recall the fact that there is a still older name which is in all respects available. This is Leidy's *Merycoidodon*, having for its type *M. culbertsoni* (Proc. Acad. Sci., Phila., 1848, p. 47). Professor Cope has rejected the name on the ground that it is a *nomen nudum;* but a generic name is hardly *nudum* when it is supported by a well-defined species and is, moreover, clothed with two pages of description.

Merycodus is another of Dr. Leidy's names which must be restored to its rightful position. This was proposed in 1854 and had for its type species *M. necatus.* On the supposition probably that this name is pre-occupied by Owen's *Merycodon*, it has been ignored. But it is incorrect to assume that any two names ending in *odus* and *odon*, but alike in other respects, clash with each other. As to their forms they are different enough to prevent confusion. As to their derivation, as has been suggested to me by my friend Dr. Leonhard Stejneger, of the U. S. National Museum, they are unlike; *odus* being the Latinized form of the Greek ὀδοὺς, while *odon* comes from the Ionic ὀδών. The acceptance of this view will relieve us of the necessity of rejecting, on philological grounds at least, either word of many such couples as *Menodus* and *Menodon*, *Cosmodus* and *Cosmodon.*

O. P. HAY.

THE FUNDAMENTAL LAW OF TEMPERATURE FOR GASEOUS CELESTIAL BODIES.

IT has been long known that an isolated celestial mass of gas rises in temperature as it radiates heat and contracts. Dr. T. J. J. See [*Astronomical Journal*, February 6, 1899; *Atlantic Monthly*, April, 1899] points out that the temperature of such a mass of gas is inversely proportional to its radius, provided the mass does not receive accretions of meteoric matter and provided the gas conforms to the laws of Boyle and Charles. When, however, the volume of the gaseous body is very great large quantities of interstellar gases and particles would fall into it and the first condition would fail; and when the gaseous body contracts to small volume it would, perhaps, be far from a perfect gas in its properties, so that the second condition would fail; to say nothing of the probable dissociation and polymerization of the gaseous constituents due to the great changes of temperature which, no doubt, take place.

The suggestion of Dr. See that nebulous masses are extremely cold is very plausible, in view of his 'new law,' which 'may be assumed to regulate the temperature of every gaseous star in space,' but it is certainly contrary to the indications of the spectroscope; for nebulæ surely are approximately in thermodynamic equilibrium in their smaller parts, if anything in the universe is; if so, there is no known agency, electrical or other, which can cause them to give off persistently abnormal radiations. Radiations (wave-length) are as intimately associated with temperature as are molecular velocities, although both may be temporarily abnormal in a given substance; for example, the velocities of the particles of a gas in a vessel may be made to deviate momentarily from Maxwell's law; a cold substance, such as calcium sulphide, may shine for a while after exposure to sunlight, and a gas in a vacuum tube may remain phosphorescent for a time as the disturbing influence of an electric discharge dies away. But it is hard to think of a certain cubic foot of nebulous matter, surrounded for millions upon millions of miles with similar matter, remote from intense radiant centers, still giving off abornmal radiations after odd millions of years. Of course, such may be the case, but Dr. See's law, in all probability, has nothing so do with nebulæ at all. There is no physical reason why a nebulous mass might not be intensely hot, held together (if, indeed, we must assume it to be a gravitational unit) by the gravitation of refractory nuclei and receiving continually from space as much matter as it throws off, because of the high molecular velocity of its gaseous parts.

Dr. See's derivation of his law of temperature is incomplete and confused. It is based upon the assumption, which should be definitely proven, that the function which expresses the density in terms of the radius coordinate r remains of the same form as the external radius ρ diminishes; and he confuses *pressure per unit surface* and *pressure between given portions of matter.* Assuming the invariance of the density function Dr. See's formula may be derived as follows. Let ρ be the radius of the gaseous mass at a given epoch. Consider the state of affairs when the radius has become $\frac{1}{2}\rho$. Gravitational forces (per unit mass) will be quadrupled and, therefore, the pressure between two contiguous portions of given mass will be quadrupled, but the area separating these portions will be quartered so that the pressure per unit area (p) will be 16 times as great. The volume v of each portion will be $\frac{1}{8}$ as great, so that pv will be twice as great. But absolute temperature is proportional to pv, therefore, the absolute temperature will have been doubled when the radius is halved. That is,

$$T = \frac{\text{constant}}{\rho}$$

"This remarkable formula," according to Dr. See, "expresses one of the most fundamental of all the laws of Nature." In simple truth it is an interesting and suggestive formula, and it may throw light upon some of the knotty questions of celestial physics.

Dr. See, in his *Atlantic Monthly* article, says among other things: "It is somewhat remarkable that, while the law of gravitation causes bodies to describe conic sections, the law of temperature for every gaseous body is represented by a rectangular hyperbola referred to its asymptotes, and thus by a particular curve of the same species." Now, it would have been quite as well, or even better, for Dr. See to have said frankly ŭm-ta-ra-ra-bum-te-a, or words to that effect; for, *seriously, the object of popular scientific writing is to develop proper and significant associations, and the bane of popular science is verbal sense which by association becomes absolute nonsense.*

IN the *Astronomical Journal* for April 8th Dr. C. M. Woodward calls attention to some of the manifest inaccuracies of Dr. See's derivation of the temperature formula. He points out that the gaseous globe cannot be assumed to have a bounding surface of definite radius ρ; he calls attention to the fact that the gravitational force at a point does not determine the pressure, but the pressure gradient at the point; and he claims that the hydrostatic pressure at a point varies inversely with ρ^2, not with ρ^4, as indicated in the above derivation of the temperature formula. In the above derivation, however, the pressure is said to increase 16 times, not at the same point in space, but at a point one-half as far from the center.

The objections raised by Dr. Woodward seem to be removed as follows: Consider the gaseous mass at the epoch t. Assume that during the contraction the radius coordinate of every particle decreases in the same proportion (this is what is meant in the above discussion by the invariance of the density function.) Consider the gaseous mass at a subsequent epoch t' when the radius coordinate of every particle has been reduced to one-half its initial value. The density at a distance $\frac{1}{2}r$ from the center at epoch t' is eight times as great as at distance r from the center at epoch t, and the gravitational force is four times as great. Therefore, the weight per unit volume is thirty-two times as great, and this weight per unit volume is the pressure gradient. In integrating the pressure gradients at epoch t and t', respectively, imagine the paths of integration to be broken up into homologous elements. The elements at epoch t' are then half as long as at epoch t, and, therefore, the integral at epoch t' from infinity to $\frac{1}{2}r$ is sixteen times as great as the integral at epoch t from infinity to r. Therefore, the pressure at homologous points is increased sixteen times when the mass of gas has contracted to half its initial dimensions, as stated in the above derivation.

W. S. FRANKLIN.

NOTES ON INORGANIC CHEMISTRY.

AN attempt is described in the *Chemiker Zeitung*, by Johann Walter, to concentrate solutions by means of a centrifugal apparatus. But while even very light and finely divided precipitates are rapidly separated by centrifugal force, an examination of different portions of a solution, taken while the machine was in rapid motion, showed that the composition was constant. The same was found true in the case of gaseous mixtures, no tendency being found for the denser constituent to collect in the most rapidly rotating portion of the vessel. This affords an interesting experimental confirmation of what might have been theoretically expected from the laws of gases and of solutions.

THE heat of formation of anhydrous oxid of