reservoir, E. Warm distilled water is allowed to percolate the crystals until the usual ammonia test indicates that the copper sulphate has been sufficiently dissolved. Then the outflow is closed, sheets of iron are thrown on and into the crystals, the apparatus is filled with hot distilled water, and steam is moderately admitted into the lower compartment. Ferrous sulphate is formed, and in connection with the iron rapidly reduces the silver sulphate to the metallic state, the reduced silver retaining the heavy compact character of the crystals. When the reaction is completed, as indicated by the chlorine test, the liquid is discharged into E, the iron sheets are removed and the silver is sweetened either in the same vessel, D, or in a special filtering vessel which rests on wheels and may be run directly to the hydraulic press.

The vat, E, is the great reservoir where all liquids holding silver sulphate in solution are collected; for instance, that from sweetening the gold and from washing the tools. Sheets of iron here precipitate all silver and copper, and the resulting solution of ferrous sulphate is, with the usual precautions, discharged into the sewer. Occasionally when copper and silver have accumulated in E in sufficient amount the mass is thrown into D, silver sulphate crystals are added and sheet copper is thrown in, instead of sheet iron. There results a hot, neutral, concentrated solution of copper sulphate, which may be run at once into a crystallizing vat for the separation of commercial crystals of copper sulphate. It will be readily understood, of course, that if there should be any advantage in manufacturing that commercial article, besides the amount prepared as described, which represents merely the copper contained in the bullion, copper sheets may be regularly employed for reducing the silver sulphate in D. The author trusts that the practical refiner will recognize that the manufacture of commercial copper sulphate is thus effected in a more rational and economical manner than by the present method of evaporating from 25° B. to 35° B., and of saturating by oxidized copper, generally in a very incomplete manner, the large amount of free acid left from the refining by the usual process. However, the sale of copper sulphate is but rarely so profitable that a refinery should not gladly dispense with that troublesome and bulky manufacture, especially the government establishments, which, besides, waste much valuable space with the crystallizing vats.

The great saving in sulphuric acid, amounting to about 50 per cent. of the present consumption, has already been pointed out. Another advantage the author merely mentions, namely, the easier condensation of the sulphurous fumes in refineries situated in cities, because the larger amount of acid available for dissolving greatly facilitates working and makes the usual frequent admission of air into the refining pot for the purpose of stirring and testing unnecessary.

The more air is excluded from the refining fumes the easier they can be condensed.

Work may be carried on continuously, the vessels C and D being empty by the time a new solution is finished in A A. Thus, the plant shown in the diagram, covering 26 ft. by 16 ft., allows the refining of 40,000 ounces of fine silver in 24 hours; that is, four charges in A A of 800 pounds each.—*F. Gutzkow, Eng. and Mining J.*

A CASE OF DROWNING, WITH RESUSCITATION.

By F. A. BURRALL, M.D., New York.

AS is usual at this season, casualties from drowning are of frequent occurrence. No class of emergencies is of a more startling character, and I think that a history of the case which I now present offers some peculiar features, and will not be without interest to physicians.

The accident which forms the subject of this paper occurred August 29, 1890, at South Harpswell, Casco Bay, Me., where I was passing my vacation.

At about 9.30 A. M., M. B.—, an American, aged eighteen, the son of a fisherman, a young man of steady habits and a good constitution, with excellent muscular development, and who had never before required the aid of a physician, was seen by the residents of the village to fall forward from a skiff into the water and go down with uplifted hands. I could not learn that he rose at all after the first submersion. Two men were standing near a bluff which overlooked the bay, and after an instant's delay in deciding that an accident had occurred, they ran over an uneven and undulating pasture for a distance of two hundred and fifty paces to the shore. One of them, after a quick decision not to swim out to where the young man had fallen in and dive for him, removed trousers and boots and waded out five yards to a boat, which he drew into the shore and entered with his companion, taking him to a yacht which lay two hundred and forty yards from the shore, in the padlocked cabin of which was a boat hook. The padlock was unfastened, the boat hook taken, and they proceeded by the boat directly to where the young man lay. He was seen through the

clear water, lying at a depth of nine feet at the bottom of the bay, on his back, with upturned face and arms extended from the sides of the body. He was quickly seized by the boat hook, drawn head upward to the surface, and with the inferior portion of the body hanging over the stern of the boat, and the superior supported in the arms of his rescuer, was rowed rapidly to the shore, where he was rolled a few times, and then placed prone upon a tub for further rolling. I was told that much water came from his mouth. Meantime I had been sent for to where I was sitting, one hundred and fifty-one yards from the scene, and I arrived to find him apparently lifeless on the tub, and to be addressed with the remark, "Well, doctor, I suppose we are doing all that can be done."

