The shower was observed by the writer this year on the evenings of the 8th and 9th (the sky being unfortunately overcast on the 10th and 11th), and the display found to be a feeble one.

A three-hours' watch on the 8th, from 9 to 12h., revealed 37 meteors. Of these, 16 were Perseids, giving as an hourly rate of Perseids (allowing for time spent in registering such tracks as were well observed) 6, and for all meteors 14.

The following table shows the number of meteors recorded each hour on the 8th during the watch, and also the calculated horary number for one observer looking towards the East:

Duration of Watch.		Length of Watch.	No. of Meteors seen.	Perseids.	Calculated Horary No.		State of Sky.
From	To				All Meteors.	Perseids.	
h. m.	h. m.	h.					
9 0	10 0	1	9	6	10	7	Very Clear.
10 0	11 0	1	11	3	13	4	
11 0	12 0	1	17	7	20	8	
9	12h.	3h.	37	16	14	6	

The magnitude of those recorded were as follows:

	= ♃	> 1 Mag.*	= 1 Mag.	= 2 Mag.	= 3 Mag.	= 4 and fainter.		Total.
Perseids	1	1	3	6	2	3	=	16
Others	0	0	2	4	6	9	=	21
Total	1	1	5	10	8	12	=	37

The radiant point of the Perseids was deduced as at R. A. $38^\circ+56^\circ$. Two showers in Cepheus furnished the majority of the uncorformable meteors recorded, their deduced positions being at R. A. $5^\circ+75^\circ$ and R. A, $332^\circ+60^\circ$. The evening of the 9th was generally clear (a few clouds at times but slightly interfering with the observations), and a watch of four hours, from 9 to 13h., was sustained, 91 meteors being recorded. Of these, 54 or 59.4 per cent. were Perseids, 12 or 13 per cent. Cassiopeids, and 25 or 27.3 per cent. belonged to feebler showers in Andromeda, etc.

The number recorded each half hour, and the calculated horary number, were as follows:

Duration of Watch.		Length of Watch.	No. of Meteors seen.	Perseids.	Cassiopeids.	Calculated Horary No.		State of Sky.
From	To					All Meteors.	Perseids.	
h. m.	h. m.	m.						
9 0	9 30	30	9	5	2	22	12	Clear.
9 30	10 0	"	10	8	0	24	19	"
10 0	10 30	"	10	6	3	25	14	FewCl'ds.
10 30	11 0	"	11	7	2	26	16	Clear.
11 0	11 30	"	14	10	2	35	23	FewCl'ds.
11 30	12 0	"	15	7	2	37	16	"
12 0	12 30	"	11	5	1	26	12	Clear.
12 30	13 0	"	11	6	0	26	14	"
9	13h.	4h.	91	54	12	28	16	

Meteors thus appeared thickest between 11 and 12h., when the hourly rate for all meteors was about 36, and of Perseids 20. The shower in Cassiopeia appears of considerable intensity, and probably the confounding of these meteors (Cassiopeids) with the true Perseids (the two radiants lying approximately near one another) may account for the large hourly rate of meteors being recorded as belonging to the Perseids by ordinary and occasional observers not discriminating enough, or who are not aware that two distinct showers exist in this region of the sky. The magnitude of those recorded on the 9th were as follows:

	= ♃ or ♀	> 1 Mag.*	= 1 Mag.	= 2 Mag.	= 3 Mag.	= 4 and fainter.		Total.
Perseids	4	5	8	13	9	15	=	54
Others	1	0	4	2	7	23	=	37
Total	5	5	12	15	16	38	=	91

