

**ON THE DIGESTIVE FERMENTS AND THE  
PREPARATION AND USE OF  
ARTIFICIALLY DIGESTED FOOD; BEING  
THE LUMLEIAN LECTURES FOR THE YEAR  
1880. DELIVERED BEFORE THE ROYAL  
COLLEGE OF PHYSICIANS**

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**WM. ROBERTS**

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Delivered before the Royal College of Physicians.

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## LECTURE I.

SUMMARY.—DIGESTION IS A FACULTY OR FUNCTION COMMON TO ANIMALS AND PLANTS—EXTERIOR DIGESTION—INTERSTITIAL DIGESTION—GENERAL CHARACTERS AND PROPERTIES OF THE DIGESTIVE FERMENTS—PREPARATION OF ARTIFICIAL DIGESTIVE JUICES—DIASTATIC FERMENTS AND THE DIGESTION OF STARCH—THEORY OF THE PROCESS—THE RESPECTIVE SHARES OF SALIVA AND PANCREATIC JUICE IN THE DIGESTION OF STARCH—WHEN CAN STARCH BE SAID TO BE FULLY DIGESTED?—ABSOLUTE ENERGY OF DIASTASE—DIGESTION OF CANE-SUGAR—AND THE INVERSIVE FERMENT.

DIGESTION has been usually regarded as the special attribute of animals. They receive into their alimentary canal the food which they require for their sustenance in a crude form. It is there subjected to the action of certain ferments which transmute its elements, by a peculiar chemical process, into new forms which are fitted for absorption. Looked at in this restricted sense, plants have no digestive function. They possess no alimentary canal nor any vestige of a digestive apparatus. But when the matter is examined more profoundly it is seen that plants digest as well as animals, and that the process in both kingdoms of nature is fundamentally the same.

In order to understand this generalization—which was first propounded by Claude Bernard, and constitutes one of the most important fruits of his splendid labours\*—it is necessary to recognize digestion under two types or conditions—namely, a

\* Claude Bernard—*Leçons sur les phénomènes de la vie*, T. II. Edited after his death by Dastre—Paris, 1879.

digestion which takes place exteriorly at the surface of the organism, and a digestion which takes place interstitially in the interior of the organs and tissues.

*Exterior* digestion is that common process with which we are familiar as taking place in the alimentary canal of animals, by which the crude food introduced from without is prepared for absorption.

*Interstitial* digestion, on the other hand, is that more recondite process by which the reserves of food lodged in the interior of plants and animals are modified and made available for the purposes of nutrition.

These two types of digestion are essentially alike both as regards the agents, and the processes by which they are carried out—and although one type of digestion is more developed in the animal kingdom and the other type more developed in the vegetable kingdom, both types are represented in the two kingdoms—and bear witness to the fundamental unity of the nutritive operations in plants and animals.

I shall only be able to indicate in outline the facts and arguments on which Bernard sought to establish these propositions.

#### *Exterior Digestion.*

We all know that the alimentary canal is simply a prolongation of the external surface; that the skin is continued, at either extremity, without a

break, into the alimentary mucous membrane. Accordingly the processes which take place in the digestive tube are, strictly speaking, as much outside the body as if they took place on the surface of the skin. Upon this inner surface, if I may so call it, are poured out the digestive juices, charged with the ferments which are the special agents of the digestive processes. This is the common condition of exterior digestion as it occurs in animals—but it is not the only condition. Among some of the lowest members of the animal series a permanent alimentary canal does not exist. In the amoeba any portion of the exterior is adapted for the reception of food. The morsel sinks into a depression formed on the surface at the point of impact—it is digested in this improvised stomach, and the indigestible portions are expelled through an improvised anus.

Among plants exterior digestion is a much less prominent feature than among animals, but examples of its occurrence and evidence of its importance are not difficult to point out. In the lowest orders of plants—fungi and saprophytes, which are devoid of chlorophyll—exterior digestion is probably a function of prime necessity. In all likelihood their carbon-containing food is only absorbed after undergoing a process of true digestion. The transformation of cane-sugar by the yeast plant is a striking example—though a distorted one—of exterior digestion. Cane-sugar is a crude form of food both to plants and animals, and requires to be transformed into invert-