I have given these details, as from a study of them I was aided in deciding the time of submersion, as well as the intervals which transpired before the intelligent use of remedies. It is also remarkable that, notwithstanding all which has been written about ready remedies for drowning, no one present knew anything about them, although living in a seafaring community.

I immediately directed that the patient should at once be placed upon the ground, which was sloping, and arranged his rubber boots under the back of the head and nape of the neck, so that the head should be slightly elevated and the neck extended, while the head was turned somewhat upon the side, that fluids might drain from the mouth. The day was clear and moderately warm. Respiration had ceased, but no time was lost in commencing artificial respiration. The patient had on a shirt and pantaloons, which were immediately unbuttoned and made loose, and placing myself at his head, I used the Silvester method, because I was more accustomed to it than any other. It seems to me more easy of application than any other, and I have often found it of service in the asphyxia of the newly born.

The patient's surface was cold, there was extensive cyanosis, and his expression was so changed that he was not recognized by his fellow townsmen, but supposed to be a stranger. The eyelids were closed, the pupils contracted, and the inferior maxilla firmly set against the superior. One of the men who had brought him ashore had endeavored to find the heart's impulse by placing his hand upon the chest, but was unable to detect any motion.

I continued the artificial respiration from 9.45 until 10, when I directed one of his rescuers to make pressure upon the ribs, as I brought the arms down upon the chest. This assistance made expiration more complete. When nature resumed the respiratory act I am unable to say, but the artificial breathing was continued in all its details for three-quarters of an hour, and then expiration was aided by pressure on the chest for half an hour longer. Friction upward was also applied to the lower extremities, and the surface became warm about half an hour after the beginning of treatment.

About twenty minutes after ten, two hypodermic syringefuls of brandy were administered, but I did not repeat this, since I think alcohol is likely to increase rather than diminish asphyxia, if given in any considerable quantity. A thermometer, with the mercury shaken down below the scale, at this time did not rise. At 11.8 the pulse was 82; respiration, 27; temperature, 97.

After a natural respiration had commenced, the wet clothing was removed, and the patient was placed in blankets. Ammonia was occasionally applied to the nostrils, since, although respiration had returned, there was no sign of consciousness; the natural respiration was at first attended by the expulsion of frothy fluid from the lips, which gradually diminished, and auscultation revealed the presence of a few pulmonary rales, which also passed away. There were efforts at vomiting, and pallor succeeded cyanosis; there were also clonic contractions of the flexors of the forearm. The pupils dilated slightly at about one hour after beginning treatment. Unconsciousness was still profound, and loud shouting into the ear elicited no response. Mustard sinapisms were applied to the præcordium, and the Faradic current to the spine.

Coffee was also administered by a ready method which, as a systematic procedure, was, I believe, novel when I introduced it to the profession in the *Medical Record*, in 1876. I take the liberty of referring to this, since I think it is now sometimes overlooked. It was described as follows:

"A simple examination which any one can make of his own buccal cavity will show that posterior to the last molar teeth, when the jaws are closed, is an opening bounded by the molars, the body of the superior, and the ramus of the inferior maxilla. If on either side the cheek is held well out from the jaw, a pocket, or gutter, is formed, into which fluids may be poured, and they will pass into the mouth through the opening behind the molars, as well as through the interstices between the teeth. When in the mouth they tend to create a disposition to swallow, and by this method a considerable quantity of liquid may be administered."

After I had worked with the patient in the open air, for four and three-quarter hours, he was carried to a cottage near by and placed, still unconscious, in bed. There had been an alvine evacuation during the time in which he lay in the blankets.

Consciousness began to return in the early part of the following morning, and with its advent it was discovered that the memory of everything which had occurred from half an hour previous to the accident, up to the return of consciousness, had been completely obliterated. With this exception the convalescence was steady and uncomplicated, and of about a week's duration. From a letter which I recently received from my patient, I learned that the lapse of memory still remains.

My experience with this case has taught me that, unless the data have been taken very accurately, we cannot depend upon any statements as to the time of submersion in cases of drowning. My first supposition was that my patient had been from thirteen to fifteen minutes under water, but a careful investigation reduced the supposed time by one-half. This makes the time of submersion about six minutes, and that which elapsed before the intelligent use of remedies about three minutes longer.

For a long time the opinion of Sir Benjamin Brodie concerning the presence of water in the lungs of the

drowned was accepted, who says "that the admission of water into the lungs is prevented by a spasm of the muscles of the glottis cannot, however, be doubted, since we are unable to account for it in any other manner."

