back as far as these very early stages of life on our planet to apply those lines of Tennyson :—

"So careful of the type she seems,
So careless of the single life."

We have arrived, then, at a condition in which the same material may be worked up over and over again; in this way ultimately higher forms might be produced. Now, if to this dissolution, as a means of giving us new material, we add reproduction, then we can go a stage very much further. If we take bi-partition, which was the first method of multiplication, as we know both in the vegetable and animal world, we have a multiplication of forms by halving instead of the inorganic multiplication of forms by doubling, then we can have a very much increased rate of advance.

These then, roughly, are the conclusions as to an organic evolution which are suggested by the stellar evidence as to inorganic evolution, and the collocation of the simplest forms noted in the hottest stars.

Let us turn finally to the facts. Biologists, as I have said before, are very much more happy than astronomers and chemists, because they can see their units. A chemist professes to believe in nothing which he does not get in a bottle, although I have never yet seen the chemist who was ever happy enough to bottle an atom or a molecule as such ; but the superstition still remains with them, and they profess to believe in nothing that they cannot see. Now, the organic cell is the unit of the biologist, which is itself a congeries of subordinate entities, as a molecule is made up of its elementary atoms, manifesting the properties common to living matter in all its forms.

The characteristic general feature of the vegetable activity of the plant forms is their feeding upon gases and liquids, including sea-water. The progress of research greatly strengthens the view that there was a common life plasm, out of which both the vegetable and the animal kingdoms have developed. Be that as it may, you see the vegetable grows upon these chemical forms to which I have referred, and the animal feeds either upon the plant or upon other animals which have in their turn fed upon plants ; so that there we get the real chemical structure of the protoplasm, of the real life unit, in our organic evolution.

The last question, then, that I have to touch upon is this. Is there any chemical relation between the chemical composition of the organic cell and the reversing layers of the hottest stars—the reversing layer being that part of a star's anatomy by which we define the different genera?

When we come to consider the chemical composition of this cell we find it consists of one or more forms of a complex compound of carbon, hydrogen, oxygen, nitrogen, with water, called protein ; and protoplasm, of which you have all heard, the common basis of vegetable and animal life, is thus composed. This substance is liable to waste and disintegration by oxidation, and there may be a concomitant reintegration of it by the assimilation of new matter.

The marvellous molecular complexity of the so-called simple cell may be gathered from the following formulæ for hæmoglobin :

Man ...	C 600	H 960	N 154	Fe 1	S 3	O 179
Horse ...	C 712	H 1130	N 214	Fe 1	S 2	O 245.[1]

Various different percentage compositions have been given of this protoplasm, but I really need not refer you to them. It is more important to consider the other chemical substances which go to form it, for there are others beside which it is of interest to study from our stellar point of view. I quote from Mr. Sheridan Lea.[2]

[1] "Verworn," p. 104.
[2] "The Chemical Bases of the Animal Body," p. 5.

"Proteids ordinarily leave on ignition a variable quantity of ash. In the case of egg-albumin the principal constituents of the ash are CHLORIDES of SODIUM and potassium, the latter exceeding the former in amount. The remainder consists of SODIUM and potassium, in combination with phosphoric, sulphuric and CARBONIC acids, and very small quantities of CALCIUM, MAGNESIUM and iron, in union with the same acids. There may be also a trace of SILICA."

My point is that the more one inquires into the chemistry of these things the more we come back to our stellar point of view and to the fact that, taking the simplicity of chemical form as determined by the appearance of these different chemical substances in the hottest stars as opposed to the cooler ones, and in relation to the "series" of spectra which they produce, we come to the conclusion that the first organic life was an interaction somehow or other between the undoubted earliest chemical forms. Not only have we hydrogen, oxygen and nitrogen among the gases common to the organic cell and the hottest stars, but those substances in addition which I have indicated by capitals.

Surely we have here, I think, thanks to some of the recent advances made by spectrum analysis, a quite new bond between man and the stars.

We shall consider in the next lecture the simplicity of chemical forms as evidenced, not by atomic weight, but by the study of spectrum-series, to which I have already made two or three references.

THE BERLIN TUBERCULOSIS CONGRESS (1899).

