the cause can only be definitely proven by bacteriological examination.

Once established in any locality, the spread of the disease is practically uncontrollable. Experiments have shown that infection can be water-borne or carried in food, and that the presence of fish that have died from the disease may be a serious source of infection. The disease is not brought in from the sea, and migratory fish may be infected in the fresh water sooner or later after they have left the sea; the fish appear to be highly susceptible when they first enter fresh water.

The most dangerous source for the spread of the disease is the occurrence of 'carriers' in which the bacilli are present in small numbers only and are located in the kidneys. Such fish may live apparently unharmed for a considerable time but generally fall victims themselves in the end, not without, however, infecting other members of the community before their death. It has been found that wounds and scratches render fish especially liable to infection.

It is probable that the disease has been spread over so large an area by the practice of stocking rivers with eggs and fry from other localities and from fish farms. It has now been shown that the eggs can be sterilised with dilute solutions of acriflavine.

Experiments and observations in Nature show that the outbreaks of the disease are controlled by temperature conditions, a temperature within a range of about 55°–66° F. apparently being necessary for its spread and development when the fish are healthy: cases have been reported of the occurrence of the disease at lower temperatures among fish in poor condition after spawning. Overcrowding is a further predisposing cause for outbreaks, and it is noticeable that where barriers occur to cause the congregation of fish awaiting flood water the disease is prevalent; where possible, therefore, such difficulties in the paths of the fish on their upstream migrations should be removed. The reporting of suspected outbreaks as soon as possible is of the utmost importance, as is also the quick removal of all dead infected fish.

Of even greater importance at this stage is the necessity for the passing of legislation whereby action may be taken to reduce risk of further dissemination to a minimum. In December 1929 an interim report was submitted in which a system of control was urged so that importation of live fish might be controlled and notification of outbreaks of disease made compulsory, and that there might also be power of control both over fish farms and over open rivers declared to be infected. It is to be hoped that the necessity for such action in the near future will receive serious consideration before the plague has assumed such alarming proportions as has been allowed with the musk-rat. It is, however, evident that one of the main difficulties in controlling the disease is that the symptoms are not always obvious and that identification necessitates sending the corpses to bacteriological laboratories for examination, and furthermore, that they should arrive before decomposition has set in.

A New Experimental Phonetics Laboratory

WITH the advent of the talking film, the recording of speech has recently received considerable attention, but, as at the time of the invention of the phonograph, more interest is shown in commercial circles in the entertainment possibilities of the new electrical methods of speech recording and reproduction. In experimental phonetics the older mechanical methods still predominate. At Armstrong College, Newcastle-upon-Tyne, with the support of Prof. W. E. Curtis and Prof. W. L. Renwick, an investigation was undertaken by Mr. R. O. L. Curry, Noble Memorial Scholar, of the available methods of speech-recording, with the object of seeing how far these were suitable for classifying speech sounds, particularly those of local dialects. The work of making and testing different types of apparatus has been so successful that the Council of the College, mindful of the importance of the investigation, has granted space in a newly-acquired building for a phonetics laboratory to house the apparatus, and in which records may be taken under conditions free from noise and vibration.

The laboratory looks out upon an empty court, and the windows on this side are sealed and provided with dark blinds. The floor is of concrete and the partition walls are 1 ft. thick, so that it was thought unnecessary to introduce sound-insulating material except on the door, which is faced on the inside with a layer of Newall's Asbestos Blanket. A ventilating shaft in the thickness of the wall leads out to the roof at a point sheltered from street noise. To make doubly sure that no 'ground noise' shall reach the recording apparatus, the microphones are placed in a double-walled insulated kiosk of the telephone-cabinet type. There is also provision for the development of photographic plates.

The recording devices which are at present available in the laboratory are as follows:

(1) A kymograph, namely, an instrument in which the pressure variations which occur in the mouth, nose and throat during speech can be severally communicated to membranes provided with styles which make traces on a revolving drum. Owing to the damping and distortion introduced by the recording mechanism, this instrument is useless for obtaining exact traces of speech sounds, but is fully satisfactory for recording the relative time intervals involved in speech sounds, and for determining the relative extent to which different parts of the vocal apparatus contribute to the sound, as, for example, in the nasalisation of a vowel or a consonant.

(2) An Einthoven string galvanometer, which while capable of giving accurate traces of vowel sounds, is too heavily damped with regard to frequencies above 6,000 cycles/sec. to record correctly the fricative high-pitched sounds associated with many of the continuant consonants. This is, in fact, the principle of the apparatus by which most talking-films are made.

(3) A cathode ray tube. This is the most effective instrument of all, and is capable of delineating the wave-form at all frequencies to which the microphones are able to respond. For visual examination of vowel sounds a 'sweep circuit' is used, which allows of a single wave-pattern being 'held' on the screen; otherwise a moving film camera is used, capable of taking photographic records of the to-and-fro motion of the spot on the fluorescent screen at 6 ft./sec., a rate which permits of the recording of the high frequency stopping and starting noises that are characteristic of the consonants.

