Thus, helium must be placed before lithium, and argon before potassium, as is seen from the table, into which radium has also been introduced. In this table there are, in the group zero, two unknown elements, x and y, which have been introduced for two reasons: first, because in the corona of the sun, above the region of incandescent hydrogen, there has been noticed an element which has an independent spectrum, and therefore is named coronium; and although it is yet unknown (helium was also first characterised by Crookes as an element, on account of the independence of its spectrum), it must have a density, and consequently an atomic weight, both smaller than those of hydrogen (in the table, this element is marked as y); and secondly, because there is no reason to believe that the system of elements is limited in the direction of the lightest ones by hydrogen. The presence of the elements x and y in the group zero makes us think that the elements which correspond to these positions in the system will be distinguished by the absence, in a high degree, of the capacity of chemical combination—a property which belongs also, as has been already pointed out, to helium, argon, and their analogues.

"The same property must be attributed to the substance of the ether, which must possess, moreover, an extremely low density, and consequently a very great rapidity of motion of its molecules, in order to have the possibility of escaping from the spheres of attraction, not only from the atmosphere of the earth, but also from the atmospheres of our sun and other suns the masses of which are greater than that of ours. The researches concerning the double stars prove that the masses of the stars which we know do not exceed the mass of our sun more than thirty-two times, while in other cases they are equal to it; therefore, if we attribute to the ether the properties of gases, we must admit, on the basis of the kinetic theory of gases, that its specific gravity must be very much smaller than the specific gravity of hydrogen. In order that the ether may escape from the sphere of attraction of stars the mass of which is fifty times greater than the mass of the sun, it must, while it chemically resembles argon and helium, have an atomic weight not more than 0·000 000 000 053 (and a density, in relation to hydrogen, half as large, as I have proved in the above mentioned article on ether). The very small value of this figure already explains why there is little hope of isolating the substance of the ether in the near future, as it also explains why it penetrates all substances, and why it is condensed in a small degree, or collects in a physicomechanical way, round ponderable substances—being mostly condensed round such immense masses as that of the sun or of stars.[1]"

Row	Group zero	Group I.	Group II.	Group III.	Group IV.	Group V.	Group VI.	Group VII	Group VIII.
0	x								
1	y	H=1·008							
2	He=4·0	Li=7·03	Be=9·1	B=11·0	C=12·0	N=14·04	O=16·0	F=19·0	
3	Ne=19·9	Na=23·05	Mg=24·1	Al=27·0	Si=28·4	P=31·0	S=32·06	Cl=35·45	
4	Ar=38	K=39·1	Ca=40·1	Sc=44·1	Ti=48·1	V=51·4	Cr=52·1	Mn=55·0	Fe=55·9 Co=59 Ni=59 (Cu)
5		Cu=63·6	Zn=65·4	Ga=70·0	Ge=72·3	As=75·0	Se=79	Br=79·95	
6	Kr=81·8	Rb=85·4	Sr=87·6	Y=89·0	Zr=90·6	Nb=94·0	Mo=96·0	—	Ru=101·7 Rh=103·0 Pd=106·5 (Ag)
7		Ag=107·9	Cd=112·4	In=114·0	Sn=119·0	Sb=120·0	Te=127	I=127	
8	Xe=128	Cs=132·9	Ba=137·4	La=139	Ce=140	—	—	—	— — — (—)
9		—	—	—	—	—	—	—	
10	—	—	—	Yb=173	—	Ta=183	W=184	—	Os=191 Ir=193 Pt=194·9 (Au)
11		Au=197·2	Hg=200·0	Tl=204·1	Pb=206·9	Bi=208	—	—	
12	—	—	Rd=224	—	Th=232	—	U=239	—	

In conclusion, Mendeléeff indicates that while the conception of the chemical elements is connected in the most intimate way with the generally received teachings of Galileo and Newton about the mass and the ponderability of matter, as also with the teaching of Lavoisier concerning the indestructibility of matter, "the conception of the ether originates exclusively from the study of phenomena and the need of reducing them to simpler conceptions. Amongst such conceptions we held for a long time the conception of imponderable substances (such as phlogiston, luminous matter, the substance of the positive and negative electricity, heat, &c.), but gradually this has disappeared, and now we can say with certainty that the luminiferous ether, if it be real, is ponderable, although it cannot be weighed, just as air cannot be weighed in air, or water in water. We cannot exclude the ether from any space; it is everywhere and penetrates everything, owing to its extreme lightness and the rapidity of motion of its molecules. Therefore such conceptions as that of the ether remain abstract, or conceptions of the intellect, like the one which also leads us to the very teaching about a limited number of chemical elements out of which all substances in nature are composed."