The radiant point of the main Perseid stream was very accurately deduced from several very short tracks near the focus, and from one perfectly stationary meteor of the 1st mag., visible two seconds and very exactly noted, as at R. A. $44\frac{3}{4}^\circ+56\frac{1}{4}^\circ$. A secondary Perseid radiant was reduced from a few short tracks, and one very nearly stationary meteor, as at R. A. $55^\circ+57^\circ$. Among the bright meteors recorded was one at 12h. 55m., which equalled ♀ (Venus) in brightness, and was of a blue color, with path from R. A. $260^\circ+67\frac{1}{2}^\circ$ to $212^\circ+66^\circ$. This meteor came from the direction of Cygnus. A letter received from Mr. W. F. Denning, F. R. A. S., of Bristol, England, informs the writer that the shower was well observed in England. Mr. Denning at Bristol recorded from August 6 to 13, inclusive, 419 † during a period of $16\frac{1}{2}$h. watching, and of these 240 were Perseids. He found the hourly rate of all meteors on the 9th to be 44, and of Perseids 28. On the 10th (when it was foggy) 34 and 28, respectively. The radiant point appeared to shift in R. A. (increasing) every night, for while on August 6 it was at R. A. $38^\circ+56^\circ$ and August 7–8 at R. A. $41^\circ+55^\circ$, it was at R. A. $48^\circ+57^\circ$ on August 11–12, and at R. A. $49\frac{1}{2}^\circ+57\frac{1}{2}^\circ$ on August 13th. The meteors were also successfully observed at the Royal Observatory, Greenwich, where the greatest hourly number on the 10th was determined to be about 25, and also by Major Tupman, Mr. Corder, and other prominent observers.

CAMBRIDGEPORT, Sept. 12, 1880.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1880.

(Continuation of papers read.)

NOTES ON JAPANESE PULMONIFERA.

BY PROF. EDW. S. MORSE.

In this communicetion Mr. Morse called attention to the occurrence of a number of species of land snails in Yeso, identical with forms occurring in New England.

He also showed the occurrence of two species of slugs in Japan, which are also common in New England.

While he had met with most of the fresh water genera of Pulmonifera in Japan, he had never yet found an example of *Physa*.

PROBLEMS IN WATSON'S CO-ORDINATES.

BY THOMAS HILL, D.D., LL.D.

IN this paper Dr. Hill investigates the equation $p=A(a-b\mathrm{Sin.}\ m\nu)^n$; giving his principal attention to the case in which $b=m=1$, and $n=-1$, which represents a curve like a figure 8 with its top concave, somewhat like the sign for Taurus. When $a=0$, this becomes a parabola; and when $a>2$, an oval, not an ellipse; a new illustration, in Dr. Hill's opinion, of the fact that the ability of members of two groups of forms to assume an intermediate form affords but a very slight presumption, if any, for a community of origin in the group.

FRICTION OF LUBRICATING OILS.

By C. J. H. Woodbury.

