stances to the mucosa of the stomach; the authors have confirmed these results, showing that raw meat juice, β -alanine, and histamine stimulate, whereas undigested foods are without effect. The actual mechanism of stimulation is, however, not yet finally settled. The presence of extrinsic nervous connexions is unnecessary, but since a denervated pouch responds to the stimulation of the main stomach, one must assume that the effective stimulus is a chemical agent, carried by the circulating blood.

The authors have been unable to obtain unequivocal evidence of a hormone, such as postulated by Edkins, in the blood, and therefore incline to a view which advocates a common mechanism, as the basis of both mechanical and chemical stimulation. The stimuli produce an increased blood flow through the gastric glands resulting in an increased flow of gastric juice; in the case of mechanical distension, the motility of the stomach is involved in this effect. It is, however, possible that increased blood flow consequent on increased movements due to distension may be concerned only in the effects of mechanical stimulation, whilst the hormone mechanism may explain the results of chemical stimulation, more especially as Ivy reports, in a recent review of the subject, that a gastric pouch transplanted to a mammary gland secretes when gastrin (an extract of gastric mucous membrane) and histamine are applied to the surface of the main stomach, in which case an increased blood flow seems scarcely adequate as an explanation (v. *Journ. Amer. Med. Assoc.*, 1925, vol. 85, p. 877). It is to be noted, moreover, that in the case of the secretion of saliva, an increased blood flow through the salivary glands does not produce an increased secretion.

The gastric juice produced by local stimulation of the stomach is only part of that secreted in response to a meal. Before the food enters the stomach secretion occurs, produced reflexly by impulses set up by the sight and smell of the meal, together with those arising from its presence in the mouth itself. The arcs concerned in the latter reflex are situated in the brainstem, since the "psychic" secretion, as it is called, occurs in a decerebrate dog when given food. But Lim, Ivy, and McCarthy have added yet a further period to the secretion of gastric juice by showing that it is aroused by the application of digestion products such as peptone, amino-acids, and amines to the mucosa of the small intestine. If a meal were given to their dog with a pouch of the entire stomach, a

secretion of gastric juice occurred about one to three hours later, depending in part on the time for digestion in the small intestine, in part on the time of appearance of the bile, which also acts as a stimulant. Hence gastric secretion can be divided into three phases, a cephalic (or "psychic"), a gastric, and an intestinal. It is only on an accurate knowledge of these processes that a rational therapy of gastro-intestinal tract disease can be based.

A certain amount of doubt has arisen as to the actual nature of the movements in the stomach, chiefly owing to the fact that different types have been described in man and animals; sometimes even different observers have found different appearances in the same species. E. D. McCrea, B. A. McSwiney, J. W. Morison, and J. S. B. Stopford (*Quart. Journ. Exper. Physiol.*, 1924, vol. 14, p. 397) have investigated the movements of the stomach in the rabbit, cat, dog, and man, both by means of the X-ray and also, in the animals, by direct inspection of the organ exposed under saline. Their observations clarify and correlate those of previous investigators. The fundus and part of the body of the organ remain almost quiescent during digestion, slowly contracting on the mass of food and forcing it into the more distal parts. In the latter two types of movements occur; in both there is a peristalsis of the remaining part of the body, but in one this is arrested at the pyloric antrum, whilst in the other the wave passes over it and reaches the pylorus; in the former case the peristaltic wave over the body is followed by contraction of the pyloric antrum and canal as a whole, in the same manner as the heart contracts in systole. The first type of movement is predominant in the stomach of the dog, rabbit, and man, the second in that of the cat; but occasionally the opposite type may occur, except that the second has not been observed in the dog's stomach. A transitional form is sometimes seen, namely, ripples running over a tonically-contracted pyloric antrum. The rhythms of the two parts of the stomach may be different. Movements can also be seen in the quiescent part of the fundus in man if the air-cap is displaced and its place taken by the barium sulphate meal. The authors conclude that the variations observed are due to differences in the type and consistence of the food, in the degree of tension in the muscular wall, and in the actual arrangement of the muscular fibres therein in the different species. The research systematises the somewhat confusing observations which have been previously made on this subject.

American Work on Tides.¹

THE United States Coast and Geodetic Survey has done useful service in issuing the special publications referred to below. The manual prepared by Mr. Schureman was designed primarily for the tidal computers of the Survey, but the aim was to produce a convenient work of reference on the subject of the harmonic analysis and prediction of tides. It gives a résumé of the work of Kelvin, Darwin, and Harris. Part I. is devoted to the development of the tide-generating force, to the methods of analysis used by the Survey, and to a description of the U.S.A. tide-predicting machine. The method of analysis is worthy of comment. It makes use of several thousand stencils for the special summations required for the isolation of the constituents. The manual indicates, apparently for the first time, some of the more recent improvements in the method, and these are such as

to diminish considerably the labour of calculation. In older methods only those constituents of which the speeds are exactly in the ratios 1 to 2, 3, 4, 6 and 8, were treated together until the final processes of the analysis were reached, but in this method constituents the speeds of which are approximately in these ratios are treated together in the earlier stages of the summations, and "secondary stencils" are then used to isolate the respective constituents.

Parts II. and III. are most useful to computers and research workers in other countries. Part II. contains tables of standard functions used in analysis and prediction, Harris's tables having been extended and others added. The astronomical arguments are now given from 1850 to 1999. Part III. consists of a noteworthy list of harmonic constants for nearly a thousand places scattered throughout the world. Hitherto research workers have had difficulty in obtaining lists of such constants, and no such comprehensive list has ever been published, though no doubt several manuscript lists have existed. The Survey has received constants from many sources,

¹ A Manual of the Harmonic Analysis and Prediction of Tides, by P. Schureman; Tides and Currents in New York Harbour, by H. A. Marmer; Tides and Currents in San Francisco Bay, by L. P. Disney and W. N. Overshiner; A Portable Automatic Tide Gauge, by G. T. Rude. Special Publications Nos. 98, 111, 115, 113. (Washington: Government Printing Office.) Prices 200, 30, 20, and 10 cents respectively.

and it must have been difficult at times to make sure that the constants were accurately given. The amplitudes for Gibraltar are ten times too great, but in general the constants appear to be trustworthy.

