formula 9/6 . 15/6, while other lines which are of vanishingly small intensity in comparison with it are assigned formulæ with much smaller quantum numbers. For example, the doublet at λ3652, which is the seventh in the sharp series and so faint that it fails to appear in the photographic reproduction of the spectrum, is assigned the formula 6/4 . 9/5. Similarly, the first diffuse singlet at λ6678 gets the formula 9/6 . 24/7, while the fifth in the same series is indicated by 7/5 . 19/5, that is, by much smaller quantum numbers, while it is actually a far fainter line than the other.

These facts naturally lead one to question whether Dr. Silberstein's proposed new combination principle has any real physical basis or significance. To settle this point, I undertook a careful survey of the figures and carried out a series of computations with the aid of my research student Mr. A. S. Ganesan, and have come to the conclusion that the approximate agreements between the calculated and actual frequencies are merely fortuitous arithmetical coincidences. This is clear from the following facts brought out by a survey of the figures :

(1) The proposed combination formula with its freedom of choice of four numbers gives a very large number of lines out of which it is possible to pick out a few coinciding approximately with practically any arbitrary series of frequencies which may be proposed, the accuracy of fit increasing as the quantum numbers chosen are increased.

(2) The coincidences between the calculated and observed frequencies are most numerous and accurate precisely in the region where the density of either series of frequencies is greatest, which is what we should expect according to the laws of chance.

(3) It is not, in general, possible to get a good fit for the earlier members of a line-series except by using large quantum numbers. This is what we should expect if the coincidences were fortuitous, as the frequency-differences between successive lines are greatest in the beginning of a series.

(4) More than one combination of quantum numbers will fit a given line tolerably well. For example, the D_3 line of helium is also represented fairly well by 13·21/5·12.

(5) The quantum numbers giving the best fit do not fall into any regular sequence when arranged either according to the frequencies of the lines or their intensities, nor do they show any characteristic differences for the singlet and doublet series.

Needless to say, the foregoing remarks apply with even greater force to the case of the lithium atom when a choice of six numbers is permitted.

Finally, it may be remarked that the Rydberg constant 109723 chosen by Dr. Silberstein is appropriate only to the case of the ionised helium atom in which only one electron is coupled to the nucleus. If both electrons exert reactions on the nucleus and move simultaneously, the value of the Rydberg constant cannot remain the same in general.

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210 Bowbazaar Street, Calcutta,
October 18, 1922.

Water Snails and Liver Flukes.

HAVING been attracted on several occasions by the presence of actively swimming cercariæ of *Fasciola hepatica* in material collected for protozoan studies and searching for the intermediate host, I have come across several examples of *Limnaea peregra* harbouring perfectly developed cercariæ of the same species. Prof. Graham Kerr has also had similar experiences.

May I claim the hospitality of your pages to ask of your readers for references to literature dealing with the subject of any intermediate host, other than *L. truncatula*, of the liver-rot parasite? Mr. Staig has kindly informed me that Prof. J. W. W. Stephens writes in "Animal Parasites of Man," by Fantham, Stephens and Theobald: "In the allied species of *L. peregra* the fluke will develop up to a certain stage but never completes all its various phases." Many text-books in zoology give one the impression that *L. truncatula* is the only intermediate host.

My experience in searching for *L. truncatula* is that the occurrence of the snail is very local in S.W. Scotland. It seems to be rare, or altogether absent in some districts. Yet in these districts the sheep are known to be infected with the liver-rot disease. It would seem, then, that *L. peregra* acts as the normal intermediate host in those districts, the Fasciola completing within its body in normal fashion the life cycle up to the stage when the cercaria becomes free.

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A Mutation of the Columbine.

LAST summer a remarkable mutation of the blue columbine (*Aquilegia cærulea* James) was discovered by Miss Madeline Gunn near the Smuggler Mine, in the vicinity of Ward, Colorado. Only a single plant was found, growing under a spruce tree. The flowers are of good size (about 63 mm. diameter), with the pale blue sepals deeply trifid apically, the divisions about 12 mm. long, broad basally, the outer ones overlapping the median one (Fig. 1). In one case the median division is bifid apically. The petals are white, the laminæ and spurs shorter than usual.

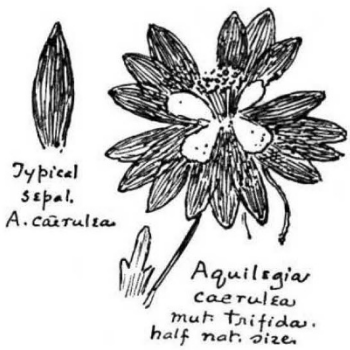

FIG. 1.

The form may be called *mut. trifida*; it represents a striking new type which, if it can be propagated, will be a notable addition to horticulture. Were it received from some remote region, it would appear to be a very distinct new species, or some might even wish to separate it generically. The trifid structure is characteristic of the divisions of the leaves of Aquilegia, and no doubt we may say that a quality of the leaf has been transferred to the sepals. Numerous cases of phyllody of the calyx in various flowers have been described by Maxwell Masters and others, but in this case the sepals are not at all leaf-like, and if such flowers were common they would not strike any one as abnormal.

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