mimic meanings: To project (*e.g.*, as in shooting with a blow-pipe); to move or push forward—or flow or pour—or even to push *back* something in the way, or something coming towards the signer; to reach or point forward; to be elongated or extended horizontally; to enclose, a long hollow or enclosure; to be empty (*i.e.*, considering the function of the cupped hands, or the walls of the mouth cavity, as containers); to be full (*i.e.*, considering the volume enclosed by the hands or mouth as containing walls).

It will be seen that, from the sign language aspect, the same hand-gesture or mouth-gesture may be expected to bear many different meanings, and that some of these may be direct opposites!

As a test of the gesture theory, a study was made of the various underlying meanings of 37 archaic Chinese words beginning with *ku, kü, yu* and *xu*[1] and of 51 Bohemian words beginning with *ku*[2]. The results may be summarized as follows. In archaic Chinese, the various underlying meanings were found to be related to the following interpretations of the originating mouth-gestures:

Interpretation	Number of instances
To flow (as through a tube), pour out	18
To project, point towards	15
Hollow	16
Empty	8
Enclosure	9
Extended hand (or hands)—offering or receiving money	4
Tube	4
Elongated in time (antiquity)	3
Elongated hollow (*cf.* English Coombe)	3
Projecting and rounded	3
Forward motion	2
Lying flat (horizontal)	1
Repelling	1
Onomatopoeic (?)	1
Of doubtful gestural significance	6

In Bohemian the symbolism was not so imaginative as in archaic Chinese. There were no examples of the interpretations "empty," "tubular," "elongated in time" or "elongated hollow," "lying flat" or "repelling," as found in archaic Chinese. On the other hand, there were examples of all the 7 remaining types, and two cases of onomatopoeia. The numbers in parentheses refer to the number of instances. Thus, "sing (choir)" (1), eject (2) are comparable to archaic Chinese "pour" or "flow"; "project up" (3), "point" (2), "sight" (1), "bundle" (1) are comparable to "project," "point upwards." The Bohemian word for "bundle"—*kukure-se*—may be compared with Japanese *kukuri* (sheaf of corn), the *ku* gesture being reduplicated to indicate a plurality of projecting elements forming the bundle or sheaf. The remaining interpretations include "hollow" (7), "enclosure" (1), to which must be added "grasp" (1), "heap or lump" (2), "offering or taking money" (1), "projecting and rounded" (6) and "forward motion" (4). There were 9 meanings of which the gestural origin was not recognizable.

It will be seen, therefore, that over 50 per cent. of the Chinese underlying meanings of words beginning with *ku, kü, yu* and *xu* are found in connection with words beginning with the similar mouth gesture (*ku*) in Bohemian speech. Such a correlation could surely not occur if the meaning of the words were due to chance.

The gesture theory was put to the test by the late Dr. R. R. Marett, D.Sc., F.B.A., Rector of Exeter College, Oxford, in 1929, when he challenged the present writer to "divine the correct interpretation" of a number of words in an unknown language by a study of their originating mouth gestures. A list of words (with their phonetic values only) was supplied by Professor Soothill (professor of Chinese at the University of Oxford) and the first 10 of these were studied by the present writer, from the point of view of the mouth gestures which produced them. They each yielded about 10 meanings. This list of "divined interpretations" was sent to Professor Soothill, who, in return, sent his list of the principal meanings of the selected words.

The two lists were then submitted to Dr. Marett, who recorded his conclusions in a Preface which he afterwards wrote to the present writer's little book, "This English" (Kegan Paul, London, 1935). He there says: "Sir Richard Paget registered over 50 per cent. of hits that were more or less on the target, some of them undoubted bulls." Dr. Marett himself had estimated the chances of a correct interpretation, by luck, at one in the hundred.

Both Dr. Marett and Professor Soothill are now dead, but Dr. Marett informed the present writer (in October, 1942) that Professor Soothill had also been satisfied that "there was something in the method" and that he also had confirmed the success of the experiment.

R. A. S. PAGET

[1] "Analytic Dictionary of Chinese," B. Karlgren, Paris, 1923.

[2] "Slovnik Česko-Anglický Sepsal," Karel Jonéš, Chicago, 1890.

