not up to standards which we have come to expect from modern technical books. Some of the lettering is not clearly legible in the reduced scale of the drawings. It is hoped that in later editions this defect can be corrected. A few well-selected photographs might also have enhanced the attractiveness of this book. In conclusion, it can be stated that "Fundamentals of Radio Communications" is a well-written book which should be found in the library of every one seriously working in the field of electronics.

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REPORTS

RECOMMENDATIONS OF THE INTERNATIONAL CONFERENCE ON PENICILLIN[1]

AN International Conference on Penicillin was called for the purpose, if possible, of establishing an International Standard for penicillin, and of setting the International Unit of penicillin in terms of this standard. Meetings were held in the apartments of the Royal Society, London, from October 16 to 19, with Sir Henry Dale in the chair. The conference succeeded in fulfilling its purpose, unanimous agreement being reached on all points. It is reported that the results achieved by various laboratories were remarkably concordant, and served as a foundation for the work of the conference. During the course of the deliberations, no essential point of disagreement arose, and eventually the following draft of resolutions was adopted.

In order to facilitate discussion the conference began by recognizing that the different penicillins known as I, II and III in Great Britain are respectively identical with those known as F, G and X in the United States. The recommendations of the conference are as follows:

(1) That, notwithstanding the existence of more than one penicillin, it is desirable and possible to select and adopt an International Penicillin Standard consisting of a specimen of the pure crystalline sodium salt of Penicillin II or G; and an International Penicillin Working Standard, the specific activity of which has been determined in relation to that of the International Standard.

(2) That the use of these Standard Preparations, for the time being, would meet the needs of practical standardization and render quantitative results obtained in different countries sufficiently comparable.

(3) That the offer of the representatives of the United States of America to prepare the material for the International Standard, from contributions generously supplied for the purpose by manufacturers in the United States and the United Kingdom be gratefully accepted, and that the individual contributions be brought into one solution and finally crystallized as one uniform preparation.

(4) That, with a view to the eventual replacement of this International Standard by a preparation of identical properties, the physical and chemical constants of the preparation now being adopted shall be accurately determined.

(5) That approximately 8 grams of the International Standard shall be prepared and a quantity regarded as adequate to satisfy international requirements shall be deposited with the Department of Biological Standards, the National Institute for Medical Research, Hampstead, London, N. W. 3, on behalf of the Health Organization of the League of Nations.

(6) That, on receipt at Hampstead, the International Standard shall be dispensed in suitable quantities into separate containers and after complete desiccation shall be sealed in these containers in pure dry nitrogen gas, by the method and technique hitherto adopted for other International Biological Standards and shall thereafter be maintained in cold storage pending supply to national control centers.

(7) That the International Penicillin Working Standard for general distribution shall, for the present, consist of a calcium salt of penicillin and that the offer of the Food and Drug Administration of the United States of America to supply such a preparation be gratefully accepted. As in the case of the International Standard, the International Penicillin Working Standard shall be deposited with the Department of Biological Standards, the National Institute for Medical Research, Hampstead, London, N. W. 3, on behalf of the Health Organization of the League of Nations. It shall be dispensed in suitable quantities, in the manner described above, and stored and distributed under the same conditions as other International Biological Standards.

(8) That the International Unit of Penicillin be defined as *the specific penicillin activity contained in 0.6 microgram of the International Penicillin Standard.*

The International Unit so defined is approximately equivalent to the unit originally adopted by Heatley and other collaborators of Florey (1941)[1] and commonly known as the "Oxford" unit.

(9) That 2.7 micrograms of the present International Penicillin Working Standard (see paragraph 7 above) be accepted as containing 1 International Unit of Penicillin.

(10) That for the determination, by a suitable method of comparative assay, of the specific activity of an unknown preparation of penicillin in terms of the International Standard it is necessary to use a suitable strain of *Staphylococcus aureus,* and that this strain must have practically equal sensitiveness to the inhibitory actions of Penicillin I, or F, and Penicillin II, or G. The two strains of *Staphylococcus aureus* which at present can be

[1] "Further Observations on Penicillin," Abraham, Chain, Fletcher, Florey, Gardner, Heatley, Jennings. *Lancet,* ii, p. 177, 1941.

certified, by the experience of many workers, to fulfill these conditions are those known variously as

(a) No. 6571 of the National Collection of Type Cultures (England).
No. NRRL B-314 (Northern Regional Research Laboratory, Peoria, Illinois, U. S. A.).
No. 9144 of the American Type Culture Collection (Washington, D. C., U. S. A.).

and (b) No. 209-P, the Food and Drug Administration (Washington, D. C., U. S. A.).
No. NRRL B-313 (Northern Regional Research Laboratory, Peoria, Illinois, U. S. A.).
No. 6538 of the American Type Culture Collection, Washington, D. C., U. S. A.).

