the neighborhood of a rapidly fermenting manure heap. If fermentation goes on slowly, much of the ammonia is changed into nitric acid, or combines with nitric acid already formed, and if such substances as calcium, potassium, or sodium are present, they also combine with nitric acid to form the important nitrates, as previously explained. The process by which nitric acid is formed is called *nitrification*, and the bacteria which are instrumental in bringing about nitrification are called *nitrifying bacteria*. Nitrification requires the presence of free oxygen, and therefore cannot go on in the absence of air. Warmth and moisture are also necessary.

There is one more possible change which must not be overlooked. It has been stated that ordinarily the bacteria which cause fermentation require air. There are, however, some kinds of bacteria which can cause organic matter to ferment in the absence of free oxygen. Oxygen is necessary to fermentation, and in the absence of free oxygen, these bacteria obtain their supply by breaking up any nitrates that may be present, using the oxygen of the nitrate, and allowing the nitrogen of the nitrate to escape as a gas. These bacteria, therefore, are very injurious to manure, since they destroy the valuable nitrates and allow their nitrogen to escape. Their effect is directly opposite to nitrification, and hence it is called *denitrification*.

The conditions favoring denitrification, according to Prof. Warington, are: 1. The presence of denitrifying bacteria. 2. The presence of a nitrate and suitable organic matter. 3. Such a condition as to aeration that the supply of free oxygen shall be limited, 4. The usual essential conditions of bacterial growth, as plant food, moisture, and a suitable temperature. Of these conditions, Warington considers an abundant supply of organic matter as most important. On the other hand, nitrifying bacteria require organic matter containing nitrogen, an abundant supply of free oxygen, the presence of some element such as calcium, potassium, or sodium to combine with the nitric acid, together with a suitable temperature, degree of moisture, etc.

It will be seen therefore that fermentation may produce injurious as well as beneficial results. It must also be borne in mind that fermentation and nitrification must take place before the nitrogen of farmyard manure can be of any use to plants, and therefore the point to be considered is how to bring about fermentation with the least danger of loss.

A very common European practice which also has some advocates in this country, is to cause considerable fermentation of the manure while in the heap. In defence of this method, it is claimed that the fermented product contains more available plant food than unfermented manure. No doubt this claim is true, but it may be questioned whether the available plant food was not obtained at too great a cost. If air is freely admitted to the heap, fermentation is extremely rapid and a large quantity of ammonia is evolved, carrying away with it much of the valuable nitrogen. Manure that has fermented very rapidly, frequently presents a scorched appearance, and is said to be "fire-fanged." Such manure is practically worthless. If air is largely excluded by packing the manure so as to check fermentation, then conditions prevail which favor denitrification of some of the nitrates which may be formed. A careful study of the question leads to the conclusion that the conditions existing in the manure heap are rather more favorable to denitrification than to nitrification, and that attempts to bring about nitrification in the manure heap are almost certain to be accompanied by a great loss of nitrogen, principally in the form of ammonia.