

Letters to the Editor.

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Variation of Intensity Ratios of Optically Excited Spectrum Lines with the Intensity of the Exciting Light.

IN a recent paper on the optical excitation of mercury vapour (*Phil. Mag.*, Sept. 1927) I directed attention to the fact that lines excited by two successive processes of absorption should increase with the square of the intensity of the exciting light, while lines resulting from a three-stage absorption should increase with the cube of this intensity.

As an example of the last case, we may take the emission of the line $\lambda 3650$ of mercury. The vapour of mercury at room temperature in a quartz tube, highly exhausted, is illuminated by the total radiation of a water-cooled quartz mercury arc. The absorption of the line $\lambda 2537$ raises the electrons from $1S$ to $2p_2$, from which level they are raised to $1s$ by the absorption of $\lambda 4358$. From $1s$ some fall to $2p_1$, a metastable level, with emission of $\lambda 5461$, and from here some are raised to the d level by the absorption of $\lambda 3650$, from which level they return to $2p_1$ with emission of $\lambda 3650$. If we move the arc away until the illumination of the vapour is reduced to one-half of its initial value, one would expect that the intensity of $\lambda 2537$ would be reduced to one-half, of $\lambda 4358$ and $\lambda 5461$ to one-quarter, and of $\lambda 3650$ to one-eighth of their initial values, for by reducing the illumination by one-half we have only half as many electrons raised from $1S$ to $2p_2$, owing to the reduced intensity of $\lambda 2537$. But $\lambda 4358$ has been reduced by one-half as well, consequently there is but half as much light available for absorption by the reduced number of electrons in $2p_2$. Lines resulting from a two-stage absorption process are thus reduced to one-quarter, and from a three-stage absorption to one-eighth of their initial values. Several observations bearing out this view were given, though a special investigation of the matter had not been made at the time.

Practically all of the light emitted by the tube results from two-stage or three-stage absorption. This accounts for something that has always surprised me, namely, the impossibility of obtaining a satisfactory amount of emission by forming an image of the lamp on the resonance tube by means of quartz lenses. I had attributed it the absorption of $\lambda 2537$ by mercury vapour in the air, but the relations above described amply account for it.

The phenomenon can be shown in a very spectacular manner by the very simple expedient of inserting a sheet of fine wire gauze, which is non-selective in reducing the intensities of the lines, first between the resonance tube and the eye, and then between the lamp and the resonance tube. We find that in the latter case the intensity of the emitted light is very much fainter than when the gauze is held between the eye and the tube. The gauze employed was of very fine copper wire, and transmitted about one-fifth of the light. When held between the eye and tube, the light was reduced to one-fifth, but when held between the lamp and the tube, the reduction was to one twenty-fifth; *i.e.* the light was almost invisible. A quantitative investigation of these relations is now in progress in collaboration with E. Gaviola.

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No. 3029, VOL. 120]

Biological Work in Russia, Siberia, and Turkestan.

MY wife and I reached Leningrad early in July, and left for England about the middle of September. In the interval we journeyed in Siberia so far as Lake Baikal, to Archan in the Buriat Republic, and to Tashkent in Usbekistan (Russian Turkestan). We visited the old town of Tashkent, where the women are veiled and the general aspect of things recalls the times of the Arabian Nights, until we notice the street cars, and entering a large mosque, find it converted into a cinema theatre, just then producing the American film 'Speed.' We travelled far on the railways, more often in the 'hard' than the 'soft' cars, in one case for ten days, and talked with all sorts of fellow passengers, getting a good idea of the state of public opinion. We took long journeys in the springless country carts, seated on a small quantity of hay; and we slept in the houses of the peasants. Thus, although the time was short, we got a fairly good idea of the condition of affairs in U.S.S.R. We were, however, on a strictly scientific mission, and what I have to say relates only to scientific work. The extent and variety of the biological investigations and institutions was greater than we could have supposed, and it seems worth while to give some account of what we saw.

I had heard of the University at Irkutsk, founded during the civil war, but was quite unprepared to see a great organisation, with numerous buildings and strong faculties. All this has come into being in less than ten years. At the head of the Biological Institute of the University is Prof. W. Schewiakoff, a zoologist of the first rank, well known for his magnificent studies of the Radiolaria, published in the series of Naples monographs. His wife is a daughter of the famous zoologist Kovalevsky, remembered especially in connexion with *Amphioxus*. Prof. Schewiakoff has devoted himself to improving the facilities for teaching, and has developed a most beautiful series of anatomical preparations, with accompanying explanatory drawings. I have never seen anything more perfect of the kind, and all has been done with small funds and what we should consider extremely poor facilities. Thus one preparation, apparently in a museum jar, was really placed in a perfume bottle, with the top neatly cut off. Prof. V. Dorogostaisky, whom I met later on the shore of Lake Baikal, is a very keen zoologist, concerning himself with the domestication of fur-bearing animals, with the Baikal fishes, with the remarkable Amphipod Crustacea of Lake Baikal, and other matters. He showed me his exquisite series of water-colour drawings of Baikal Amphipods, many of them new. The paper will be published later by the Academy of Sciences at Leningrad. Prof. B. Swartschewsky, whom I met in Irkutsk, is also a zoologist concerning himself with the fauna of Baikal, and the author of important papers. I also met the botanist V. Jasnitsky, who is specially interested in algæ, and has published on the plankton of Baikal and other matters. He has also a good knowledge of the local flowering plants, as I found when accompanying him in the field.

My wife and I were for some days guests at the biological station of the University of Irkutsk, situated on the shore of Lake Baikal. There we found a group of young people living happily together, investigating the fauna and flora, and doing excellent work. The beauty of the surroundings, and the endless fascination of Baikal, together with the good fellowship and enthusiasm in the station, produced an impression long to be remembered with pleasure. At Maritue, nearer the southern end of the lake, I visited the headquarters of the Baikal expeditions of