Both of these cultures may be obtained by application to the National Collection of Type Cultures, The Lister Institute, London, or to the American Type Culture Collection, Georgetown University, Washington, D. C.

(11) That the Conference recognizes that it may eventually become necessary and practicable to establish further standards made from other varieties of Penicillin; and recommends that, with a view to such further development, efforts should be made to make pure samples of other penicillins available for international exchange among research workers in this field.

These recommendations are signed by M. V. Veldee, R. P. Herwick and R. D. Coghill, *chairman*.

SPECIAL ARTICLES

PYRIDOXAMINE AND THE SYNTHESIS OF AMINO ACIDS BY LACTOBACILLI

Lactobacillus delbrückii LD5 requires 15 amino acids, namely, leucine, isoleucine, valine, cystine, tryptophane, tyrosine, phenylalanine, glutamic acid, threonine, aspartic acid, lysine, arginine, serine, methionine and alanine, for full growth in a basal medium of essentially the same composition as that described for *Lactobacillus casei*.[1] Little or no growth occurs if any of these amino acids, with the exception of the last two, is omitted; approximately half-maximum growth is obtained in the absence of either methionine or alanine. Replacement of the pyridoxine of the medium by an equal amount (2 γ per 10 cc medium) of pyridoxamine (or pyridoxal)[2,3] eliminates the requirement of *L. delbrückii* for lysine, threonine and alanine but not for any of the remaining 12 amino acids. Good growth occurs in the absence of any one of these amino acids or of all three (Table 1). Similar results were obtained with *L. casei* and *L. arabinosus* 17–5. However, the amino acid requirements of *Streptococcus lactis* R, which includes lysine, threonine and alanine,[4] are not affected by pyridoxamine except that the latter supports a small amount of growth in the absence of alanine.

TABLE 1

INFLUENCE OF PYRIDOXINE AND PYRIDOXAMINE ON AMINO ACID REQUIREMENTS OF LACTOBACILLUS DELBRÜCKII LD5

Amino acids omitted from basal medium	*L. delbrückii* LD5		
	No pyridoxine	Pyridoxine*	Pyridoxamine
Lysine	1.0†	2.0	8.9
Threonine	0.9	1.2	7.7
Alanine	0.8	4.5	8.5
Lysine, threonine, alanine	1.0	1.4	6.0
None	1.0	8.5	8.9

* Seitz filtered.
† The figures are the cc of 0.1 N acid formed in 10 cc of medium during incubation for 72 hours at 37°; growth is proportional to acid formation.

It was possible, therefore, to determine by means of *S. lactis* R whether lysine, threonine and alanine are synthesized by the lactobacilli when grown in media containing pyridoxamine. Cells of the three lactobacilli cultivated without lysine, threonine or alanine were hydrolyzed in sealed ampules with 10 per cent. HCl for 10 hours at 15 pounds pressure. Addition of portions of the neutralized cell hydrolysates to *S. lactis* media from which either lysine, threonine or alanine was omitted, permitted maximum growth of *S. lactis* indicating that all three amino acids were present in each lactobacillus.

Pyridoxamine fulfils functions other than those concerned with the formation of the three specified amino acids, since it is necessary for development of *L. delbrückii* and *L. casei* also in media containing those amino acids (Table 1). However, in such media, pyridoxine is equally effective. There are indications that pyridoxine is involved in protein[5] and tryptophane[6] metabolism in animals and that pyridoxine and pyridoxal function in the decarboxylation of tyrosine by *Streptococcus fecalis*.[7]

L. arabinosus differs from the other two lactobacilli in that it does not require added pyridoxine for development in an otherwise complete medium. Presumably it synthesizes pyridoxine or some similarly active compound, possibly pyridoxamine.[8] The necessity of adding the latter for growth of *L. arabinosus* in media lacking lysine, threonine and alanine may be

[1] Hutchings and Peterson, *Proc. Soc. Exp. Biol. Med.*, 52: 36, 1943.
[2] Snell, *Jour. Biol. Chem.*, 154: 313, 1944.
[3] Harris, Heyl and Folkers, *ibid.*, 154: 315, 1944. We are indebted to these investigators for supplies of the pyridoxine derivatives.
[4] Snell and Guirard, *Proc. Nat'l. Acad. Sci. (U. S.)*, 29: 66, 1943.
[5] McHenry and Gavin, *Jour. Biol. Chem.*, 138: 471, 1941.
[6] Lepkovsky, Roboz and Haagen-Smit, *ibid.*, 149: 195, 1943.
[7] Gunsalus and Bellamy, *Jour. Bact.*, 47: 413, 1944; *Jour. Biol. Chem.*, 155: 357, 1944.
[8] Bohonos, Hutchings and Peterson, *Jour. Bact.*, 44: 479, 1942.