

mote. As it is claimed by the proponents of physical culture that exercises increase resistance to disease, we are now in a position to consider the relationship between disease (infections) and resistance. The formula of Theobald Smith shows this relationship thus:

$$D = \frac{Mnv}{r} \quad \text{Where "D" is interpreted as the positive or negative production of the disease condition, "m" the specific character of the microorganism involved, "n" equals the number of organisms concerned in the initial infection; "v" equals the virulence of the strain and "r" equals the resistance of the host.}$$

For teaching purposes and in order to emphasize and contrast the great importance of specific resistance (as that given by vaccination to small-pox or to typhoid fever) to general resistance, and the great differences produced by entrance of the invader into the host by various avenues, I have added two other factors to make the equation appear thus:

$$D = \frac{mnve}{rr'}$$

This was done because specific resistance "r'" is so important and so definite, while general resistance is a loose, unknown, immeasurable quantity, and because the mode of entrance of the organism "e" is of the greatest import. It is, of course, only with the general resistance of the body that exercise may in any way be thought of as a factor in disease prevention or control.

Many Other Factors

There are many other factors beside exercise that we imagine may affect general resistance such as diet, housing conditions, elimination, clothing, excessive use of alcohol, bathing, etc. And even the most enthusiastic adherent of these subjects knows, (provided he has had a biological training) that general resistance is suspected of being of value in only four conditions, namely, colds, tuberculosis, pneumonia, and the generalized blood stream infections, (bacteremias). The absurdity of taking any of these minor factors as of real value in the control of disease is apparent by a few questions.

"What clothing shall I wear to protect me from heart disease?"

"What diet shall I use to prevent small-pox?"

"What exercise shall I take to prevent nephritis?"

The extreme limitations of the factors above in preventing disease are immediately seen. Because physicians

at times may use exercises in the treatment of certain relatively infrequent conditions does not mean that lack of physical exercise has produced the condition in question any more than the use of digitalis for increasing the efficiency of a heart condition means that the heart has suffered from a previous lack of the drug. If the above is true, then exercise is only one factor of a very great number of factors that may be thought of as perhaps influencing, indirectly, only four disease conditions.

Three Are Communicable

Three of these conditions (colds, tuberculosis, and pneumonia) are definitely recognized as communicable. In the last, (bacteremias) the causative agents certainly do not arise *de novo*, which in its last analysis brings us back to a previous host, so we see that it is the previous case of the disease and contact with that case that is important rather than an assumed immunity depending on such a chimera as "general resistance."

Those of us who are charged with "teaching the young idea how to shoot" must be careful of loose statements that the individual later on, because of his own experiences, can disprove. Much of our teaching of hygiene, particularly in the grade schools, is not preventive medicine at all in the sense that it attempts to control sickness and lengthen the useful span of life. The chief reason for this is that the goal of hygiene is not clear in the minds of the instructors, as it is most frequently confused with problems of ethics and decency.

To keep the teeth and finger nails clean for esthetic reasons is sufficient to my mind and should not be bolstered up with any relationship of health, for such association, if indeed one exists at all, is extremely remote, and when our student, by personal observation, learns that statements relative to such things do not accord with the facts he will be apt to doubt the whole content of the subject that was presented to him.

Relative to the extraneous material usually taught in hygiene Hill¹ in discussing this matter as it relates to diet says:

"It should be needless to add that the benefits of good nutrition are too obvious, in developing the body, in securing efficiency, general well-being, and physical capacity for enjoyment to require any laudation here. It is not an advocacy of mal-nutrition to

point out that it has one less defect than has usually been attributed to it, nor is it depreciatory of good nutrition to point out that one advantage it never possessed (the prevention of infection) has been improperly credited to it."

In our smaller colleges we frequently combine physics, mathematics, and chemistry in a "department of science." On reflection it must be apparent that these sciences are more closely related than medicine and exercise, but perhaps in the smaller colleges these latter two, widely separated subjects might be combined. In the larger universities where we have a separate department of physics and of mathematics, there is even less reason for combining a department of preventive medicine with a department of physical education for these latter are much more widely separated in scope and objectives than are the former. Both are highly specialized and concerned with entirely different kinds of training and interests.

No more will four years on a football team or in a gymnasium prepare a man to practice scientific medicine than will four years in medical school prepare him to coach a football team or handle classes in gymnastics. And if one is expected to keep up with preventive medicine in all its applications to that very special population under his care—a student body—he is not liable to be an authority on any game or sport—the converse of this is also true.

Enough in One Baliwick

In conclusion—preventive medicine has enough material in its own baliwick (if only realized) to keep any one man busy and he does not need to look outside of its confines for something he does not know.

The great mass of the public learn by observation and we should have these object lessons (especially in our universities) pillars of truth. Too many untrained people think they now see in terminal disinfection one of the chief activities of a board of health and in garbage collection an activity of first importance in preventing pestilence. Let our universities once and for all lay this ghost that physical exercise is an important factor in preventive medicine by entirely separating those departments concerned with medicine from those interested in physical education and athletics. Between the two there should be the closest cooperation as also there should be between all departments in any institution that desires to progress.

¹"Non-Relation of Malnutrition in School Children to Infections," *Public Health Journal*, Sept. 1926, page 421.