large wedges of water are sometimes found at considerable depths in the neighbourhood of rivers of the same temperature as the river-water. These wedges gradually flatten out and spread themselves between the upper warm water and the colder water below—unless, indeed, the rivers bring down quantities of matter in suspension, which make the water heavy, and carry it, although perhaps warmer than the surface-water, down to considerable depths.

(2) **Radiation.**—Radiation is a source of gain of heat which affects the cycle of temperature changes in a lake more directly than rivers do, but it is a factor which is frequently overestimated. At first sight it may seem that direct insolation is the chief source of gain of heat in a lake, but it is not so. Although the sun's rays may be perceptible to depths of 100 feet or more (the depth being dependent on the nature of the water and the amount of matter in suspension), the heat rays do not penetrate to anything like so great a depth. There is also a large quantity of heat reflected from the surface, especially when the surface is calm and mirror-like. Dufour[1] found in the Lake of Geneva that more than one-half of the radiant energy received at the surface of the lake was directly reflected.

Dr Knott[2] has calculated for the latitude of Edinburgh the solar energy which crosses unit surface in a given time from insolation, and he finds that per square centimetre—

Energy supplied during summer months = 114,840 gram calories.
Energy supplied during winter months = 19,080 „ „

This gives, say, 134,000 gram calories per square centimetre per annum for the solar supply, or for the whole of Loch Ness a supply of $7{\cdot}2 \times 10^{16}$ gram calories. The actual amount of energy stored up in Loch Ness, as calculated from the temperature observations, was $1{\cdot}9 \times 10^{16}$ gram calories,[3] so that about three-quarters of the heat supplied was lost by reflection and radiation from the lake surface, and by the various other methods by which a lake loses heat.

This seems a reasonable result, and it is confirmed by the observations in Loch Garry, from which it appeared that five-sixths of the heat supplied was lost.

Dr Knott's calculations were for the latitude of Edinburgh, but his values are probably correct within the limits of error for Loch Ness and Loch Garry.

It is a natural question to ask to what depth the sun's rays are appreciable. Forel, by means of a black-bulb thermometer, found that at a depth of 1 metre the direct effect of sunshine was

[1] See Forel, *Le Léman*, vol. ii. p. 333, 1895.
[2] See *Proc. Roy. Soc. Edin.*, vol. xxiii. p. 296, 1901.
[3] See page 134.