A similar investigation transecting the junction between grassy scrub and a strip of forest following a water-course showed a significant and high population of mites in the narrow intermediate belt of dense vegetation between open scrub and forest. Such ecotones have repeatedly been associated with scrub typhus: we have been calling them 'fringe-habitats', and including hedgerows as a special case within this category.

The seasonal changes in vegetation were found to be considerable, to be related to seasonal variations in behaviour and population of the rats, and to be very intricate. Even so, some useful light was thrown on this complex picture by a study of the infestation of the rats, although the following discussion is intended to suggest ways in which this can be done and not to present a picture of what was actually happening in the Imphal area, where our investigations were very greatly limited and, in ignorance, not properly designed to this end.

T. deliensis, like *T. akamushi*, is a seasonal mite, in that the larvæ become very scanty during the dry season, whereas they appear in great numbers shortly after the onset of the rains. The 1945-46 inter-monsoon period in Imphal was unusually dry; but even so, at its height larvæ of *T. deliensis* could always be recovered from foci on seepages or by perennial streams which were kept moist by ground water, while they had almost completely disappeared from exposed dry sites. At such a time, it is possible to use this species in selected areas as an index of the host behaviour in relation to water-points, as well as an indicator of the behaviour of the hosts during the different seasons. This, however, needs very extensive collections: only one application appears to be worth while with the Imphal material, and that is to group the rats according to intensity of infestation (0, 0-10, 10-50, 50-100, 100-200, and more than 200 mites per rat), and to study the frequency of distribution of the rats within these groups month by month, in conjunction with the rate and average intensity of infestation. As this can be done only with pure cultures of the species, *T. deliensis*, being investigated, it is clear that we are dealing with a selected sample of rats exposed on fairly uncontaminated '*deliensis* islands'. This study shows that with the first flood of larvæ which appeared after the rains broke in May 1945 there was a very high rate of infestation (more than 70 per cent) but a relatively low intensity, most of the rats being in the 10-50 mites-per-rat group. Two or three months later, there was a distinct shift in distribution from the low-intensity groups to the highest. At the height of the following dry season, the rate of infestation fell from more than 60 per cent to less than 10 per cent, and particularly the lowest and the highest intensity groups were represented. This suggests either an initially dispersed appearance of larval mites, or a wide and variable range of movement of the rats, or more probably both, followed later probably by a second generation of larvæ in more compact conditions of association between mite and rat. Later still, the larvæ were scarce and a few rats remained heavily infested because they were in moist foci where the larval population was being maintained.

All these findings have a bearing on the ecology of scrub typhus itself. The disease is very sharply localized, and has an ecology of its own, which is related to vegetation and terrain but not directly to any specific plant, although most of the typhus

appears to reside in rank grassy undergrowth, on waste-land or water-meadows, or in the fringe-habitats at the edge of such tracts.

It is considered that a planned study of the Trombiculids infesting rodents and shrews, as well as the other ectoparasites such as fleas and gamasid mites which appear to be related to the domestic habits of the hosts, is an economical method of investigation, because it throws as much light on the mammals as it does on a variety of ectoparasites. It is a synecological approach.

¹ Buxton, P. A., *Nature*, 155, 643 (1945).

² Gater, B. A. R., *Parasitology*, 24 (2), 149 and 163 (1932).

OBITUARY

Prof. A. A. Glagoleva-Arkadieva

A YEAR has passed since the death on October 30, 1945, of Alexandra Andreevna Glagoleva-Arkadieva, professor of physics at the University of Moscow. Prof. Glagoleva-Arkadieva was born in 1884. Upon leaving a secondary school in Tula, she worked as a country school-teacher during 1900-6. In 1910 she completed the Moscow Higher Courses for Women, where she studied physico-mathematics, attending lectures by Prof. A. A. Eichenwald and N. A. Umov, the physicists. Following her graduation she became an assistant in physics at the courses, which after the Revolution of 1917 were reorganised into the Second University of Moscow.

During the First World War, Glagoleva-Arkadieva organised an X-ray room at the war hospital belonging to the Higher Courses, where she designed and built an instrument called the roentgenostereometer for determining precisely the location of bullets or shell splinters in the human body. The fundamental theory of this instrument, which enabled an observer to make precise measurements of depth at any ocular distance, was worked out by the designer herself. After the War the instrument found application in midwifery. With her wealth of practical experience, Glagoleva-Arkadieva for a number of years gave a highly popular lecture course in X-rays for medical men and students.

In 1920, Glagoleva-Arkadieva initiated research in the J. C. Maxwell Laboratory at the University of Moscow on the generation of millimetre electric waves, which was necessary for the study of magnetic properties in the frequency range in which an abrupt drop in permeability of iron and nickel approaching unity had been detected in 1912. Already in 1922 she was able to report to the convention of Russian physicists on a mass radiator, on a new source of ultra-short electric waves. This source, which she described in 1924 in a communication in *Nature* (May 3, 1924, p. 640), made it possible to obtain wave-lengths from several centimetres to 82 microns. Her method consisted in passing electric sparks through a mixture of filings and viscous oil (vibrational mass). The new rays she obtained more than filled the gap between radio-waves and the long infra-red waves of Rubens that had remained in the wave scale since the time of O. Lodge and P. Lebedev. The ease of obtaining interference curves of the waves of the mass radiator pointed to the formation of undamped very short waves during spark discharges; this was corroborated by Leontieva in 1925, and more recently by H. G. Kelliher and E. T. S. Walton.