THE Congress, which has just brought its proceedings to a close, was not, as has been frequently stated in the medical and lay press, an International Congress ; it was a German Congress to which foreign delegates and communications were invited. The mass of communications were made in German, this being the official language of the Congress ; a few, some half-dozen, in English and French. The necessity, or at any rate advisability, of discoursing in German, may account for the very meagre manner in which English medicine was represented either privately or officially. It seemed somewhat anomalous that the staff of only one London consumption hospital (the North London) was represented at the Congress. Further, the English doctors practising at foreign health resorts, who probably have unrivalled opportunities for observing the different phases of consumption, and the influence of treatment upon them amongst better class patients, were for the most part conspicuous by their absence. This nonchalance is to be regretted, especially as the hygienic treatment of phthisis, a relatively, at any rate in its systematic form, new development, occupied some 50 per cent. of the whole time of the Congress.

The enormous amount of material at the disposal of the Committee was classified in two ways. All papers were in the first instance denominated as lectures ("Referate"), or discussion communications. For the former twenty minutes was allowed, for the latter ten. The subject-matter was divided into five Sections. I. Extent and Spread of Tuberculosis. II. Aetiology. III. Prophylaxis. IV. Treatment. V. Sanatorium Treatment.

Section I.—Dr. Bollingen (Munich) read a paper upon tuberculosis amongst domestic animals, and its relationship to tubercular disease in man. Amongst many important points, the lecturer emphasised the importance of milk as a source of tubercular infection to men, directly and indirectly. Indirectly in the sense that tuberculosis is very common amongst pigs, who get infected in considerable numbers from being fed with the milk of tuberculous cows. Dr. Krieger (Strassburg) discussed the re-

lationship of external surroundings to the spread of tubercular disease. The author pointed out the unsatisfactory nature of statistics upon this subject, owing to the complexity of apparently simple factors. Constant attendance upon phthisical patients in badly ventilated rooms, and certain occupations giving rise to irritation of respiratory tract from dust, metallic or otherwise, were however, according to the lecturer, potent factors in the spread of tuberculosis. Papers followed upon tubercular disease among various employés, notably knife and sword makers, bookbinders, compositors, and cigar makers.

Section II.—Aetiology.—This Section was opened by Prof. Flügge (Breslau), who read a well-appreciated paper upon the relation of the tubercle bacillus to tuberculosis. Recent work has not in this connection modified to any extent the dicta originally enunciated by Koch. The tubercle bacillus is the immediate cause of tuberculosis, and arises in practically all cases from a tuberculous animal. Its parasitic nature is obligatory, *i.e.* except in the case of artificial cultures the bacillus cannot develop outside the animal organism. By means of artificial cultures it is possible to modify the tubercle bacillus in certain ways, notably with regard to its morphological character, and its virulence. Prof. C. Fränkel (Halle) discoursed eloquently upon the nature and *modus operandi* of tubercular infection. He pointed out that outside the animal body tubercle bacilli die in from six to seven months, the important factors in killing them being light, and the fact that they lose their water by evaporation, and with it their life. As a result of this it is, as a rule, only the immediate neighbourhood of the patient, from 1 to 1½ metre, that is infective. Infection usually takes place through the infected person inhaling fresh and moist tubercle bacilli which ("infected drops") have been ejected usually during a coughing fit, also by the inhalation of dust contaminated with dried sputum. He further pointed out that man was relatively unsusceptible to tubercular infection, and that, as a rule, it was only by repeated and continued inhalation, &c., of tubercle bacilli that infection occurred.