[1] "It is worth noting that all the incandescent, self-luminous celestial bodies are immense as regards their masses, in comparison with the cooler bodies like the earth or the moon; perhaps this depends upon the distribution of the ether, which is condensed precisely round such very big masses as the sun and the stars. It is also worth noticing that the atomic weights of radium, as also of thorium and uranium, are very great in comparison with those of the other elements."

WELSH CONFERENCE ON THE TRAINING OF TEACHERS.

THE Welsh National Conference on the Training of Teachers was held in Shrewsbury on November 10 and 11, and although no special reference was made to science teaching, still the subject of education is now in a fair way to be considered a science, since it has been included as a section of the British Association.

The conference was convened by the Central Welsh Board and the University of Wales, and in addition to these bodies, representatives attended from every county education authority in Wales, from every type of educational institution, from the National Executive of Welsh Councils and from all the associations of masters and mistresses. Upwards of 200 delegates attended in all, most of whom remained throughout all four sessions.

At the first session, which was devoted to "The Special Aspect of the Problem of Training Presented in Wales,"

Principal Griffiths, vice-chancellor of the University of Wales, presided, and in his opening address submitted the points which it was most important that the conference should decide. Briefly they were these: What were the real demands of the Principality, and how far were they met by existing institutions? Was Wales to import the shortage of teachers, or to increase her own production? In what manner could the schools be best utilised as training grounds without injuring the schools? and should local education authorities undertake the training of secondary teachers? To these questions no uncertain answer was suggested, although the conference abstained from passing formal resolutions until an opportunity had been accorded the members to consider the verbatim report, which it was decided to publish at an early date.

At the second session Mr. Lloyd George, M.P., presided, and a paper was read by Lord Stanley of Alderley, chairman of the Anglesea Education Committee, and late chairman of the London School Board, on "The Point of View of the Local Authorities." The debate was opened by Mr. S. J. Hughes, county alderman of Glamorganshire. Both Lord Stanley and Alderman Hughes emphasised the paramount importance of training for the elementary school teacher. In summing up the debate, Mr. Lloyd George replaced the sword by the trowel, and emphasised the need for additional accommodation and for subsidising the buildings and the staffs. Enthusiasm was required, he said, to meet the increased burden on the rates, but he believed that the enthusiasm would be forthcoming. At this stage the only resolution of the conference was passed. This was moved by Principal Griffiths, and asserted "That it is the duty of the Principality to undertake the training and supply of teachers sufficient to meet the requirements of the Principality."

At the third session, which was presided over by Sir John Gorst, "The Special Aspects of the Problem of the Training of Elementary Teachers" was considered, a paper being read by Mr. T. John, vice-president of the National Union of Teachers. The experiments already being tried in the utilisation of the intermediate schools of Wales for the training of pupil teachers were described in detail, but the general opinion of the conference was unmistakable—that any half-time system should be a temporary expedient only.

As regards the question of the concurrent instruction of primary and secondary teachers, it was agreed that it is necessary for the separation of the primary teacher's professional training from his general education, and that under certain conditions it is possible and desirable that primary and secondary students should be trained together. The important question of the further training of those acting teachers whose qualifications are incomplete was introduced by Mr. Badger, director of higher education for Monmouthshire.

The relations between the various qualifying examinations were considered, and there was practical unanimity that matriculation should be a condition of entering the primary training departments of the three university colleges of Wales.

Mr. Humphreys Owen, M.P., chairman of the Central Welsh Board, presided over the fourth session, which was devoted to the "Special Aspects of the Problem of Secondary Training." Two papers were read, by Miss E. P. Hughes, late principal of the Cambridge Training College for Secondary Teachers, and Mr. Trevor Owen, Swansea, who acted as the official spokesman of the Association of Welsh County Schoolmasters. The conference was decidedly of opinion that secondary training should be post-graduate and completely differentiated from the degree course, but that the training college should be essentially attached to the university college. Representatives of the Association of Assistant Masters also addressed the conference and endorsed the views expressed by the readers of the papers.

