Statistical Societies or Associations; Non-Official or Semi-Official Statistical Agencies; System of Official Statistics; Principal Official Serial Statistical Publications.

An interesting and useful feature of the book is a biographical directory of the prominent statisticians (370 names) for all American nations except the United States. Appendix 1 is an excerpt from "The Economic Literature of Latin America," Harvard University Press. Appendix 2 is a report of the meeting of the statistical section of the Eighth American Scientific Congress, which was held in May, 1940.

This book is the first attempt to present a comprehensive account of what is going on statistically in North and South America. In view of the pressure of world events it is a timely document. It should at least serve to disseminate knowledge of the various statistical activities going on in the Western Hemisphere and to introduce important statisticians and statistical administrators in the hemisphere to each other.

S. S. WILKS

GLASS: THE MIRACLE MAKER

Glass: The Miracle Maker. By C. J. PHILLIPS, Corning Glass Works, Corning, N. Y. xii + 424 pp. 208 figures. 41 tables. New York: Pitman Publishing Corporation. 1941. $4.50.

"GLASS: The Miracle Maker" occupies a unique position in the relatively small library of books that are related to this subject. It can be roughly classified in a position intermediate between the type of book designed for a reader of popular science material and that intended for the glass technologist. For the former individual, the author suggests that the more technical chapters on chemistry and mechanical and physical properties be omitted if so desired. However, exclusive of these chapters, certain of the nomenclature employed in the remaining portions may cause the lay reader of science subjects some difficulty. Even with the inclusion of the aforementioned technical material the book can scarcely be considered sufficient in scope for use as a text by the student of glass technology.

The author in the foreword states: "This book is intended primarily, but not exclusively, for the architect, the civil, mechanical, electrical or chemical engineer, the industrial designer, or other industrial executive—in short, for those who may see in glass a unique and versatile material, interesting in its own right, and full of unexplored possibilities for creating products and improving production methods."

For these individuals the book has been wisely divided into two sections. Part One, devoted to History and Technology, includes the following topics: The History and Present Status of Glass; The Chemistry of Glass dealing with its constitution, composition and chemical durability; Mechanical and Other Physical Properties of Glass, including elasticity, hardness, strength, thermal endurance, density, coefficient of expansion, heat conductivity, viscosity and electrical and optical properties; Materials Handling, covering methods of unloading, storage, weighing, mixing and charging the raw materials that constitute a glass batch; Fuels, Refractories, Furnaces and the Melting Process; The Principles of Glassworking, including glass blowing, the production of mold ware, tubes and rods, casting and lamp-working; Glassworking Machinery; Finishing, Annealing, Decoration and Inspection.

In Part Two the author devotes over 160 pages to Applications and discusses the multitude of uses found for glass in architecture and building construction, in the home, in electrical transmission and communication, in illumination, in manufacture and in science and research. The last chapter considers the utilization of fiber glass. It is this latter portion of the book that is unique in its excellent portrayal of the rôle played by glass in modern civilization.

One of the outstanding features in "Glass: The Miracle Maker" is to be found in the some 150 excellent photographic illustrations. Particularly outstanding are those depicting "offhand" glass blowing and the Steuben art glass collection. Each chapter is ended with a list of references for further studying the subjects. These features go toward fulfilling the hope of the author that his book will meet the needs of engineers and industrial designers. The glass technologist himself may find in it a source of not too highly technical, yet interesting and perhaps profitable information.

The format is particularly attractive and a book mark of fiber glass is appropriately enclosed.

H. W. SAFFORD

UNIVERSITY OF PITTSBURGH

REPORTS

RESEARCHES AT MELLON INSTITUTE 1941–42

OUTSTANDING at Mellon Institute during the fiscal year ended February 28, 1942, has been the growth of the industrial research staff to 205 fellows (from 187) and 150 fellowship assistants (from 114). The services of these scientists and engineers have been required on the 95 industrial fellowships in operation.

The investigational exigencies of the emergency have in fact caused a considerable expansion in the activities of certain fellowships, particularly those concerned with coke by-products, and have resulted in many special studies for Federal Government agencies by various fellowships, such as those pertaining to heat-insulation, petroleum, plate glass, protective coatings, synthetic organic chemicals and tar synthetics. The range of the programs of most fellowships has regard for post-war economic problems. During the fiscal year from March 1, 1941, to March 1, 1942, the institute has expended $1,378,752 in carrying on its various pure and applied science projects. These particulars are brought out in the twenty-ninth annual report of the director, Dr. E. R. Weidlein, to the trustees of the institution.

