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Catholic Physicians' Guild

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## INSTITUTUM DIVI THOMAE

A BRIEF SURVEY OF THE PURPOSES OF THE INSTITUTE  
AND OF ITS PROGRESS\*

Institutum Divi Thomae in Cincinnati is an institution for scientific research and for the training of limited numbers of research workers. It was established in June, 1935, by His Grace, the Most Reverend Archbishop John T. McNicholas, O.P., of Cincinnati. No distinction is made regarding the religious convictions of staff members or those in training. Its broad purposes include the investigation of fundamental problems in various fields of science; the establishment and co-operative assistance of research laboratories at affiliated colleges, hospitals, and other institutions; and the consideration of science in its relation to philosophy.

Research at the Institute is under the direction of Dr. George Speri Sperti, member of the Papal Academy of Sciences and former Director of the Basic Science Research Laboratory at the University of Cincinnati. Administration, other than research, is under the direction of the Very Reverend Cletus A. Miller, Dean of the Institute.

Institutum Divi Thomae is not a graduate school in the ordinary sense of affording training to those wishing to enter the teaching profession. Its entire training program is directed toward

the development, as outstanding research workers, of limited numbers of persons who show creative ability in science. An intensive experience in research is afforded such persons, and the formal training given them is especially planned to afford them a broad knowledge of the basic sciences (mathematics, physics, chemistry, and biology), as well as advanced training in their special fields. In accomplishing this purpose, no endeavor is made to conform to the conventional systems of credits of universities, nor is the Ph.D. degree (which in this country often means a professional qualification rather than reliable evidence of ability to do creative work) granted.

Since its opening, research work has been and is being done in the following fields: plant physiology, genetics, chemical spectroscopy, cancer research, biochemistry, biophysics, synthetic organic chemistry, vitamins, optics, and philosophy in relation to science. The contributions in each of these fields will be reviewed in what follows.

Scientific papers from the Institutum are published in part in outside journals and in part in its own journal, *Studies of the Institutum Divi Thomae*, which has a mailing list of about three thousand, to forty countries of the

\* Adapted from a pamphlet published by the Institute, Cincinnati, Ohio.

world. Through the medium of the *Studies*, various institutions are reached (especially in foreign countries) which do not have available many of the standard American and English scientific journals.

#### PLANT PHYSIOLOGY

Studies of the conditions affecting the formation of pigments in plants have included the development of photo-electric methods of pigment estimation; the demonstration that, while chlorophyll is not developed in the absence of light, carotene and xanthophyll and a colorless substance which may be protochlorophyll are; investigations of the effects of pressure and light on plant pigment formation; quantitative studies of the relationship between chlorophyll production and light energy, and studies of the effect of seed size on the quantities of pigments formed in seedlings.

More recent investigations have been concerned primarily with growth phenomena in plants. Preliminary researches on bending and cell enlargement in the hypocotyl of *Helianthus annuus* have been reported. By means of a sensitive optical lever method, rhythmic growth in seedlings has been demonstrated. Further investigations of plant growth phenomena are in progress, among the most unique of which are studies of chemical growth factors utilizing tissue cultures of pollen tubes as an assay method.

It has been shown that phyto-

hormones are associated with the floral organs, and a pigmented nucleus has been discovered in *Hymenocallis tubiflora*.

#### GENETICS

Investigations of mutations produced by X-rays in the fruit fly *Drosophila melanogaster* have been concerned primarily with the use of accurate physical methods of detecting mutants. By measuring the phototropic response of such flies with colored light of narrow spectral range, and by studying eye-color mutants by means of quantitatively determined reflection spectra, it has been shown that accurate quantitative methods of determining mutations may lead to results quite different from those obtained by other quantitative methods.

#### CHEMICAL SPECTROSCOPY

Two lines of investigation have been followed in this field—the application of absorption spectroscopy to the identification of metabolic stimulating factors which have been isolated from cells in these laboratories, and fundamental studies of the relationship between ultraviolet absorption spectra and chemical structure. With regard to the latter problem, a large amount of data, as yet unpublished, has been collected concerning the effects of tautomerism on the absorption of purines and pyrimidines, and certain quantitative methods have been developed for calculating the magnitudes and shapes of absorption curves

from the chemical groupings and substituents in the absorbing molecules.

