of the stratosphere which is found with increasing latitude. The increased depth of the stratosphere over areas of low pressure may also explain the increase of ozone with decrease of pressure in high latitudes.

H. HELM CLAYTON.

1410 Washington St.,
Canton,
Mass., U.S.A.

The Mechanism of the so-called 'Posterior Sucker' of a Simulium Larva.

IN NATURE of April 23, p. 599, there appears a letter from Dr. Sunder Lal Hora of the Indian Museum, Calcutta, on the subject of the mechanism of the so-called 'posterior sucker' of the Simulium larva, in which he describes the true method of progression of this remarkable larva. In the course of his remarks, Dr. Hora quotes a passage from Tonnoir (*Ann. Biol. Lacustre*, **11**, pp. 163-172; 1923) to the effect that this worker, "not finding any muscles inserted in the middle of the disc, doubted its utility as a true sucker and ascribed the function of attachment to the hooks alone." He then goes on to discuss Dr. Puri's well-known paper (*Parasitology*, **17**, pp. 295-369; 1925).

Mr. Tonnoir worked at the life-histories of New Zealand Simuliidæ during part of his two years' tenure of a research studentship at this institute, 1921–23, and the paper mentioned above contains some of his observations on the biology of Simulium larvæ. Apparently Dr. Hora has not understood the paper, but only made use of the last sentence in Section I., p. 165, as quoted by Dr. Puri, which is the least important of all Mr. Tonnoir's observations. The whole section, pp. 163-165, entitled "Progression et fixation des larves," deals very fully with the points raised in Dr. Hora's letter, and reaches exactly the same conclusions as he does, only they are given in more abundant detail and as the result of longer and closer studies of the larvæ in specially constructed running-water aquaria designed by Mr. Tonnoir himself.

May I be allowed to quote, side by side, the two sets of observations as briefly as possible:

(1) Tonnoir: "*Les larves ne sont pas munies de ventouses; . . . il faut définitivement abandonner cette théorie des ventouses tant postérieures qu'antérieures.*"

Hora: "the posterior appendage does not act as a sucker, but fixes itself with the help of hooks alone."

(2) Tonnoir: "La larve fixe *toujours, sans exception*, l'extrémité postérieure de son corps exactement à l'endroit où se trouvait sa tête un instant auparavant, et, pendant le court instant où elle forme la boucle avec son corps, sa couronne de crochets postérieure (la soi-disant ventouse) vient *toujours* en contact avec sa bouche." "La larve dépose, avec sa bouche, une certaine quantité de matière glutineuse (dont elle forme ordinairement ses fils de soie) sur ces crochets postérieurs et sur le support; ainsi fixée solidement par l'extrémité postérieure, elle redresse ensuite son corps et l'étend, de toute sa longueur, en avant, pour se fixer au support par la bouche contre laquelle se trouvent appliqués les crochets terminaux de la fausse patte antérieure; elle ramène alors en avant en se pliant en U, son extrémité postérieure et la série des mouvements se répète."

Hora: "These [the sucker-hooks] are capable of gripping firmly a cluster of silk threads (the sticky salivary secretion) which the animal secretes on the spot where it intends the posterior appendage to be fixed."

The only differences between the two accounts are that Dr. Hora supplements the lack of detail in his account by giving a figure of the tracks of the sticky secretion made by the larva, whereas Tonnoir's detailed account makes a figure unnecessary.

The real difference in interpretation lies in the question of the muscles of the so-called 'posterior sucker.' In the larvæ of Blepharoceridæ, where true suckers are present, the muscles are of great strength, much stronger than the ordinary segmental muscles; this requirement is obvious, when one reflects that the vacuum is produced within the suction area by the long-continued *contraction* of these same muscles. The muscles of the 'posterior sucker' in Simulium larvæ, on the other hand, are much weaker than the segmental muscles, as Dr. Puri's figure (pl. viii. fig. 10) clearly shows, and could not possibly accomplish this function. Tonnoir had the blepharocerid larva in mind (on which he was also working at the time) when he wrote "il n'existe pas de faisceaux musculaires destinés à la formation de cette coupe"; he did not imply that *no* muscles existed, but only that *no muscles strong enough* existed. To call these muscles 'strong,' as Dr. Hora does, seems to me misleading; they are strong enough to pull the disc from the sticky secretion, but, compared with the segmental muscles, and more especially with the sucker muscles of Blepharoceridæ, they should be described as 'weak.'

The principal object of this letter is to show that Dr. Hora, by not carefully reading Mr. Tonnoir's paper published four years earlier, has laid claim to a discovery which has been even more fully made and more beautifully described by a brilliant worker in this Institute.

R. J. TILLYARD.

Biological Department,
Cawthron Institute, Nelson, N.Z.,
May 31.

Radiation of Stars and Thermodynamical Fluctuations.

ACCORDING to modern views the substance of the sun and stars is in a state closely approximating to that of a perfect gas. These spherical gaseous bodies have been extensively studied on the basis of classical thermodynamics. It can scarcely be doubted that the internal layers of a star are in an almost perfect thermodynamical equilibrium having a radiative character, as has been convincingly established by Eddington.

It is only in the close proximity of the surface that considerable deviations from this state of equilibrium can occur.

In this note I wish to suggest that the theory of the stars may be greatly enlarged and improved by an introduction of a new agent, namely, thermodynamical fluctuations.

It is shown in statistical mechanics that the thermodynamical equilibrium is never absolute, there are always fluctuations, namely, irregular oscillations about a state of equilibrium.

When the system under examination is closed this state undergoes no change in the course of time. But a star must be regarded as an open system, which can exchange energy with surrounding bodies. In such a system the exact balance of fluctuations cannot exist either on the surface or in the deep interior. In these conditions the external radiation will appear as a necessary consequence of fluctuations.

The thermodynamical fluctuations may be of different kinds. The most important for our purpose are the fluctuations of emission and absorption. If E is the energy of full radiation contained in a volume