In the institute's department of research in pure chemistry studies on the chemistry and chemotherapy of modified cinchona alkaloids and related synthetics have been continued. In the findings to date there has been no beneficial action of quinine which can not be accomplished equally well by hydroxyethylapocupreine, a drug which is greatly superior to quinine in pneumonia, in infections of the eye and throat and in certain asthmatic conditions. Because of the possible difficulty in obtaining adequate supplies of cinchona alkaloids, investigations are under way aimed at the production of simpler compounds which can be made from easily available materials. It is hoped that medically important chemicals can be prepared by the application of knowledge of the structural and biological relationships obtaining in the cinchona field.

In studies for the twelfth revision of the U. S. Pharmacopoeia different assay procedures for new synthetic organic chemicals have been evaluated. And much attention has been accorded to the chemical durability of glass containers for pharmaceutical solutions.

The projects subsidized by Mellon Institute at the Institute of Pathology of the Western Pennsylvania Hospital have related to chemotherapeutic and bacteriologic researches largely pertaining to the effects of the sulfonamides. A new sulfhydryl preparation has been found to possess utility in the treatment of burns. Work has proceeded on natural resistance and the common cold and on the role of certain enzymes involved in the metabolism of oxygen and carbon dioxide. The objective of the latter investigation is to acquire facts concerning the relation of these enzymes to the underlying metabolic disturbances associated with arthritis. Another program has been concerned with the bacteriology of subacute bacterial endocarditis.

Industrial Hygiene Foundation, a combined research and service association for health protection in the industries, which maintains its headquarters at Mellon Institute, is especially active these days. Battle lines in to-day's wars advance and retreat with production. The protection of industrial workers, who are forging the weapons, therefore becomes a supreme necessity, riveting attention on their health as never before in history. And rightly so, for increasing production tends to increase health hazards in industry. Unless successful remedies are swiftly applied, approximately one billion man hours will be lost through illness during 1942 when production means protection.

Investigations of Industrial Hygiene Foundation have pertained to the effects of arc-welding fumes on susceptibility to tuberculosis, to the reactions of living tissues to silica granules, to the appraisal of x-ray films for use in physical examinations in the industries and to the evaluation of present exhaust ventilation for the control of industrial health hazards. Since early in 1941 the foundation has been studying sick absenteeism in the industries. Fatigue is another topic that is getting constant consideration. The report also includes a review of the work on aluminum powder as a possible preventive in silicosis.

Nine new industrial fellowships started on their researches during the fiscal year: calcite technology, coke-plant construction materials, fur, lock-nut technology, naphthalene chemistry, packaging, pine chemicals, tape technology and tar constituents. Eight fellowships completed their investigational programs during the year. The annual publications consist of 5 bulletins, 34 research papers and 53 other articles. Fifty-three United States patents have been issued on fellowship inventions.

Of special interest is the information set forth regarding continued industrial fellowship researches. Anthrafloss is a high-grade mineral wool for insulating purposes made from anthracite by-products by the multiple fellowship of Anthracite Industries, Inc. The multiple fellowship on heat insulation and roofing has aided in the development of an efficient insulating material suitable for temperatures up to and including 1500° F. A prominent consequence of the research program of the multiple fellowship on plastic metals has been the construction of a large commercial sponge-iron plant. The activities of other fellowships have benefited gray cast-iron and steel production. Of pertinence here is the research of another fellowship on the refining of chromium. The multiple fellowship of the American Iron and Steel Institute has pursued steadily the utilization of waste pickle liquor. Research initiated by this fellowship has been conducted on five potential processes for the recovery

of values from this industrial waste; the investigational work includes the recovery of free sulfuric acid and copperas, the manufacture of iron carbonate and ammonium sulfate, the production of magnesium from low-grade ores by leaching with waste pickle liquor and the preparation of sodium sulfate and ferric chloride.

In the realm of ceramics, cast-iron enameling, hollow-ware enameling materials, flat glass and waste grinding sand from plate-glass manufacture are the projects of various fellowships. The multiple fellowship on plate glass technology has brought about substantial advances in methods for evaluating flatness and texture of surfaces. Garspar, Garcolite and Gartex are being made commercially from waste grinding sand as a result of the research and development work of the mineral products fellowship. New markets have been evolved for Garspar in the fields of pottery and glass; Garcolite has been used as a pulverulent aggregate in concrete; Gartex is a processed filler for rubber, plastics and paints.