#### CANCER RESEARCH

The approach to the cancer problem at the Institutum has been primarily in the field of cellular physiology — an approach adopted as a result of some fifteen years of research in this field by Dr. Sperti, Director of the Institutum, and certain of his associates, prior to the opening of the present institution. It is felt that the unsatisfactory experience in the treatment of cancer by such lethal agents as X-rays and radium, points emphatically to the need of a clear characterization of the abnormal physiology of the cancer cell and, if possible, the finding of methods of changing this abnormal metabolism to a more normal kind as the chief hope in the control of cancer.

Two characteristics of tumors have received particular attention: the apparent etiological relationship of many types of tumors to long-continued cellular injury, and the peculiarly high ratio of glycolysis to respiration found by Warburg and others as a general phenomenon in tumor tissue.

With regard to the first of these problems, a study has been made of products formed by cells when they are injured by various lethal agents. This has led to the isolation from such cell suspensions of proliferation-promoting factors, which are evidently produced

by the living cells as a physiologic response to injury. Preliminary chemical studies of these factors have shown them to be related to nucleic acids. Repeated injection of these "intercellular wound hormones" into animals has led to the formation of tumor-like growths.

With regard to the second problem, a search has been made for factors produced by cells which control cellular proliferation, respiration, and glycolysis. This had led to the isolation of several partially-purified proliferation, respiration, and fermentation stimulating concentrates from various cells and tissues. These factors are evidently quite specific in their action on various types of cells depending on their source and method of preparation. The addition of appropriate respiratory-stimulating concentrates to mouse tumors has been shown to stimulate their respiration, and in more recent studies both stimulation of respiration and depression of anaerobic and aerobic glycolysis has been obtained with such factors on transplantable, methylcholanthrene, and spontaneous mouse and rat tumors. Preliminary chemical studies of the respiratory factors have been aimed principally at obtaining them in more highly purified form.

Other studies relating to the cancer problem have included investigations of the relation of tissue respiration to the age of animals and studies of the effects of X-rays and carcinogenic hydro-

carbons on cellular respiration.

A review of much of this work has recently been prepared.

#### BIOPHYSICS

Contributions in this field have included various studies of the effects of radiation on animals, and cells, as discussed in the foregoing paragraphs, investigations of photoelectric methods of microorganism population counts, physical calculations of heart overload, a review, now in preparation, of borderland problems in biology and physics, and a survey of pedagogical problems in medical physics.

#### VITAMINS

The particular contributions in the field of vitamins have been concerned with topically-applied vitamins A and D. It has been shown that both of these vitamins are absorbed through the skin and are effective in protecting against their respective deficiency diseases when so applied. Further studies have shown that washing removes the vitamin D precursor from the human skin. Work in progress includes a study of anti-rachitic activation of substances by soft X-rays. A study has been made of the effect of vitamin A deficiency on the respiration of rat liver.

#### OPTICS

A paper describing a push-pull photo-electric photo-densitometer for determining fine structure in absorption spectra has recently

been published, and preliminary investigations have been made of characteristics of photographic emulsions in the ultraviolet. Efforts in this field are now concerned on the development of automatic methods of spectroscopy by the use of various scanning devices in conjunction with cathode-ray registration.

#### GENERAL CONSIDERATIONS

It is evident from the foregoing that research investigations at Institutum Divi Thomae cover a wide range of subjects. The fields investigated are adapted both to the problems which present themselves as of greatest interest at the time, and to the needs of Associates and Assistants in training at the Institute.

#### AFFILIATED LABORATORIES

In 1938, an affiliated research laboratory was established at Rosary College, Chicago, where investigations are concerned primarily with tumor metabolism. A laboratory established at Siena Heights College, Adrian, Michigan, late in 1939 will concern itself primarily with certain problems in physical chemistry, and one opened at Good Samaritan Hospital, Dayton, Ohio, in September, 1939, is at present investigating the use of selected wavebands in the ultraviolet spectrum in heliotherapy. It is planned to open other laboratories in affiliation with the Institutum.