The resistance existing between bodies of fixed matter moving with different velocities or directions presents itself in the form of a passive force, which results in the diminution or destruction of opponent motion. Modern science has demonstrated that this destruction is only apparent, being merely the conversion of the force of the moving body into the oscillation of the resisting obstacle or into that molecular vibration which is recognized as heat. Direct friction refers to the case where the two bodies are in actual contact and mediate friction where a film of lubricant is interposed between the surfaces, and it is this which applies to nearly every motion in mechanics where bodies slide upon each other. The coefficient of friction is the relation which the pressure upon moving surfaces bears to resistance. Mr. Woodbury limited his discussion to a description of the apparatus for measuring the friction of lubricating oils, the method of its use and the results obtained with a number of oils in the market which are used for lubricating spindles. Previous investigation of nine different oil-testing machines used showed that none of them could yield consistent duplicate results in furnishing the co-efficient of friction. The paper mentioned the circumstances which must be known or preserved constant,—temperature, velocity, pressure, area of frictional surfaces, thickness of the film of oil between the surfaces, and the mechanical effect of the friction. The radiation of heat generated by friction must be reduced to a minimum, and no oil should be allowed to escape till subjected to attrition. Therefore a dynamometer is required which is instantaneous and automatic in its action. Mr. Woodbury described in detail the construction of his instrument and the mode of its operation, which was too elaborate to be reproduced in an abstract. The operation of the machine under equal conditions with the same oil gives results which are as closely consistent with each other as could be expected from such physical measurements. Much of the slight irregularity was due to the variable speed of the engine. The results were remarkably uniform, but they do not agree with the laws of friction, as given in works on mechanics, but the co-efficient of friction varies in an inverse ratio with the pressure. Friction varies as the area, because the adhesiveness of the lubricant is proportional to the area, and the resistance due to this cause is a larger fraction of the total mechanical effect with light than with heavy pressures. The lubricant used is one of the most important factors in the cost of power. In the present condition of engineering science it is impossible to state what exact proportion of the power used by a mill is lost in sliding friction, but in a print-cloth mill only about 25 per cent. of the power is utilized in the actual processes of carding, spinning and weaving the fibre, not including the machinery engaged in the operation, leaving 75 per cent. of the power as absorbed by the rigidity of the belts, the resistance of the air and friction. Mr. Woodbury concludes that the successful operation of a spinning frame is far more closely dependent upon the individual management in respect to the conditions of band-tension, lubrication and temperature of the spinning room than all other causes combined. Not that some forms of spindle are not superior to others, but without wise supervision the most desirable forms of spindle must fail to show the merits due to the skill of their promoter. The lubricating qualities of an oil are inversely proportional to its viscosity; the endurance of a lubricant is, in some degree, proportional to its adhesion to the surfaces forming the journal. An ideal lubricant, in these respects, would be a fluid whose molecules had a minimum cohesion for each other, and a maximum adhesion for metallic surfaces. Viscous oils adhere more strongly to metal surfaces, hence it is obligatory to use such thick lubricants on heavy bearings. With light pressures more fluid oils are admissable, and in all cases the oils should be as limpid as possible. Oils with great endurance are likely to give great fractional resistance, and in the endeavor to save gallons of oil, many a manager has wasted tons of coal. The true solution of the problem of lubricating machinery is to ascertain the consumption of oil and the expenditure of power, both being measured by the same unit, namely, dollars. Mr. Woodbury detailed his experiments in measuring the fluidity of oils, and gave the data for determining the safety and efficiency of a lubricant.

THE LAW OF LAND-FORMING ON OUR GLOBE.

By Prof. Richard Owen, M.D., LL.D.*

The truth of a general law can best be proved by such a large collection of co-incident facts as to carry conviction to the scientist. But in a synopsis all that can be done is to state the law and suggest a few prominent demonstrations, leaving it for the reader to trace with compasses or string, on a good globe or large map of each separate continent, those phenomena presented, and such other analogous details as may suggest themselves.

General Law: *The land shows itself above the ocean level, in definite multiple proportions, by measurement; the unit is the angular difference between the axis of revolution and the axis of progression.*

For convenience, as that angle has been lessening for some centuries, we might call it $24^\circ = \frac{360}{15}^\circ$.

The greatest width and length of continents $= 3 \times 24^\circ = 72^\circ = \frac{360}{5}^\circ$.

Consequently, the radius for continents $= 36^\circ = \frac{360}{10}^\circ$.

The measure for oceanic distances is the complement of $24^\circ = 66^\circ$.

The ratio of land to water is as 100 : 275.

The ratio of 24° to 66° :: 100 : 275.

All measurements are to be estimated at the equator.

The above general law may, for the purpose of demonstration, be subdivided.

I.—*First subdivision or section of the law.*—Many longitudinal elevations and depressions on the earth's surface, especially near the greatest median, north and south, extension of each continent, coincide with some meridian. Although this is partly due to early cooling and shrinkage, probably all continents have been extended north and south by successive depositions, as great river-deltas are usually found near the southern terminus of that median line. On these median lines we seldom find volcanoes.

Demonstration.—As the details regarding North America are most familiar, illustrations will be taken chiefly from that continent, although the law applies as well to all the others. In North America the greatest elongation is about in long. 96° W. of Gr. Near that line, as we shall see later, are found the foci of land forming for our continent, and not far distant the great rivers which drain the Mississippi valley. From Boothia Felix to the Gulf of Mexico we have no volcanoes, and the only earthquake action (near New Madrid, etc.) is due to a great circle of force crossing diagonally as shown subsequently.

II.—*Second Subdivision of the Law.*—Although the median lines of continents run north and south, the outlines or trends of continents form, with the meridians, angles of about 23½° (as I pointed out in "Key to the Geology of the

* Former State Geologist of Indiana, and for fifteen years Professor of Natural Science in the Indiana State University.