that ineptitude in its name is scarcely to be condoned.

It would seem to be in the interest of clarity, therefore, to abandon the expression "germ tract" for both the abstract idea and the object to which it has been applied. It can not legitimately mean continuity, and it is not a good name for the germ mass. Surely, at least, no one with a feeling for language can go on using it for the continuity which the words "germ track" were used to describe.

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UNITS IN MECHANICS

IN the recent text-book, "Mechanics," by W. F. Osgood, there appears in Section 11 of Chapter III a discussion of "Change of Units in Physics." The author is very definite and precise as to the method he proposes to use, but at the same time he vigorously denounces another method, viz., that of including units in the analysis. That Osgood has not seen the point to this method is very difficult to believe, but at any rate that is what is apparent from his criticism.

He states that to measure the length of right lines is to find how many times a right line chosen arbitrarily as the unit of length is contained in a given right line, and that the number, s, thus resulting is called the length of the line. Further, if s' is the length of a line in this sense when the yard is the unit and if s is its length when the foot is unit, then he shows by a proportionality that $s' = s/3$.

In a footnote he comments in part:

> It would seem paradoxical to say that the same *line* has a length of 6 when the foot is the unit and a length of 2 when the yard is the unit. But it must be remembered that the length is a function of two variables, the unit being one of them. The attempt is sometimes made to meet the apparent difficulty by saying "3 ft. = 1 yd." But this makes confusion worse confounded; for $3 = 1$ is not true, while on the other hand to try to introduce "concrete numbers" like 3 ft., 10 lbs., 5 secs., into mathematics is not feasible. To try to change units in this way leads to blunders and wrong numerical results.

To illustrate this last claim he proceeds in a second footnote to find the relation between s' and s when the units are the yard and foot, respectively. He says "it would seem to follow from the statement (1 yd. = 3 ft.) that s' yds. = $3s$ ft. But $s' = 1/3s$. What a cheerful prospect of getting the right answer by that method!"

This is erroneous. From the notation he has adopted it follows that s' yds. = s ft., not $3s$ ft., as he suggests. Also, *in transforming an equation one can replace any term or quantity by its equivalent and the equation will remain true.* In the above equation, therefore, one may replace *yds.* by *3 ft.*, and the equation then becomes s' (3ft.) = s ft., whence $3s' = s$, or $s' = s/3$ as before.

So why the claim that there is confusion worse confounded? From the equation 3 ft. = 1 yd. there is no more reason for writing $3 = 1$ than there is from the equation $3x = 2y$ for writing $3 = 2$.

Evidently with Osgood a symbol or letter always signifies an arithmetical number. But why should it not be used to designate a *physical quantity,* or "concrete number" as he calls it? If s is the position of a point at time t (units included implicitly in both s and t) then ds/dt is the velocity (units included) at time t.

Furthermore, the statement "the length is 6" has by itself no meaning. To this Osgood would doubtless agree, for he states the length is a function of two variables, the unit being one of them. He thus must say, "the length is 6 when the ft. is the unit," or something similar. But the statement, "the length is 6 ft.," is only a shorthand way of conveying the same idea.

For the treatment of general theory in physical problems it is convenient to regard all symbols as including units implicitly. Then no mention of units need be made in developing equations. In applying developed equations to numerical problems one will never go wrong if when substituting for a symbol he puts in units as well as numerical measures, and in solving or reducing adheres to the principle of replacing units by their equivalents in other units. On the other hand, it is not *necessary* to operate in this way, for one may simplify matters by the use of a *homogeneous system* of units.

By a homogeneous system of units is meant: If in a general physical equation a set of corresponding values is substituted, units as well as measures, and if, with the units deleted, the resulting equation (in measures alone) remains true, then the units used belong to a homogeneous system.

This makes it possible to work as follows: If a homogeneous system of units is used in which to express the physical quantities occurring, the general equations developed may be regarded as relations among the measures only. The equations may be solved for the desired measures, and the results may then be stated physically by means of the system of units adopted.

Osgood uses Newton's second law with a proportionality factor, and in any given problem determines the value of the factor by the units being used. This is one possible way of dealing with units. Whether or not it is the best way is a matter of taste. But certainly there is no justification for the claim that to include units in analysis is to promote blundering.

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