The multiple industrial fellowship on sulfur has been devoting main study to sulfur cements, to the reaction of gaseous olefins with sulfur and to the employment of sulfur as a filtering medium. The efficiency of sulfur in removing sediment from water was found to equal or surpass that of sand filters. The multiple fellowship on gas by-products has made many new inorganic and organic thiocyanates. A novel series of rubber accelerators has been discovered by this group. Other fellowships are investigating the upgrading of the components of coke-oven light oil, the physical properties of tars and pitches and their improvement, new products from tars and problems of waste disposal in the by-product coking industry. A process has been devised for the commercial recovery of cyclopentadiene, of great interest as a potential copolymer in the preparation of synthetic rubber and resins. Several types of natural gasoline and casing-head gasoline have been shown to contain amounts of isobutane and isopentane which make them desirable for sources of alkylation materials and for the production of 100-octane grade aviation fuel. The feasibility of installing a butane extraction plant has been demonstrated; normal butane is useful in the manufacture of butadiene for synthetic rubber production.

The multiple fellowship on petroleum, which has been in operation since 1911, has had another year of creative activity. The study of the chemical constitution of high melting waxes has been carried onward as has also that of the overall chemical nature of crude petroleums. Another fellowship is probing the composition of petrolatum. The twenty-eighth year of the operation of the multiple fellowship on organic synthesis has followed the usual pattern of development of new products and utilization of these chemicals to meet changing demands of the industries. Investigations on the manufacture and applications of amines, detergents, lubricants, hydraulic fluids and synthetic resins have been lengthened with success. Research in oil additives has uncovered compounds having marked detergent and anti-oxidation properties. The search for successors for chemicals unobtainable because of the war has brought forth promising products. The physiological effects of new organic compounds are being investigated by the multiple fellowship on chemical hygiene.

Mellon Institute is also quite energetic in food and nutritional research. The multiple fellowship on food varieties has perfected a new type of instant baby cereal and several novel junior foods, and a project has been begun that will survey the whole field of food flavors. A process for the rapid tenderization of meat worked out by a fellowship is now in use in 23 plants.

A fifth year of success in cotton investigation has been had by the multiple fellowship sponsored by the non-profit Cotton Research Foundation, technical agency of the National Cotton Council of America. Studies on the fiber have received most attention; investigations on the practicability and on methods of adapting virgin cotton to the manufacture of high-grade papers have been continued; fundamental research on the properties and structure of cotton cellulose and on the influence of such processes as mercerization is being conducted by novel techniques. The studies on cottonseed began to mature in encouraging fashion during the past year. The industrial fellowship on felt has devised methods which impart to paper-machine felts and other woolen industrial fabrics markedly improved physical characteristics and resistance to chemical injury. This fellowship has also worked out a process for rendering wool and wool fabrics non-shrinking and non-felting, and an improved system of wool scouring and scouring-room control that has brought an average daily increase in production of better than 75 per cent. A third textile fellowship has made important advances in the processing of hosiery yarn, particularly nylon.

The fellowship on bone products has announced methods for obtaining higher yields and grades of glue; this fellowship has lately been studying granular adsorbents for use in sugar refining. The fellowship on rubber technology is increasing its staff for fundamental studies of underlying problems of the industry. Raolin, a special chlorinated rubber, the creation of another fellowship, is being allocated ac-

cording to Federal Government instructions and a substantial plant expansion program has been undertaken. Of interest in connection with needs for plastics is the program of the multiple fellowship that is engaged in research on polymerizable silicon compounds. The likely uses of these silicon derivatives are many and varied; certain applications have been proposed which have potential utility in warfare. Fellowship research is also being conducted on the employment of plastics in water and gas meters and for many other purposes.

W. A. HAMOR

SPECIAL ARTICLES

PHOSPHORYLATIVE GLYCOGENOLYSIS AND CALCIFICATION IN CARTILAGE[1]

PHOSPHORYLASE, an enzyme which catalyzes the reaction

Glycogen + inorganic phosphate ⇌ glucose-1-phosphate

(the first step in phosphorylative glycogenolysis in muscle and liver),[2] has recently been found in significant concentration in the epiphyses of growing rats and rabbits.[3] This enzyme can initiate conversion of the glycogen of hypertrophic cartilage cells into phosphoric ester substrates for cartilage (bone) phosphatase, and may thus play a significant role in the calcification of cartilage. We have investigated this by determining the effects of known inhibitors of the glycogenolytic cycle in muscle[4] upon *in vitro* calcification of cartilage (Table I).