A subject of great interest to physicians was considered at some length by Prof. Pfeiffer (Berlin), viz. "mixed infection." Consumption, as we know it, is rarely due simply to the tubercle bacillus, but to the superadded action of other infective organisms. As many as twenty-four different varieties of bacilli have been obtained from the sputum of a phthisical patient. An important practical point brought out by the lecturer was that cases of mixed infection ought to be recognised in consumptive hospitals, and isolated, as they may be a source of danger to phthisical patients; that is, these latter may get a mixed infection superadded to their other troubles. Prof. Löffler read a short paper upon heredity, immunity and disposition in their relation to tuberculosis. Hereditary tuberculosis in the sense, for instance, of congenital syphilis, is unknown. In this disease hereditary influences probably play a relatively small part as such. Tuberculosis occurs in members of the same family, mostly because by living together the members infect each other. Prof. Löffler quoted one family as an instance of this. The father and mother, two daughters and seven sons, all died of phthisis. The family consisted of fifty-eight other members, not one of whom was tuberculous. The infection was entirely confined to the members of the family living together. The lecturer emphasised the fact that no natural immunity to tuberculosis exists. Dr. von Zander gave some aetiological statistics of tuberculosis. Out of 312 cases investigated, 116 were communicated from man to man; amongst these infection between sisters occurred the most often.

Section III.—Prophylaxis.—Dr. Roth (Potsdam) discussed certain rules for the prevention of tubercular infection. These mostly consisted of measures directed to the disposal of the sputum, and the use of a cloth in front of the mouth during coughing fits, to limit the area of "infective drop" dispersion. Prof. v. Leube (Wurzburg) considered the prophylactive methods against tuberculosis in hospitals. If measures such as those mentioned above are thoroughly carried out, tubercular patients need not be isolated from the general hospital inmates. Care should be taken by attendants and nurses especially in dusting rooms, when it would be advisable for them to have their mouth and nose protected by a mask.

All members of the Congress listened most attentively to a short paper, by Prof. Virchow, upon the prevention of tuberculosis in so far as concerns food. Prof. Virchow considered four articles of diet: (1) beef, (2) pork, (3) poultry, (4) milk. Of these he regarded milk as far the most important. He advised a more careful and systematic exclusion (under central control) of tubercular meat and cattle, and the rejection of milk from all cows which reacted to the tuberculin list. Even these measures the author described as palliative, the only curative measure being the killing of all animals that reacted to the tubercular list. In this connection, Dr. Schumburg (Hannover) gave the result of his researches as to whether ordinary butcher's meat contained tubercle bacilli. The result of twenty-four inoculations (intra-peritoneal) of guinea-pigs with the juice of twelve different meat samples, was that two animals died of purulent peritonitis, two greatly diminished in weight, the remaining twenty remained well. Dr. Baer (Berlin) discussed the much-vexed question of alcohol and tuberculosis. He concludes, upon apparently very insufficient grounds, that alcohol in the consumptive sanatoria should only be used as medicine under the most urgent circumstances. Dr. Ritter read a paper upon the protection of children from tuberculosis. An interesting communication upon the diminution in the total death-rate from consumption due to modern methods of treatment was made by Dr. Julius Lehmann (Copenhagen). Dr. Kuno Obermüller discussed some interesting investigations upon the presence of the tubercle bacillus in ordinary market milk and butter. He centrifugalised the milk, and injected less than ·5 cc. of the sediment into the peritoneal cavity of guinea-pigs. The milk was taken from a dairy which supplies Berlin with 80,000 litres daily. The result was that 30 per cent. of the injected animals died in from eleven to thirteen weeks of tuberculosis. The milk used was the best and most costly infant milk. According to the author, Berlin butter is also largely infected with virulent tubercle bacilli, which are quite distinct from the so-called butter bacillus. Dr. Hambleton, President of the Polytechnic Physical Development Society, was the author of a communication on the prevention of pulmonary tuberculosis. One of the most potent factors to this end is, according to the author, chest development, and he took this opportunity of bringing before the notice of the Congress the work of the Society in this direction. This method had, according to the author, been most successful in preventing and even arresting tuberculosis among the employés of trades having an injurious effect upon the respiratory organs.

F. W. TUNNICLIFFE.

THE JUBILEE OF SIR GEORGE GABRIEL STOKES.

THE celebrations in connection with the jubilee of Sir George Gabriel Stokes, who has occupied the Lucasian Chair of Mathematics at Cambridge University since 1849, begin this afternoon (Thursday) with the delivery by Prof. Cornu, of the École Polytechnique, Paris, of the Rede Lecture. Prof. Cornu has chosen as his subject, "The Wave Theory of Light and its Influence on Moder Physics."