

Professor A.I. Virtanen was born on 15th Jan. 1895 in Helsinki. During the years at the University in Helsinki his studies were turned besides chemistry also to biological subjects. After he had taken the doctor's degree in organic chemistry in 1918 he studied colloid chemistry at prof. Wiegner's laboratory in Zürich, bacteriology at prof. Barhtel's in Stockholm and biochemistry at prof. v. Euler's in Stockholm. In 1921 he became director of the laboratory of Valio, (the central organization of the Finnish co-operative dairies). From the small beginning - the staff consisted at first of Virtanen and the laboratory keeper - it grew in twenties into a research laboratory where young chemists and students gathered and where plenty of scientific work was performed in the field of biochemistry together with solution of practical problems. Especially enzyme chemistry and metabolism of micro-organisms are to be mentioned. In these investigations for instance the esterification of phosphoric acid with sugar was for the first time established in the bacterial fermentation processes, and the similarity of the chemical reactions of different fermentation processes was thus proved. In difficult outward conditions this laboratory undertook in 1925 investigations into elucidation of N-fixation by legume bacteria. This natural phenomenon upon which the plant and indirectly also the animal life decisively rest and which still forms the foundation of agriculture - e.g. in USA industrial nitrogen fertilizers were used annually before the war in amounts which contained about 0.5 mill. tons of nitrogen, whereas the legume bacteria fixed according to Lipman's calculations 5.5 mill. tons of nitrogen and the free-living nitrogen fixing bacteria 4.4 mill. tons. The elucidation of the biological N-fixation is thus of paramount importance. In 1931 the large Biochemical Institute was established in Helsinki, consisting of the laboratory of Valio and of that of the Foundation for Chemical Research. As director of this institute Virtanen has continued together with his collaborators in

favourable outward conditions the elucidation of N-fixation. Much light has been thrown on this mysterious phenomenon during the past 20 years and a well-founded hypothesis now exists of its chemical mechanism. The oxaloacetic acid present in the plant juice is ~~connected with~~ <sup>connected with</sup> N-fixation as a central carbon compound and the formation of hydroxylamine in the N-fixation has ~~gained some evidence~~ <sup>been demonstrated</sup>. The possibility still remains that also ammonium is formed as an intermediate product but it has not been proved experimentally. Virtanen has also accomplished N-fixation with excised root nodules, he has developed a micro method for determination of N-fixation and has showed the close relationship between the haemoglobin system of the root nodules and the N-fixation. The change of leghaemoglobin (= haemoglobin of the root nodules) to green pre-cursors of bile pigments offers an interesting resemblance to the changes of red pigment of blood occurring in the animal organism. Also the biology of legume bacteria has been examined by Virtanen and the introduction of ~~sterile~~ sterile culture method to these studies in 1929 has laid a reliable foundation for experimentation on these lines. Virtanen has also proved the differing efficiency of legume bacteria strains and the amazing constancy of this property as well as the ~~significant~~ significant bearing the first bacterial strain invading the nodule has on the N-uptake of plants.

After having personally observed the immense possibilities the effective cultivation of legumes offered to agriculture and especially to dairy farming Virtanen undertook the solution of the problem how this effective cultivation can be attained. It became evident that decisive means was to work out a reliable and effective method for conservation of protein rich legume crops. The principle of such a method became clear in 1925, the first practical conservation ~~trials~~ trials were carried out in 1928 and the following year the method was introduced into practice. Under the name of AIV-method this method has spread to different ~~countries~~ countries. Its theoretical foundation is clear and simple and thereby

the problem of conservation of fresh fodders has got its solution.

Virtanen has proved conclusively that the decomposition processes taking place in silage are dependent on the pH of the fodder (the evolution of carbon dioxide and the formation of ammonium and volatile fatty acids) and thus simplified the estimation <sup>(of the quality)</sup> of fodders. The exact determination of decompositions and losses according to the method of Virtanen whereby the gas and the effluent formed can be collected is of particular importance in removing the confusion and the uncertain results existing in the field of fodder preservation.

It is ~~is~~ especially significant that also the vitamins are preserved in the fodder when this method is used and thus it is possible to produce in winter milk with same vitamin content as in summer. This is of especial importance in view of popular health because the vitamin A potency of the ordinary winter milk is only 1/3-1/2 of the corresponding potency of ~~the~~ summer milk and accordingly lack of vitamin A is generally noted in popular diets during winter and spring.

Virtanen, whose AIV-method opens new possibilities for the development of agriculture and dairying, is originally not an agriculturist, but has become one through his works. His interest towards farming is great and in the course of years deepened so that in 1933 he bought himself an experimental farm in the neighbourhood of Helsinki. Here he has adapted his ideas and methods to use and has attained without purchased nitrogen fertilizers and concentrates an average production of 4000 kgs per cow per year and a high yield per hectare. During 12 years he has thus proved in practice the applicability of his ideas.

Prof. Virtanen and his collaborators have worked in different fields of biochemical research and his name is internationally known. Both in England and in USA, not to mention the Scandinavian countries, he has many friends among scientists.