M/100 phlorizin markedly, in some experiments almost completely, inhibited calcification of cartilage in solutions containing 8 mg per cent. Ca and 5 mg per cent. P as inorganic phosphate. M/200 phlorizin consistently caused partial but definite inhibition, M/2,000 phloretin almost completely blocked calcification. Adding glucose-1-phosphate to these solutions restored the capacity of cartilage to calcify well, even in the presence of phlorizin or phloretin. Since phlorizin and its aglycone, phloretin, principally inhibit phosphorylase activity,[4] these results imply that phosphorylase is not only present, but that its action (the formation of glucose-1-phosphate) is necessary for calcification of cartilage in a medium containing P as inorganic phosphate.

How the P of glucose-1-phosphate is then made available for the formation of bone salts apparently depends upon the activities of 3 enzymes present in calcifying cartilage: phosphorylase, phosphatase and phosphoglucomutase, all of which act upon this ester. Significant dephosphorylation of glucose-1-phosphate by phosphorylase is improbable, at least under the equilibrium conditions of *in vivo* calcification, because the glycogen stores of hypertrophic cartilage do not increase as bone salts are deposited, but disappear. Direct dephosphorylation of much glucose-1-phosphate by phosphatase is also unlikely, for reasons given elsewhere.[3] Equilibrium conditions apparently favor conversion of glucose-1-phosphate by phosphoglucomutase to glucose-6-phosphate and thereafter (by the glycolytic enzyme system known to be present in cartilage),[5] to subsequent phosphoric esters of the glycolytic series. Such, at least, is the implication of observations made by Robison and Rosenheim,[6] which we have confirmed: *in vitro* calcification of cartilage in a medium containing P only as inorganic phosphate is blocked by M/1,000 cyanide, by M/1,000

TABLE I

EFFECT OF INHIBITORS OF GLYCOGENOLYSIS ON *in vitro* CALCIFICATION OF CARTILAGE* WHEN P IS SUPPLIED AS INORGANIC PHOSPHATE, AND AS PHOSPHORIC ESTERS OF THE GLYCOGENOLYTIC SERIES (pH ADJUSTED TO 7.4; TIME 18 HOURS; TEMP. 37°C.)

Phosphoric ester added to calcifying solution†	Inhibitor	Calcification
None (inorganic P only)	none	++++
"	M/100 phlorizin	+
"	M/200 phlorizin	++
"	M/2,000 phloretin	±
Glucose-1-phosphate	M/100 phlorizin	+++
"	M/2,000 phloretin	+++
None (inorganic P only)	M/1,000 KCN	+
"	M/1,000 iodoacetate	+
"	M/10,000 NaF	±
Glucose-1-phosphate	M/1,000 KCN	+
"	M/1,000 iodoacetate	+
"	M/10,000 NaF	±
2-phosphoglycerate	M/100 phlorizin	+++
"	M/1,000 KCN	+++
"	M/1,000 iodoacetate	++++
"	M/10,000 NaF	±
α-glycerophosphate	M/100 phlorizin	+++
"	M/1,000 KCN	+++
"	M/1,000 iodoacetate	++++
"	M/10,000 NaF	++++

* We used the proximal ends of the tibiae of 20–22 day old male rats made somewhat rachitic by 8–12 days maintenance on a Steenbock-Black diet. Each tissue slice was placed in a tube containing 40 cc. control or calcifying solution, the tubes being gently rocked mechanically in a water-bath. The slices were then stained with silver nitrate.

† Solutions contained the control basal salt solution (6) plus 8 mg per cent. Ca as $CaCl_2$, plus 5 mg per cent. P as phosphate buffer, plus (where added) 10 mg per cent. P as phosphoric ester, plus (where added) inhibitor. All concentrations are those in the final solution. pH adjustments were made by choosing suitable phosphate buffers; where phlorizin or KCN were added, it was necessary to make further pH adjustments with $NaHCO_3$ resp. HCl.

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[6] R. Robison and A. H. Rosenheim, *Biochem. Jour.*, 28: 684, 1934.