Later experiments made by a committee of the Royal Medico-Chirurgical Society, of London, demonstrated, on the contrary, that "in drowned animals not only were all the air passages choked with frothy fluid, more or less bloody, but that both lungs were highly gorged with blood, so that they were heavy, dark colored, and pitted on pressure, and on being cut exuded an abundance of blood-tinged fluid with many air bubbles in it." Dr. R. L. Bowles* also holds that the lungs of the drowned contain water, and supports his views by a list of cases. In his words, "These examples show very conclusively that in cases of drowning in man, water does exist in the lungs, that the water only very gradually and after a long time is effectually expelled, and that it is absolutely impossible that any relief should be afforded in that way by the Silvester method." Dr. Bowles believes that the method of Dr. Marshall Hall is superior to any other in this class of cases. He thinks that on account of the immediate adoption and continued use of the pronolateral position, this method is more to be trusted than any other for keeping the pharynx clear of obstruction. "It also empties the stomach and gradually clears the lungs of the watery and frothy fluids, and will surely and gently introduce sufficient air at each inspiration to take the place of the fluid which has been expelled." In the light of even my limited experience I cannot but feel that Dr. Bowles' opinion concerning the Silvester method would admit of some modification. This is often the case with very positive statements concerning medical matters. In my own case the Silvester method answered well, but I was much impressed with Dr. Bowles' claims for the Marshall Hall method, and should bear them in mind were I called upon to attend another case of drowning.

I think it must be admitted that pulling the tongue forward as a means of opening the glottis, which has become a standard treatment in asphyxia, is unscientific, and not warranted by the results of experiments made to determine its value.†

Dr. Bowles also believes that "the safety of the patient is most perfectly secured by keeping him on one side during the whole treatment, one lung being thus kept quite free." With the account of my case I have brought forward such views of other writers as it seemed to me would be of practical service and throw light on a subject which is of great importance, since the yearly record of mortality from drowning is by no means inconsiderable. I think, however, that a knowledge of what ought to be done in cases of drowning should be much more generally diffused than is the case at present. It should be one of the items of school instruction, since no one can tell when such knowledge may be of immense importance in saving life, and the time lost in securing medical aid would involve a fatal result.

It is also very desirable that all doubt should be removed, by the decision of competent medical authorities, as to which "ready" method or methods are the best, since there are several in the field. With this should be decided what is the best means for securing patency of the air passages, and, in short, a very careful revision of the treatment now recommended for drowning, in order that there may be no doubt as to the course which should be adopted in such a serious emergency.—*Medical Record*.

THE STORY OF THE UNIVERSE.‡

By Dr. WILLIAM HUGGINS.

THE opening meeting of the British Association was held in Park Hall, Cardiff, August 18, where a large and brilliant audience assembled, including, in his richly trimmed official robes, the Marquis of Bute, who this year holds office as mayor of Cardiff. At the commencement of the proceedings Sir Frederick Abel took the chair, but this was only *pro forma*, and in order that he might, after a few complimentary sentences, resign it to the president-elect, Professor Huggins, the eminent astronomer, who at once, amid applause, assumed the presidency and proceeded to deliver the opening address.

Dr. Huggins said that the very remarkable discoveries in our knowledge of the heavens which had taken place during the past thirty years—a period of amazing and ever-increasing activity in all branches of science—had not passed unnoticed in the addresses of successive presidents; still, it seemed to him fitting that he should speak of those newer methods of astronomical research which had led to those discoveries, and which had become possible by the introduction into the observatory, since 1860, of the spectroscopic and the modern photographic plate. Spectroscopic astronomy had become a distinct and acknowledged branch of the science, possessing a large literature of its own, and observatories specially devoted to it. The more recent discovery of the gelatine dry plate had given a further great impetus to this modern side of astronomy, and had opened a pathway into the unknown of which even an enthusiast thirty years ago would scarcely have dared to dream.

HERSCHEL'S THEORY.

