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FRONTISPIECE DESIGN:
ALCHEMISTS MELTING CRUCIBLE SURROUNDED BY BURNING COAL
FROM AN OLD ITALIAN M. S. (1464)

I N D E X

1. E. B. CHAIN and G. GUALANDI — Aeration studies	p.	5
2. E. B. CHAIN, S. PALADINO, F. UGOLINI, D. S. CALLOW and J. VAN DER SLUIS — A laboratory fermenter for vortex and sparger aeration	»	61
3. S. PALADINO, F. UGOLINI and E. B. CHAIN — Fermenters of 90 and 300 l capacity for vortex and sparger aeration	»	87
4. S. PALADINO and F. UGOLINI — A « compensated » stuffing box and bearing unit for fermenters of semiindustrial and industrial capacities	»	121
5. E. B. CHAIN, S. PALADINO, F. UGOLINI and D. S. CALLOW — Pilot plant for fermentation in submerged culture	»	132
6. S. PALADINO — A simple rotary shaker	»	145
7. D. GHOSH and S. J. PIRT — Antifoam agents in aerobic fermentations. Evaluation of the activities of antifoam preparations	»	149

(Continued on Inside back cover.)

8. R. CAVANNA, E. B. CHAIN, C. G. HEDEN, B. MALMGREN, N. ELIAS- SON, E. HAMMARSTEN and S. AQVIST — Interrelation of pro- tein and polynucleotide synthesis in « Escherichia coli »	p.	168
9. W. M. DION, A. CARILLI, G. SERMONTI and E. B. CHAIN — The effect of mechanical agitation on the morphology of « Penicillium chrysogenum » . Thom in stirred fermenters	»	187
10. M. J. THIRUMALACHAR — Romanoa, a new genus of soil fungus with antibacterial activity	»	206
11. G. SERMONTI — Genetics of Penicillium chrysogenum. - I. Hetero- karyosis in « Penicillium chrysogenum »	»	213
12. G. SERMONTI — Genetics of « Penicillium chrysogenum ». - II. Se- gregation and recombination from a heterozygous diploid.	»	231

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DEDICATION

This volume is dedicated in friendship and admiration to Professor Domenico Marotta, Director-General of the Istituto Superiore di Sanità, through whose superb leadership, farsighted vision and exceptional organizing ability a great European Research Centre with unique experimental facilities has been created.

Without his unfailing support and encouragement the work described in this volume, including the construction of a pilot plant for the bulk production of micro-organisms and their metabolites — a powerful tool for biochemical research, but setting many difficult technical and organizational problems — could not have been accomplished.

E. B. CHAIN

PREFACE

The suggestion was made to us by Messrs Blackwell Scientific Publications and also by a number of our English speaking friends that in order to make the results of the different research activities of the Istituto Superiore di Sanità more readily accessible to a wider circle of interested persons it would be desirable to publish an English Edition of the Institute Journal, the "*Rendiconti*", in which a selection of the more important research developments made in the various departments of the Institute would be published at regular intervals.

We are very happy to have finally been able to meet these wishes and to introduce with this volume an English Edition of the *Rendiconti del Istituto Superiore di Sanità*.

In addition, it is planned to publish in form of special supplements the Proceedings of Symposia on subjects of topical interest which are held from time to time under the auspices of the Institute, often in collaboration with international organisations. A beginning in this direction has already been made with the publication of six Symposia on microbiological subjects held in Rome in connection with the VI International Congress of Microbiology and the Symposium on the Control of Insect Vectors of Disease, sponsored jointly by the World Health Organisation and the Istituto Superiore di Sanità.

The present volume contains a series of papers from one of the youngest sections of the Institute, the International Research Centre for Chemical Microbiology, which was inaugurated in 1951 and is under the scientific direction of Professor E. B. Chain, F.R.S.

Chemical Microbiology is a branch of biochemistry which assumes an ever increasing importance both scientifically and industrially. The spectacular development of the field of antibiotics, following the discovery of the remarkable chemotherapeutic properties of the mould metabolite penicillin by Chain, Florey and their colleagues at Oxford is too well known to be further commented upon on this occasion. But apart from antibiotics there exist many other substances of microbial

origin of very great interest to the biochemist, the biologist and the industrialist.

The study of the metabolism of microorganisms, their enzymes and coenzymes, has in many instances been of the greatest value for the understanding of the metabolic mechanisms of cells of higher animals, and frequently microorganisms are a better source of some of the important vitamins than animal tissues.