There can be no doubt that the ultimate result of the conference will be far-reaching and beneficial. The interchange of ideas always makes for good, and it is not too much to hope that from the deliberations there may be devised a scheme which will be workable for all parts of the Principality, and will in time produce a supply of fully trained teachers of all grades, which, like her system of secondary education already established, will be a lasting and tangible proof of the enthusiasm of the Welsh people for education.

THERAPEUTIC BACTERIAL INOCULATION.[1]

ALTHOUGH the majority of diseases are produced directly or indirectly by the invasion of microbes, it has come to be generally recognised that the soil in which they grow plays a cardinal part in determining the ultimate effect or fate of the microbe. The finding of a pathogenic microbe, and even the accessory disposing factors of a disease, are, however, after all only the beginnings of the greater problem which is the end and aim of all medical science, viz. the cure of the disease.

To attack the causal agent is manifestly a solution of the problem, and this was the method originally advocated by Lister, who may be regarded as the founder of the doctrine of the ætiological curative principle. Experience has, however, shown that the attempt to destroy by means of ordinary chemical poisons the microbes in the living body is fraught with danger, for long before the protoplasm of the microbe is destroyed the cells of the body are irreparably damaged. Internal antiseptic therapy is a thing of the past. To-day we must rely on the stimulus produced by bacteria in the body whereby the cells of the latter elaborate substances which are antagonistic to these same bacteria. These substances—germicidal in the widest sense of the word—differ considerably in their mode of action. Some neutralise the bacterial poisons, others produce a solution —a lysis—of the bacteria. In other cases, again, Metchnikoff claims that the destruction takes place by a kind of digestion in the interior of certain cells of which the chief representatives are the wandering corpuscles of the blood.

The inoculation of a living microbe for the purposes of prophylaxis dates from the time of Edward Jenner, whose work was widely extended by Pasteur. It is not even necessary to use living bacteria, dead bacteria being likewise capable of conferring immunity. In any case, with the exception of diphtheria antitoxin, previous attempts have aimed at prevention rather than cure. The authors of the papers before us are the first who have utilised bacterial inoculations as a curative agent. Dr. A. E. Wright, late professor in the Army Medical School, is already widely known for his method of the preventive inoculation against typhoid fever—a method which is admitted to have led to a marked diminution of this disease in the British Army. His most important work, however, has been the discovery of therapeutic inoculation. To introduce bacteria into an individual already infected with the same bacteria would at first sight appear to be a paradox, but the results obtained justify the means. By the invention of accurate methods of testing the effects produced in the body by the inoculations, Dr. Wright has been able to demonstrate that the elaboration of protective substances follows a general law, characterised at first by a negative phase and followed by a positive phase in which the protective substances in the blood are increased in quantity.

In a series of papers he has likewise shown that in so-called phagocytosis there is really a cooperation of the cells and fluids of the body, and that in the latter there are substances—opsonins—which in some way or other act upon the microbes and prepare them for subsequent destruction by the leucocytes. This opsonic type of immunity is applicable to a number of diseases, but the present researches show that the mere presence of these opsonins is not sufficient to induce immunity. They must be in the proper place and at the required time if they are to exert their action, and a great deal of art is required on the part of the inoculator to create the most advantageous conditions for his patient. The methods advocated by Prof. Wright are so new that it is difficult to foresee how far they may go, but the striking curative results obtained justify one in prophesying that the time is not so very far distant when the abilities of the physician will be judged by his successes as an immunisator, for it must not be imagined that

[1] "On the Action exerted upon the *Staphylococcus pyogenes* by the Human Blood Fluids, and on the Elaboration of Protective Elements in the Human Organism in response to Inoculations of a Staphylococcus Vaccine." By Dr. A. E. Wright and Capt. Stewart R. Douglas, I.M.S. (*Proc.* Roy. Soc., September, 1904).

"On the Action exerted upon the Tubercle Bacillus by the Human Blood Fluids, and on the Elaboration of Protective Elements in the Human Organism in response to Inoculations of a Tubercle Vaccine." By the same Authors (*Proc.* Roy. Soc., September, 1904).