It was now some thirty years since the spectroscopic gave us for the first time certain knowledge of the nature of the heavenly bodies, and revealed the fundamental fact that terrestrial matter is not peculiar to the solar system, but is common to all the stars which are visible to us. Professor Rowland had since shown us that if the whole earth were heated to the temperature of the sun, its spectrum would resemble very closely the solar spectrum. In the nebulae, the elder Herschel saw portions of the fiery mist or "shining fluid," out of which the heavens and the earth had been slowly fashioned. For a time this view of the nebulae gave place to that which regarded them as external galaxies—cosmical "sand heaps," too remote to

be resolved into separate stars, though, indeed, in 1858, Mr. Herbert Spencer showed that the observations of nebulae up to that time were really in favor of an evolutionary progress. In 1864 he (the speaker) brought the spectroscopic to bear upon them; the bright lines which flashed upon the eye showed the source of the light to be glowing gas, and so restored these bodies to what is probably their true place, as an early stage of sidereal life. At that early time our knowledge of stellar spectra was small. For this reason partly, and probably also under the undue influence of theological opinions then widely prevalent, he unwisely wrote in his original paper in 1864, that "in these objects we no longer have to do with a special modification of our own type of sun, but find ourselves in presence of objects possessing a distinct and peculiar plan of structure." Two years later, however, in a lecture before this association, he took a truer position. "Our views of the universe," he said, "are undergoing important changes; let us wait for more facts with minds unfettered by any dogmatic theory, and, therefore, free to receive the teaching, whatever it may be, of new observations."

THE NEBULAR HYPOTHESIS.

Let them turn aside for a moment from the nebulae in the sky to the conclusions to which philosophers had been irresistibly led by a consideration of the features of the solar system. We had before us in the sun and planets obviously not a haphazard aggregation of bodies, but a system resting upon a multitude of relations pointing to a common physical cause. From these considerations Kant and Laplace formulated the nebular hypothesis, resting it on gravitation alone, for at that time the science of the conservation of energy was practically unknown. These philosophers showed how, on the supposition that the space now occupied by the solar system was once filled by a vaporous mass, the formation of the sun and planets could be reasonably accounted for. By a totally different method of reasoning, modern science traced the solar system backward step by step to a similar state of things at the beginning. According to Helmholtz, the sun's heat was maintained by the contraction of his mass, at the rate of about 220 feet a year. Whether

DR. WILLIAM HUGGINS, D.C.L., LL.D., PRESIDENT OF THE BRITISH ASSOCIATION.

Dr. Huggins is one of the most eminent astronomers of the present day, and his spectroscopic researches on the celestial bodies have had the most important results. He is a D.C.L. of Oxford, LL.D. of Cambridge, and Ph.D. of Leyden. Dr. Huggins was born in 1824 and educated at the City of London School. He continued his studies, giving much of his time to experiments in natural philosophy and physical science. In 1855 Dr. Huggins erected a private observatory at his residence on Tulse Hill, where he has carried out valuable prismatic researches with the spectroscopic.—*Daily Graphic*.

at the present time the sun was getting hotter or colder we did not certainly know. We could reason back to the time when the sun was sufficiently expanded to fill the whole space occupied by the solar system, and was reduced to a great glowing nebula. Though man's life, the life of the race perhaps, was too short to give us direct evidence of any distinct stages of so august a process, still the probability was great that the nebular hypothesis, especially in the more precise form given to it by Roche, did represent broadly, notwithstanding some difficulties, the succession of events through which the sun and planets had passed.

OTHER SPECULATIONS.

The nebular hypothesis of Laplace required a rotating mass of fluid which at successive epochs became unstable from excess of motion, and left behind rings, or more probably, perhaps, lumps, of matter from the equatorial regions. To some thinkers was suggested a different view of things, according to which it was not necessary to suppose that one part of the system gravitationally supported another. The whole might consist of a congeries of discrete bodies, even if these bodies were the ultimate molecules of matter. The planets might have been formed by the gradual accretion of such discrete bodies. On the view that the material of the condensing solar system consisted of separate particles or masses, we had no longer the fluid pressure which was an essential part of Laplace's theory. Faye, in his theory of evolution from meteorites, had to throw over his fundamental idea of the nebular hypothesis, and formulated instead a different succession of events of which the outer planets were formed last, a theory which had difficulties of its own. Professor George Darwin had recently shown, from an

investigation of the mechanical conditions of a swarm of meteorites, that on certain assumptions a meteoric swarm might behave as a coarse gas, and in this way bring back the fluid pressure exercised by one part of the system on the other, which was required by Laplace's theory. One chief assumption consisted in supposing that such inelastic bodies as meteoric stones might attain the effective elasticity of a high order which was necessary to the theory through the sudden volatilization of a part of their mass at an encounter, by which what was virtually a violent explosive was introduced between the two colliding stones. Professor Darwin was careful to point out that it must necessarily be obscure as to how a small mass of solid matter could take up a very large amount of energy in a small fraction of a second.

HELMHOLTZ'S DISCOVERY.