ACTION OF CLARASE UPON PENICILLIN

IN a recent issue of SCIENCE[1] there appeared an article by the writer entitled "Sterility Test for Penicillin." Since the statement was made in a footnote that additional studies would be published on this subject, numerous inquiries have been made as to when this material would appear in print. Inasmuch

[1] SCIENCE, 98: 413, November 5, 1943.

as some time will necessarily elapse between submission of the article for publication and its appearance, the present note is intended to give preliminary information as to the mechanism of action of the Clarase and Taka-Diastase preparations upon penicillin reported previously.

Other diastatic enzyme systems than those of Clarase and Taka-Diastase used in our preliminary studies on penicillin, although derived also from the fungus, *Aspergillus oryzae,* failed completely to show evidence of antipenicillin activity. Subsequent studies revealed that the preparations active against the antibiotic agent contained, in addition to diastase or amylase, certain water-soluble, filtrable substances, which are of bacterial origin and which are responsible in part, if not entirely, for penicillin inactivation. Broth filtrates of pure cultures of many of the organisms isolated from the active enzyme preparations will neutralize the effects of penicillin. These bacteria have been identified as belonging to the gram-positive, spore-forming *B. subtilis* and related groups of organisms.

Therefore, the demonstrated power of Clarase and Taka-Diastase to inactivate penicillin in the sterility test is due to bacterial end products which these preparations contain.

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THE IDENTITY OF CLAVACIN WITH PATULIN

WAKSMAN, Horning and Spencer[1] investigated the antibiotic agent produced by *Aspergillus clavatus* (No. 129) and proposed the name clavacin for this substance. Some time ago we began a study of the production, isolation and chemical properties of clavacin. Dr. Waksman kindly supplied one of us (H.W.A.) with *Aspergillus clavatus* (No. 129) which was grown on a Czapek-Dox medium modified as recommended by Waksman. The active material was extracted from the mold culture with ether. The ether solution was evaporated, leaving a brown gum from which the clavacin was extracted with a small volume of water. The aqueous solution was re-extracted with ether and the clavacin was obtained either by direct crystallization from the concentrated ether solution or after a preliminary purification over a silica gel column. The column was developed with moist ether which removed colored impurities first and then the clavacin. The crude material was readily purified by recrystallization from ether. The following data concerning the pure substance have been obtained: Melting point, 109–10° C; empirical formula, $C_7H_6O_4$; molecular weight (cryoscopic in benzophenone) 151, 157; $C_7H_6O_4$ requires 154); semicarbazone, darkens at 200°, decomposes at 290° C; 2,4-dinitrophenylhydrazone, darkens above 190°, decomposes about 300° C; lactone group indicated by slow reaction with alkali; saponification number 69, 71 (evidently molecule cleaved); Zereiwitinoff determination (in *n*-butyl ether) shows slightly less than one active hydrogen per mole; esterification by the acetic anhydride-pyridine method shows one hydroxyl per molecule. The substance is a neutral compound, darkens and loses activity in the presence of alkali, readily decolorizes alkaline permanganate, does not react with aqueous ferric chloride or Schiff's reagent, and is optically inactive.

At this point in our studies a publication by Raistrick and coworkers[2] appeared describing the substance patulin, an antibacterial agent produced by *Penicillium patulum* Bainier. Patulin has the same physical and chemical properties as clavacin. The 2,4-dinitrophenylhydrazones behave in the same way on heating. In order to extend the comparison the acetyl derivative and phenylhydrazone of clavacin were prepared. They melted at the same temperatures (116–117° and 151–152° C, respectively) as the corresponding derivatives of patulin. These results establish beyond question that patulin and clavacin are identical. The fact that both an *Aspergillus* and a *Penicillium* mold produce the same antibiotic substance and in about the same amount is sufficiently unusual to warrant publication of a brief note at this time. The details will be reported later.

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SCIENTIFIC BOOKS

UNDER A LUCKY STAR

Under a Lucky Star. A Lifetime of Adventure. By ROY CHAPMAN ANDREWS. 300 pp. The Viking Press. New York. 1943.

THE title of this book would seem to imply that fortunate circumstances were the making of Roy Chapman Andrews. But I think nearly all readers, nearly all those who know Andrews and his work will

[1] Waksman, Horning and Spencer, *Jour. Bact.*, 45: 233, 1943.

[2] Raistrick, Birkinshaw, Bracken and Michael, *Lancet*, 245: Part II, 633, 1943.