until some competent worker prepares a monograph of the genus for the western North American forms based on all available material in both institutional and private collections.

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THE EQUATION OF SUBSPECIATION

by L. PAUL GREY

Algebra is the accepted bedfellow of logic, nowadays; the following ideas have no claim to originality but in the present application perhaps will provide amusement for an idle moment.

Variability in wild populations, from the minor differences peculiar to local strains up to the unique character combinations of independent subspecies, are assumed to be *divergencies* which are products of isolation in *time* and isolation by *barriers*, which is to say,

$$d = tb.$$

Granting this to be a logical proposition the ratios derived from transpositions should hold true also. And, of course, from two knowns the third unknown is predictable, both if

$$t = \frac{d}{b}$$
 or $b = \frac{d}{t}$.

Divergence can be evaluated by a specialist, not precisely but quite well to such logical symbols as "large", "medium", and "small", which may be put into the above equation with propriety, using the numerical symbols "100", "50", and "10".

Some idea of "how large the barrier" and "how long (large or small) the time" can be gained from evaluating one against the other, first to a "standard t" and then to a "standard b". The number taken is immaterial to the answer gained from comparison with known "d" since only ratios are concerned, but for convenience "50" may be used.

From permutations of the equation, using these numbers, one gets numerical answers representing consequences logically following from the prime assumptions, answers which can be read as, *e.g.*, "time being fixed, barrier effects have been small if divergence is small", and "barrier being fixed divergence will be small or large proportionately as time has been small or large", and so on.

Next, it is possible to show the divergence theoretically to be expected, by putting in large, medium, and small values for b against a standard t and vice versa.

Specialists usually are bursting with theories of subspeciation rates, times of isolations, severity of present and paleographic barriers, and the like; possibly this formula could be juggled to give them some comfort, or, in the hands of a real mathematician (I am weak in long division) further elaborated to bulwark grandiose claims.

My pets (*Speyeria*) are negligibly subspeciated on the severely barriered Milk River Plateau highlands of interior Montana; the formula says that time has been very small.

Again, many subspeciations in the Pacific Coast Ranges will not equate unless a large t or b is assumed. Balancing against an unknown standard for either, and being able to see more of "barrier" than is known of "time", one of the applicable answers implies that "divergence becomes large as barrier is increased, time being fixed". If b as observed is too small to satisfy, the implication becomes "reach into paleogeography for some more barrier".

A still more generalized equation covering the same ground is

m plus
$$t = CS_2$$

which means nothing more than that, given Time, Mathematicians will be able to catch up with Common Sense.

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