The distribution of the radiating power on the surface of the vibrational mass of the mass radiator—

the spectral composition of the radiation at its various points—was investigated by Glagoleva-Arkadieva in 1928. Simultaneously, with the aid of her wave detector thermo-element, she investigated the long-wave radiation of the mercury lamp. Since she employed a Boltzmann interferometer, she obtained a symmetrical interference curve, which was 2.5 times longer than that obtained by previous investigators; the curve gave a wave-length of 340 microns.

During 1932–33, A. A. Glagoleva-Arkadieva, employing an echelette grating, isolated from the mixed radiation of the mass radiator pure waves ranging from 9.9 mm. to 350 microns in length. In 1937 she developed a method of reticulate filters making it possible to isolate bands of definite width. The method is based on the utilization of Hertz gratings folded crosswise. The last ten years of her life found her studying the mechanism of the mass radiator and developing its theory of operation. She established that filings of irregular shape are more effective than spherical ones, and that the smallest particles still giving vibrations had a length of 0.02 mm. She showed that in the radiation of the mass radiator

there are three principal waves: one conditioned by vibrations in individual grains (as in the sphere of the Lodge vibrator); another by the vibrations of a pair of grains (as in the Lebedev vibrator); while the third wave depends upon the design of the apparatus and arises from the vibrations in the chains of particles that form in the vibrational mass when sparks jump across. Her mass radiator has been applied to measurements in the field of millimetre waves, which other generators of electric vibrations do not produce.

A. A. Glagoleva-Arkadieva was able to combine her outstanding research with extensive teaching and other activity. Only in 1937, on medical advice, did she resign her position as head of a department at the Second Moscow Medical Institute, and in 1939, at the University of Moscow. She trained many teachers, medical radiographers and research workers, who have high praise for her power to imbue a love for science. By decision of the Academy of Sciences of the U.S.S.R. a collection of the papers of A. A. Glagoleva-Arkadieva is to be published.

S. VAVILOV
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NEWS and VIEWS

Alexander Graham Bell (1847–1922)

THE name of Alexander Graham Bell, who was born in Edinburgh on March 3, 1847, will always be associated with two memorable achievements: the invention of the telephone and the education of the deaf. His interest in the human voice was inspired by his father and grandfather, both authorities in phonetics and elocution. From his mother he inherited a remarkable appreciation of tone values. In 1868 he began to teach his father's system of 'visible speech' for the deaf at a school in Kensington. Two years later he accompanied his parents to Canada, and in 1873 he was appointed professor of vocal physiology at Boston University. It was his simultaneous study of the air waves in the ear during the utterance of voice sounds, and of a tuned system of multiple telegraphy, which led to the invention of the telephone. In June 1875 he made his first telephone at Boston, and on March 10, 1876, sent the first intelligible message: "Mr. Watson, come here; I want you". His novel machine was demonstrated before the American Academy of Arts and Sciences in Boston two months later, and was introduced to the world at the Philadelphia Centennial Exhibition. The Bell Telephone Company was inaugurated in the following year. With the Volta Prize of 50,000 francs awarded by the French Government in 1880, Bell financed the Volta Bureau in Washington for the increase and diffusion of knowledge relating to the deaf. Interested in the subject of marriage of the deaf, he took up the study of eugenics, while after 1895 aviation chiefly engaged his attention.

National Research Council, Canada: Appointment of Dr. David A. Keys

DR. DAVID A. KEYS, Macdonald professor of physics at McGill University, has been appointed

vice-president of the National Research Council, Canada, in charge of the atomic energy establishment at Chalk River, Ontario. The National Research Council has now taken complete responsibility for the operation of this undertaking. Hitherto, the National Research Council was responsible for the Research Division on Atomic Energy, of which Dr. W. B. Lewis is director, but Defence Industries Ltd. was in charge of the construction and operation of the industrial, pilot plant facilities and the village of Deep River. Dr. Keys has had a long and impressive experience in research, scientific education and administration. Born in Toronto, he attended Upper Canada College and had a brilliant record at the Universities of Toronto and Cambridge and Harvard University. He joined the staff of McGill University in 1922.

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National Research Council for Natural Sciences in Sweden

IN addition to the already existing National Research Councils for Technology, for Medicine and for Agriculture, a new Research Council for Natural Sciences has recently been established in Sweden by a royal charter. The new Council will have as its most important task the distribution of funds for fundamental research in the natural sciences and mathematics and the granting of fellowships for scientific studies and expeditions abroad. The Council will also encourage and support work for the international relations of Swedish research workers and institutions. The Swedish Parliament has granted one million Swedish crowns to the Council for the present fiscal year. The president (Prof. Arne Tiselius, Uppsala) and two other members (Prof. T. Caspersson and Prof. Bo Kalling, Stockholm) are appointed by the King. The other four members of the Council are Prof. B. Lindblad, elected by the Royal Academy of Sciences, Prof. E. Melin, elected by the University of Uppsala, Prof. B. Edlén, elected

This issue of *Nature* (dated March 1) and also that dated February 22 were not printed until after the restrictions on the use of electric power were removed on March 3