An immense amount of labour must have been expended in preparing these tables, and all concerned in the production of the manual deserve congratulation upon the efficient manner in which the work has been carried out.

Another activity of the Survey is shown by the two publications dealing with the tides and currents in New York Harbour and in San Francisco Bay. Altogether apart from their importance in navigation, tides and tidal currents enter as important factors into a number of problems connected with harbours and ports. These special publications are not devoted to the discussion of any involved mathematical theory of tides and currents, but are intended to present and discuss the results of observations in such a manner that they will be of interest and practical value to the mariner, the engineer, and the scientific worker. Mr. Marmer's introduction, however, is an admirable statement in simple language of the general characteristics of tides, and this is reprinted in the second publication.

The heights of various planes, such as mean sea level, mean tide level, mean high-water level, storm high-water level, and so on, from year to year are tabulated, explained, and discussed. Engineers must find this information exceedingly useful. Maps give the

directions of current flow at intervals of time related to high-water time or to the time of high-water slack.

The importance of tidal currents is becoming increasingly recognised, and the Survey has taken the lead in preparing a separate annual volume of predictions of tidal currents. Hitherto, the current predictions for San Francisco Entrance refer only to the times of slack water for each day of the year, with suitable indications as to whether the current is about to turn from east to west, or vice versa. Beginning with the year 1926, however, the predictions will be considerably elaborated. For each day will be tabulated the time of slack water before flood, the time and velocity of each maximum flood, and corresponding times and velocities connected with the ebb. It will be noticed that fifty per cent. more information is given for the currents than for the elevations.

To meet the need for a portable tide gauge suitable for the use of hydrographic parties requiring tidal observations during a period of soundings, an instrument has been designed which appears to have reached almost the lowest practical limit of size. When encased, the instrument is almost a cube of 11 inches side, and it is supported on $3\frac{1}{2}$ -inch stock iron pipe which serves as a float-well at the same time. According to Commander Rude the apparatus will function for a week without attention. The gauge appears to be well suited to the purposes for which it is designed.

A. T. DOODSON.

Research in Textiles.

THE Fabrics Co-ordinating Research Committee was appointed in 1921, its members being representatives of the fighting services, the National Physical Laboratory, and the research associations for the textile industries. The duties of the Committee are the maintenance of co-ordination between research work on fabrics carried out by Government departments and others, and the direction of new investigations which appear necessary in the national interest and of civilian as well as of naval or military importance. The report recently issued¹ on the activities of the Committee during the past four years gives a lucid summary of progress in the scientific investigation of several problems of considerable national importance and of very diverse character.

The academic research worker will be interested to learn how frequently, in the solution of such problems, the application of laboratory results is limited by considerations apparently foreign to the subject, a striking illustration being afforded by the search for an antiseptic which will give protection to a fabric from the attacks of micro-organisms and, at the same time, have no deleterious effect upon it. This seemingly simple problem becomes very complex in practice, most antiseptic substances being excluded on account of some objectionable quality or an equally objectionable action on the properties of the fabric or the substances employed in dyeing or finishing this.

The Committee has initiated work on the deterioration of fabrics by the action of light, a problem of great urgency in connexion with aircraft, clothing and tentage, and a summary is given of recent work on the determination of the destructive band of the sun's spectrum (3900 Å.U. to 3100 Å.U.), the protective action of dyes having an absorption band covering this region, and the mechanism of deterioration. Much further work on the latter subject is required, for the causes are still obscure; but an interesting theory of the action of ozone in this

connexion is outlined. This takes account of the oxygen adsorbed by the fibres and the possibility of this being ozonised by the direct action of sunlight, and is based upon a calculation by Lindeman that the ozonisation of the adsorbed air may be effected by light of wave-length 3200 Å.U.

Future progress depends largely upon the provision of more suitable sources of light for experimental purposes than sunlight or the mercury vapour lamp, and a more delicate means of measuring deterioration than the strength test. It is satisfactory to learn that research is being conducted on both these subjects.

An interesting appendix on the deterioration of fabrics by micro-organisms sketches the organisation of a large-scale attempt to collect systematically the organisms capable of causing the decay of fabrics. Specimens of the latter are being exposed, under the supervision of mycologists, at a number of stations in the British Empire, and arrangements are being made for the examination of the specimens after exposure. Again, the possibility of a more suitable test of deterioration than those now available requires further exploration.

A large section of the report is devoted to a comparison of fabric strength tests carried out on machines of different makes and capacities. From a technical point of view this is probably the most important section, for the results are of direct practical significance. They should, naturally, be read with great interest by all concerned with the mechanical testing of fabrics and the scientific investigation of the principles underlying the methods employed.

As a précis of the results of scientific research the report is highly commendable. A misleading statement has been noticed on p. 30, where it is stated, in a discussion of rate of loading, that, when textiles are broken, a larger percentage of the interlaced fibres are "disentangled and slip past one another without breakage." So far as the writer is aware, there is no evidence supporting this generalisation, which, for example, certainly does not apply to a fine yarn broken on the ballistic tester.

F. SUMMERS.

¹ Department of Scientific and Industrial Research. First Report of the Fabrics Co-ordinating Research Committee. Pp. iv+70. (London: H.M. Stationery Office, 1925.) 1s. 9d. net.