Letters to the Editor.

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Discoveries in Tropical Medicine.

It is a matter for regret that the obituary notice of a well-known medical man should be used to put forward a statement of his share in the progress of knowledge which is misleading. It is necessary to correct such a statement when it is conspicuous and likely to be accepted as truthful. In a brief biography of the late Sir Patrick Manson in the *Times* of April 10, it is stated that "modern tropical medicine" was born when he suggested that the *Filaria sanguinis hominis*—discovered some years previously by Dr. Timothy Lewis in persons afflicted with elephantiasis—"is taken from one person to another by mosquitoes." On the ground that this was the first suggestion as to the carriage of disease-germs by mosquitoes, and was well founded, the chief merit in the later discoveries of the part played by those insects in the transmission of malaria and of yellow fever is attributed by the *Times* to Sir Patrick Manson.

This, however, is a misapprehension, the propagation of which must do injustice and falsify history. The fact is that Manson's "suggestion" that the *Filaria* of elephantiasis is actually carried by mosquitoes from the blood of one person to that of another remains to this day a "suggestion." It has not been established as a fact.

Another important misconception enunciated in the same article is that no suggestion as to the mode of entry of the malaria parasite into the blood of human beings was made until Manson, fourteen years after their discovery by Laveran, "suggested" mosquitoes as the carriers. The fact, on the contrary, is that Laveran himself had stated this to be a possible and not improbable mode of transmission, and that the notion was long ago prevalent in India. The man who actually "discovered" the fact of the carriage of malaria germs by a mosquito and the particular species (*Anopheles maculipennis*) so concerned, as well as important facts as to the multiplication of the malarial parasite in the gnat's body, is Sir Ronald Ross.

Finally, the *Times* states that General Sir David Bruce is a disciple of Sir Patrick Manson. This is a peculiarly unfortunate assertion, for it makes it necessary to state the fact, well known to their colleagues, that Bruce, so far from being a disciple of Manson, disapproved of his suggestions and of his methods. The man of genius who discovered and finally abolished Malta fever, who by laborious years of work in Africa gave us solid and absolutely new knowledge of the Tsetse fly and Trypanosome diseases, nagana and sleeping-sickness—not to mention his war work in conjunction with pupils and colleagues on tetanus and on trench fever—was not in any way, directly or indirectly, influenced by or associated with Sir Patrick Manson. The attempt to associate the discoveries of Bruce with the Manson legend is a mere assertion regardless of fact and of the pain which it must cause to the friends of both.

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Atmospheric Refraction.

IN NATURE of August 11, 1921, p. 745, appeared my letter in which I criticised a result stated by Mr. Mallock in NATURE of June 9, p. 456; and also a further brief letter by Mr. Mallock. Further letters have appeared by Dr. Ball (January 5, p. 8) and Instr. Commander Baker, R.N. (January 5, p. 8, and January 26, p. 105). In his second letter Mr. Mallock says that "the pressure gradient near the ground, and the density and refractive-index gradients also, decrease linearly at such a rate that if the linear relation continues to hold, the pressure and density would be zero and the refractive index unity at height H." This statement is incorrect as regards the density and refractive-index gradients, except in the special case when the temperature gradient is zero.

The relation between density and refractive index, $\mu - 1 = K\rho$, where K is constant ($= 222.16$ for sodium line D), shows that $d\mu/dh = Kd\rho/dh$, and so it is only necessary to consider the density gradient. Using suffixes ₁, ₀ to indicate values at sea level and at the upper limit of the atmosphere, the height H of the homogeneous atmosphere is given by $\int_1^0 \rho g dh = \rho_1 g_1 H = p_1$. Hence $p_1/H = \rho_1 g_1$, and by the ordinary mechanical law of equilibrium this is equal to $-(d\rho/dh)_1$, proving Mr. Mallock's statement as regards the pressure gradient.

Now if the absolute temperature near the level considered (sea level) is given by $t = t_1(1 - ah)$, then $p = C t^b = C t_1^b (1 - ah)^b$, which differentiated logarithmically gives for $h = 0$, $(d\rho/dh)_1 = -\rho_1(1 - Ha)/H$. This result agrees with Mr. Mallock's only when $a = 0$, that is, when the temperature gradient is zero.

The curvature $1/\sigma$ of a ray inclined at an angle ϕ to the vertical is derived from $\mu r \sin \phi = \text{constant}$, $d\psi = d\phi + \sin \phi ds/r$, whereby $1/\sigma = d\psi/ds = -K \sin \phi d\rho/dh = (1 - Ha) \sin \phi \cdot K\rho/H = (1 - Ha) \sin \phi (\mu - 1)/H$, a result applicable to any point of the ray if H is understood to mean the height of the homogeneous atmosphere, of density ρ at the point, above the point. Here again agreement with Mr. Mallock is obtained if $a = 0$ and $\phi = 90^\circ$, i.e. for a horizontal ray.

Introducing the temperature gradient $\beta = t_1 a$, we see that $Ha = C\beta/g_1 = 29.28\beta g_{45}/g$. Also $(\mu - 1)/H$ varies as Bg/t^2 , B being the barometer reduced reading. Hence

$$\frac{1}{\sigma} = 3.665 \times 10^{-5} \frac{B}{760} \cdot \frac{g}{g_{45}} (1 + at)^{-2} (1 - 29.28\beta \frac{g_{45}}{g}) \sin \phi,$$

where $a = 1/273$, β' is fall of temperature t per metre, and σ is in kilometres. No mention has been made of humidity for the reason that its action is chiefly to modify the temperature gradient, which has been allowed for.

If we multiply $1/\sigma$ by the earth's mean radius, 6371 km., we obtain $2h$, according to the Indian definition of coefficient of refraction k ; or h , according to the continental definition. The result is to change the numerical factor in $1/\sigma$ into 0.2335. This agrees well with Jordan's formula quoted by Dr. Ball, which I had not previously seen and which, I believe, has never been used by surveyors. For $B = 760$ mm. and latitude 45° we can write

$$\sigma = 27285 (1 + at)^2 (1 - 29.28\beta)^{-1} \operatorname{cosec} \phi \text{ kilometres.}$$

The following table gives values of the radius of curvature σ in miles of a horizontal ray at level $B = 760$ mm., and the coefficient of refraction as defined in India.