(4) There is also an electric gramophone recorder for making dialect gramophone records, and a jet-tone apparatus for studying the action of the vocal organs in speech.

The first work of the laboratory, which is under the joint supervision of Mr. H. Orton, of the English Department, and Dr. E. G. Richardson, of the Physics Department, will be to obtain definitive pictures of the standard English speech sounds. This work is, in fact, almost completed. Records of dialect speakers will then be taken for the purpose of the main object of the laboratory, which is the comparative philology of the region in which the University of Durham lies. In this connexion, room is provided elsewhere in the College for card indexes of local variants in pronunciation.

For the benefit of others who may be intending to take up similar work, it may be mentioned that the cost of the equipment of a laboratory such as this is quite moderate. Excluding the string galvanometer (which is not essential), the whole of the equipment has cost less than fifty pounds, although it is true that this does not include the cost of the labour of assembling the apparatus.

Chemical Society's Mendeléeff Commemoration

THE centenary of the birth of Mendeléeff was commemorated by the Chemical Society on April 19, when Lord Rutherford delivered an address at the Royal Institution on "The Periodic Law and its Interpretation".

About the period 1860–70, accurate atomic weights and chemical data were available for the known elements, and the time was ripe for some connecting generalisation. The conception of a periodicity in properties when the elements are arranged in the order of their atomic weights was advanced tentatively by Newlands in 1864. Mendeléeff was the first, in 1869, to enunciate the law clearly, to perceive its utility in correlating and even correcting the recorded chemical properties of the elements, and to make from it predictions which might be verified by later investigation.

Mendeleéff's first table, published in 1871, bears a remarkable resemblance to that of the present day. He perceived the true place of the transition elements in the scheme, and did not hesitate to reverse the apparently discordant order of iodine and tellurium. Where his table demanded the presence of then unknown elements, he ventured to predict their properties, his prophecies being strikingly fulfilled by the subsequent discovery of scandium, gallium and germanium.

The discovery of argon and its congeners by Ramsay, at the close of the century, led not to an alteration, but to a widening of Mendeléeff's scheme, the inert gases falling naturally into a group of zero valency and forming a transition between the halogens and the alkali metals. During this period, the Periodic Law lacked any theoretical background which might lead to its interpretation. Sir J. J. Thomson's recognition of the electron as a constituent of all atoms of matter, in 1897, first led to the conception of the electrical structure of matter.

Lord Rutherford himself has been intimately connected with much of the subsequent development in this field. From consideration of the scattering of α-particles by heavy atoms, he was led to the nuclear theory of the atom, according to which the mass of the atom is concentrated in a minute, positively charged nucleus, the charge on which is proportional to the atomic weight of the atom. The conception that the nuclear charge and ordinal number of an element might be the same was applied by Bohr in his theory of spectra. It was brilliantly verified by Moseley's work on the X-ray spectra of the elements, which fixed the true order of the elements, and showed that only 92 exist from hydrogen to uranium. Of these, only one—No. 85—still awaits discovery.

The recognition of atomic number rather than atomic weight as defining the properties of the elements cleared away the apparent discrepancies in Mendeléeff's table. It has been found that most of the elements are actually complex, consisting of isotopes having the same nuclear charge but different masses. The chemical properties of isotopes, depending on nuclear charge, are identical: properties depending on mass may differ sufficiently to render separation possible, as is the case with hydrogen and lithium.

The explanation of the Periodic Law must lie in the arrangement of the outer electrons. Bohr's conception of quantised planetary orbits has been developed by the new wave mechanics to give a complete picture of atomic properties. The rare gases have highly symmetrical, tightly bound configurations. Addition of successive electrons leads to the occupation of the next group of orbits, and runs parallel to the observed chemical properties of the elements. A periodic pattern is thereby obtained, repeating after each inert gas, in which the transition elements and rare earths find a natural place. About the structure of atomic nuclei, little is yet known: the recognition of any periodicity with increasing nuclear charge awaits the discovery of the future.

Increase in Temperature due to Solar Radiation

PROFESSIONAL NOTE No. 63 of the Meteorological Office, the title of which is "Maximum Day Temperatures and the Tephigram", by Lieut.-Col. E. Gold, is a discussion of the problem of estimating the probable rise of temperature in the course of a single day during clear weather on account of the solar radiation, with the aid of the 'tephigram' of Sir Napier Shaw.

In the 'tephigram' the rectangular co-ordinates are temperature and entropy, and any closed area, corresponding with a cycle of changes of a portion of the atmosphere, represents a definite amount of energy. Isothermal lines and dry adiabatics are represented respectively by vertical and horizontal lines, and moist adiabatics, corresponding with saturated air that is rising and expanding, and is in consequence having its entropy increased by the energy released by condensation of water vapour, are represented by sloping lines that become more nearly horizontal at low temperatures owing to the diminished capacity of air for water vapour at such temperatures. This form of diagram is in use in the