gen or nitrogen, and corresponds with the breakdown processes or chemical changes which cause and maintain contraction. The recovery heat production is due to the reformation of glycogen and oxidation. For every gram of lactic acid developed during exercise 370 calories are produced, and therefore in recovery, the opposite takes place and 370 calories are absorbed in conversion to the precursor.

Concerning the theory of muscular contraction, the consensus of opinion seems to be that the liberation of lactic acid is the active agent which brings it about, but as to the manner in which this is done, there is a variance of opinion between the de-ionization, surface tension, osmotic, and swelling theories, and it must "remain for the present a matter of speculation."[4]

Fatigue.

The aspects of fatigue are so varied and numerous that it will not be possible to give any more than an extremely limited discussion of this physiological phenomenon at this time. Its relation to general health and efficiency, lost time and sickness, industrial fatigue and accidents, length of the working day, etc., is intimate indeed, and any consideration of these problems must take fatigue into account. Fatigue has already been defined, and whenever there is any disturbance of the dynamic equilibrium, nature's method of correction is that of rest and sleep. Its general effects have been spoken of as nature's provision against overstress and overstrain, the danger signal, as it were, that the organic functions of the body are being heavily taxed to accommodate themselves to the demand upon them. McKenzie[11] has given a classical exposition of the general effects of systemic strain in depicting from life the facial expressions or echoes of effort, breathlessness, fatigue, and exhaustion. These conditions are the result of extreme effort involving action of most of the muscles of the body as contrasted with local fatigue, when only a small group of muscles is employed.

The limitations that are placed upon the maximum working ability are determined, not only by the functional capacity of the muscular system, but also by the supply of oxygen to the muscles, heart and brain. This supply is ultimately dependent upon the output of the heart, and this output depends upon its ability to nourish itself as well as the other tissues where the demand is so great. If the effort is confined to a small group of muscles, there is a limitation of the amount of work that can be done, due, of course, to similar physiological causes, although there is not the same evidence of systemic toxæmia, the limiting factor being restricted to the parts of the body involved in the work performed. Where the production of the toxins is so restricted and confined, it is spoken of as "localized fatigue." The direct cause of the limitation or loss of power is probably due, in part, to a using up of the available energy yielding material, but the high accumulation of lactic acid, due to its excessive release, or its failure to be restored to its precursor fast enough, is doubtless the immediate cause of the loss of irritability. This condition is spoken of as fatigue.

Many tests have been devised for the estimation of general fatigue, and the ability of the body to perform work under varying conditions. Most of the experiments, however, both general and local, have had to do with the maximum working power of the body, or some specific group of muscles. Lee and VanBuskirk[12] state that, while certain of the tests employed, e.g., heart rate or blood pressure in the reclining or standing position, and the tests of Crampton, Schneider, Beaunis-Erlanger-Hooker, Ryan, Flack, and Martin have demonstrated their value in the detection of pronounced physical deterioration, "none of them appears to be practicable in the detection or measurement of the physical fatigue resulting from the day's work of the individual." The work referred to in this case was a walk of fourteen miles. Hill's[4] outstanding work on the capabilities of the body and most of the ergographic tests for fatigue have disregarded the recovery of the muscle from the condition of fatigue, in so far as its ability to function once more is concerned. Hill, Long, and Lupton (1924) have shown that the work done in a maximal contraction depends upon its speed, decreasing in a linear manner as the speed is increased. This is attributed by Hill to the viscosity