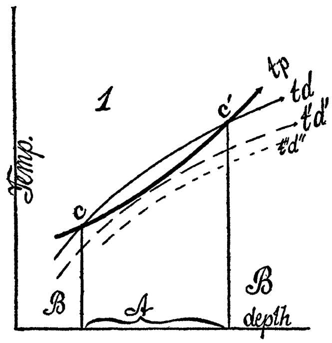

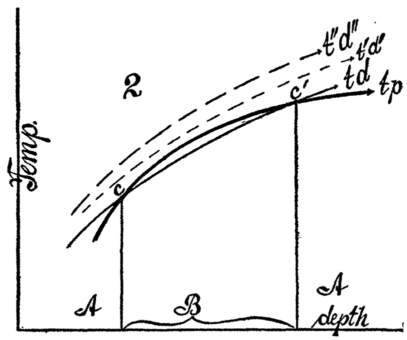

erties of the AB system determines the frequency of the sun-spot period: the element A escapes (let us say) in gaseous form. As the curves are drawn there is not sufficient 'supersaturation' to transmute A to B. This would occur at $t''d''$ for instance.

The relation of the curves td and tp will vary with the solar latitude, for td is a mere graph of temperature and depth while tp is inherently a graph of temperature and pressure. On passing from pole to equator tp moves bodily from left to right in diagram. At the poles the region A may thus be permanently absent, while at the equator $t'd'$ may never fall below tp. Hence, an intermediate sun-spot zone may be inferred.

Finally it is clear that the cycle of changes may be reversed as in Fig. 2. Let the transition of A into B be a source of heat, and let the ensuing eleven years of the sun-spot period be an interval of cooling. Immediately after eruption, the temperature depth line will have some high position, $t'd'$, and A matter only is in occurrence. As the sun cools superficially, $t'd'$ tends toward td, and between the depths c and c', B matter is potentially present. When, after sufficient 'supersaturation,' the transition A to B ultimately does occur, tp is again raised to $t'p'$; and so on in turn. The engine works at the expense of atomic energy, supposing that B matter[1] is continually eliminated from the active region by gravitation, as the $t''d''$ condition is not reached.

CARL BARUS

[1] If corpuscles leave A to transfer it into B, an absence of these may prohibit the reversed transfer BA.

DOES THE MAMMALIAN HEART OBEY THE LAW FOR CHEMICAL REACTION VELOCITIES AS INFLUENCED BY TEMPERATURE?

IN a recent paper[1] it was shown that the temperature coefficient for the velocity of the heart-beat in mammals is the same as that for a purely chemical reaction. From the results of previous workers who experimented upon the influence of temperature upon the mammalian heart this fact was shown in a clear and decisive manner. At that time the writer had not yet seen Herlitzka's paper.[2] This author takes data out of only three of the fifteen to eighteen tables in Langendorff's paper, and determines a few constants. In one case, table XIV., in a range of temperature from 23° to 39° C., he exhibits only five constants. Between 29° and 35.2° there are no constants shown, but for these degrees he finds the constants 3.45 and 10.8, and then complains that these constants do not represent the curve of the formula for a chemical reaction velocity for temperature, but rather a straight line. In tables VII. and VIII. he says that the values observed correspond well enough with the values of K calculated from the formula, but that one, for 35° (3.74), is too high!

Herlitzka has looked at a few individual cases of Langendorff's results. On the other hand, the present writer put all of Langendorff's results (from fifteen cat hearts) together into one table; put the figures in round numbers and determined the constants from

[1] Snyder, Charles D., *Amer. Jour. of Physiology*, December 1, 1906.

[2] Herlitzka, 'Richerche sull' azione della temperatura sul cuore isolato di Mammifero,' *Zeitschrift f. Allgemeine Physiologie*, V., 264, 1905.

10° to 46°. Of these constants only those at the extreme limits of temperature vary from the 2–3 limit set for the chemical reaction constant. As to his own experiments on dogs, Herlitzka studied but few hearts, and these apparently from dogs of all sizes and weights, and compares results of hearts in apparently all stages of nutrition, age, size and state of injury. He then comes to this conclusion (p. 286):

2°. L'aumento della frequenza delle contrazioni cardiache non è una funzione costante della temperatura, ma varia da un cuore all' altro ed anche nello stesso cuore in varie fasi dell'esperimento. A volte si tratto di una funzione lineare; raramente e mai completamente la frequenza seque la legge a cui soggiaciano le comuni reazioni chimiche, gli enzimi, l'accrescimento ecc.

As to what value should be placed upon this author's work and his conclusions, this must be left to the decision of the intelligent reader.

In the paper already referred to the writer has shown from Martin's results that the dog heart obeys the law for chemical reactions as closely as if one were dealing with pure chemicals. Not only when studied statistically, then, but also when the individual heart of the mammal is studied, is this found to be the case. The same relation was shown to hold for the rabbit heart and, in an unexpected way, also for the human heart.

While the thesis seems to be proved beyond doubt the writer will be pardoned if he adds still other evidence.

Baxt[3] studied the effect of temperature upon the dog heart primarily to find out the influence of temperature upon the action of the vagus and accelerens nerves. But in recording his results he always put down the temperature and rate of the heart before stimulation. So it happens we have in his paper considerable data for further study of the temperature coefficient of the 'normal' heart of the dog. Under the conditions of his experiment the temperature of the animals had a tendency to fall off. By surrounding the dogs with a double-wall chamber in which water circulated the temperature could be lowered and increased at will. Dogs of middle weight and in good condition were selected for the experiments. The hearts were left intact in the body, and artificial respiration was maintained, the animals being poisoned with curare. The temperature was varied between 27.15° and 42.8° C.

[3] Baxt, *Berichte d. K. Sächsischen Gesellschaft der Wissenschaft*, Leipzig, Math. physik. classe, 1875.

Wherever a number of observations were made, at about the same time, of temperature and rates of very nearly the same value, the writer determined averages for them. These averages were compared with rates at lower or higher temperatures and their coefficients interpolated by the formula, $10R_1/R_2(t_1-t_2)$, where R_1 and R_2 are rates at the corresponding higher and lower temperatures, t_1 and t_2. These coefficients are: (1) From pages 339–340, for 'A'—2.18, 2.3, 2.0; for 'B'—2.3, 2.7. (2) From page 341, for 'A'—2.2, 2.6; for 'B'—2.5, 2.0, 4.3, 3.1, 3.6, 4.0. (3) From page 342, for 'A'—2.2, 2.0, 3.1, 2.5, 3.1, 2.6, 2.4, 3.9; for 'B'—1.7, 2.6, 2.7, 2.2, 2.2, 2.8, 2.6, 2.5. (4) From page 356—1.2, 1.8, 2.5, 2.5, 2.0 1.7, 2.4, 2.6.

Of the individual coefficients shown above the lowest is 1.2, the highest 4.3; 71 per cent. of them range between 2 and 3. The mean average is 2.43. Verily, the mammalian heart does follow the law for a chemical reaction velocity as influenced by temperature.

CHARLES D. SNYDER

BERLIN,

THE FLANKING DETRITAL SLOPES OF THE MOUNTAINS OF THE SOUTHWEST

General Aspect and Grade of Detrital Slopes.—The attention of travelers in the southwestern portion of the United States is arrested by the long and regular slopes of gentle grade flanking the rocky ridges of the mountains, and stretching in unbroken lines, often for ten or twenty miles, across the line of vision. Such slopes are most distinctly developed in the Great Basin of Nevada and the semi-desert Piedmont region of Arizona. They give a striking and unique character to the scenery, producing upon the beholder