The old view of the original matter of the nebulae, that it consisted of a "fiery mist,"

"a tumultuous cloud,
Instinct with fire and niter,"

fell at once with the rise of the science of thermodynamics. In 1854, Helmholtz showed that the supposition of an original fiery condition of the nebulous stuff was unnecessary, since in the mutual gravitation of widely separated matter we had a store of potential energy sufficient to generate the high temperature of the sun and stars. We could scarcely go wrong in attributing the light of the nebulae to the conversion of the gravitational energy of shrinkage into molecular motion. The inquisitiveness of the human mind did not allow us to remain content with the interpretation of the present state of the cosmical masses, but suggested the question—

What see'st thou else

In the dark backward and abysm of time?

What was the original state of things? How had it come about that by the side of ageing worlds we had nebulae in a relatively younger stage? Had any of them received their birth from dark suns, which had collided into new life, and so belonged to a second or later generation of the heavenly bodies?

LOOKING BACKWARD.

During the short historic period there was no record of such an event; still it would seem to be only through the collision of dark suns, of which the number must be increasing, that a temporary rejuvenescence of the heavens was possible, and by such ebbs and flowings of stellar life that the inevitable end to which evolution in its apparently uncompensated progress was carrying us could, even for a little, be delayed. We could not refuse to admit as possible such an origin for nebulae. In considering, however, the formation of the existing nebulae we must bear in mind that, in the part of the heavens within our ken, the stars still in the early and middle stages of evolution exceeded greatly in number those which appeared to be in an advanced condition of condensation. Indeed, we found some stars which might be regarded as not far advanced beyond the nebular condition. It might be that the cosmical bodies which were still nebulous owed their later development to some conditions of the part of space where they occurred, such as conceivably a greater original homogeneity, in consequence of which condensation began less early. In other parts of space condensation might have been still further delayed, or even have not yet begun. If light matter were suggested by the spectrum of these nebulae, it might be asked further, as a pure speculation, whether in them we were witnessing possibly a later condensation of the light matter which had been left behind, at least in a relatively greater proportion, after the first growth of worlds into which the heavier matter condensed, though not without some entanglement of the lighter substances. The wide extent and great diffuseness of this bright-line nebulosity over a large part of the constellation of Orion might be regarded, perhaps, as pointing in this direction. The diffuse nebulous matter streaming round the Pleiades might possibly be another instance, though the character of its spectrum had not yet been ascertained.

THE MOTIONS OF THE STARS.

Besides its more direct use in the chemical analysis of the heavenly bodies, the spectroscopic had given to us a great and unexpected power of advance along the lines of the older astronomy. In the future a higher value might, indeed, be placed upon this indirect use of the spectroscopic than upon its chemical revelations. By no direct astronomical methods could motions of approach or of recession of the stars be even detected, much less could they be measured. A body coming directly toward us or going directly from us appeared to stand still. In the case of the stars we could receive no assistance from change of size or of brightness. The stars showed no true disks in our instruments, and the nearest of them was so far off that if it were approaching us at the rate of a hundred miles in a second of time, a whole century of such rapid approach would not do more than increase its brightness by the one-fortieth part. Still it was formerly only too clear that, so long as we were unable to ascertain directly those components of the stars' motions which lay in the line of sight, the speed and direction of the solar motion in space, and many of the great problems of the constitution of the heavens must have remained more or less imperfectly known. Now the spectroscopic had placed in our hands this power, which, though so essential, had previously appeared almost in the nature of things to lie forever beyond our grasp; it enabled us to measure directly, and, under favorable circumstances, to within a mile per second, or even less, the speed of approach or of recession of a heavenly body. This method of observation had the great advantage for the astronomer of being independent of the distance of the moving body, and was, therefore, as applicable and as certain in the case of a body on the extreme confines of the visible universe, so long as it was bright enough, as in the case of a neighboring planet.

ALGOL AND SPICA.

By observations with the Potsdam spectrophotograph, Professor Vogel found that the bright star of Algol pulsated backward and forward in the visual direction in a period corresponding to the known variation of its light. The explanation which had been suggested for

* Resuscitation of the Apparently Drowned, by R. L. Bowles, M.D., F.R.C.P., Medico-Chirurgical Transactions, vol. lxxii., 1889.

† Dragging on the tongue's tip would not affect its base or the epiglottis sufficiently to make it a praiseworthy procedure. Medico-Chirurgical Transactions, vol. lxxii. See also *Medical Record*, April 4, 1891. Pulling out the tongue is a mistake, since irritation of nerves of deglutition stops the diaphragm.—*Medical Times and Gazette*.

‡ Presidential address before the British Association, Cardiff, 1891.