

applied to those in a cell. In the chemical laboratory we can accelerate a chemical change by increasing the temperature and retard it by cooling. In most cases a rise of 10 deg. C. about doubles the rate; and this same temperature co-efficient has been recently observed in many reactions involved in the life processes of animals and plants. The elaborate mechanism for regulating the temperature of all the higher animals was no doubt evolved in order that the rates of the vital processes might be kept under control. However the marked influence of variation in temperature on the rate of chemical change may be made use of in nature's fight against disease. In the healthy body enzymes are the accelerators. For instance, hydrogen peroxide, which can be decomposed by heat, is in the animal body broken up by an enzyme called catalase.

In the chemical laboratory light is an effective agent in producing and augmenting chemical changes. I need only refer to its influence on silver salts, and on the action of chlorine on hydrogen, acetic acid and other compounds. In the vegetable kingdom light is essential, and in the animal body also it is probably an important agent in modifying metabolism. The beneficial action of sunlight is probably due to increased metabolic changes.

In the chemical laboratory there are agents which accelerate whole classes of chemical changes. Thus the addition of dilute mineral acids to aqueous solutions accelerates hydrolysis: disaccharides (cane sugar, malt sugar and milk sugar) are hydrolyzed into hexoses, and proteins into amino acids. In the animal body also catalytic agents (enzymes) exist, which do the same work. In the chemical laboratory oxidizing agents change aldehydes to acids, side chains of benzene derivatives to carboxyl groups, etc. In the animal body oxygen with ferments called oxidases effect the same changes. Thus benzaldehyde, C_6H_5COH , is oxidized to benzoic acid, C_6H_5COOH , toluol, $C_6H_5CH_3$, to benzoic acid, and glucose to glycuronic acid.

In studying chemical changes in theoretical chemistry I have found the following classification of value:

- Combinations.
- Decompositions.
- Substitutions.
- Double decompositions.
- Oxidations and reductions.