Hence the availability of the methods for the production of microorganisms and their metabolic products is a matter of considerable importance. One of the difficulties encountered in this field is that some of the most interesting microbial metabolic products, having a catalytic function, are produced by the microorganisms only in minute amounts, and in order to produce them in bulk it is frequently necessary to have available facilities for the production of large quantities of culture fluid, as well as the equipment for extracting and concentrating the desired substances. For this purpose special pilot plant equipment of almost industrial dimensions is required which normally is not available in academic research laboratories.

In order to fill this gap and make adequate research facilities in at least some of the most important sections of chemical microbiology internationally available to biochemists requiring them, the International Research Centre for Chemical Microbiology was created and has been provided with a fermentation pilot plant and all the accessory equipment for the production in bulk of non-pathogenic microorganisms or their metabolic products.

In the field of chemical microbiology, and particularly in the mass production of microorganisms problems frequently arise the solution of which require the closest collaboration between the chemist, the microbiologist and the microbiological engineer.

The present volume represents the results of a collaborative effort of this type. The work described is primarily concerned with technical aspects of submerged fermentation, and special attention has been given to aeration studies and the design of fermenters of different dimensions. A number of technical innovations, some of industrial applicability, have been described; they have been subjected to extended practical tests and it is hoped and believed that they will serve to improve both the industrial and laboratory technique of submerged fermentation. In this connection it is a pleasure to acknowledge the important contributions of Professor Dr. S. Paladino and Doctor F. Ugolini towards the development of the vortex aeration system and the stuffing boxes.

The fermenters and their accessories as well as their routine operation have been described in sufficient detail to enable anyone interested in the field to build similar equipment and to manipulate it effectively. The biochemical results of investigations on different fermentations which have been obtained with the equipment described in this volume will be published in subsequent issues of the English Edition of the *Rendiconti*; however, one paper of biochemical nature is included in the present volume; it describes work carried out in collaboration with Professor E. Hammarsten, director of the Caroline Institute of Chemistry, Stockholm, and his collaborators, which was begun in Rome in the fermentation pilot plant of the Istituto Superiore di Sanità and continued with semi-scale fermenters developed in Stockholm. The present volume also contains some mycological observations on the effect of mechanical agitation on the morphological appearance of mycelium of *penicillium chrysogenum*, and genetical studies in which facile methods for the production of heterokaryons in *penicillium chrysogenum* are described, which it is hoped will make possible the application of biochemical genetics to this type of microorganism for the purpose of studying metabolic pathways.

The International Research Centre for Chemical Microbiology has given hospitality to guest research workers from many nations, including numerous Fellows of the World Health Organisation to which the Centre has been affiliated since its conception in 1951; the names of several of these appear as co-authors of the papers. A list of WHO Fellows and guest research workers of the International Centre for Chemical Microbiology is appended below.

The work of all sections of the Istituto Superiore di Sanità has always been conducted in the spirit of furthering international scientific collaboration on the widest possible scale, and with this aim in view many foreign scientists have been welcomed as guests in its various laboratories.

The decision to publish in English the principal research work of the Institute which covers a wide range of pure and applied science has been conceived in the same spirit; it is hoped that the English Edition of the *Rendiconti* may represent a contribution of real value towards the advancement of international science and it is believed that as such it will fulfil a useful function.

With the hope that the new venture will meet with the approval and receive the support and encouragement of our colleagues in the different branches of scientific research all over the world the first

volume of the *English Edition of the Rendiconti dell'Istituto Superiore di Sanità* is sent to press.

In conclusion I wish to express my appreciation and gratitude to Professor E.B. Chain, F.R.S., N.L., who has directed and co-ordinated the work described in this volume; my thanks are also due to our Italian and Foreign colleagues for their valuable contributions, and last but not least to all members of the permanent technical staff of the Institute who have to a large measure been responsible for erecting and keeping in function the fermentation pilot plant and have spared no fatigue or effort in carrying out their allotted often physically and mentally tiring tasks with conscientious and enthusiastic devotion to duty and in that splendid spirit of collaboration which is an essential requisite for the success of team work, indispensable in Chemical Microbiology and becoming more and more frequently a prominent feature in many other fields of modern scientific research.

Roma, 1954.

DOMENICO MAROTTA

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