

from the educational standpoint. Due weight must, however, be given to the health considerations outlined above, and it is necessary to emphasize the need for continuous and skilled supervision of health and hygiene for children in nursery schools and classes no less than in day nurseries.

Conclusion

To sum up, day nurseries are needed principally as a means of alleviating the effects of grave social disorders which make it impossible for many children to have anything approaching a healthy or happy home life. But it should be clearly realized that group care—on its intrinsic merits, and social considerations apart—is not a sound health measure for young children, particularly those under 2 or 3 years old.

It is the realization of this fact and the recognition of the home and family as the natural healthy social background for a young child that warrant the aim already stated—that every mother should be enabled to bring up her own children in health and happiness within the family circle in their early years. The social disorders that stand in the way of achieving this aim should be directly attacked, and the provision of day nurseries should be regarded mainly as an interim measure of alleviation until the attack is successful and home life in early childhood can be widely developed at its best.

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A POSSIBLE MODE OF ACTION OF PENICILLIN

BY

K. M. PANDALAI, M.Sc., Ph.D.

AND

MARIAM GEORGE

(From the Department of Biochemistry, Indian Institute of Science, Bangalore)

Among the many theories suggested to explain the mechanism of drug action the concept that drugs act by metabolic interference has gained much prominence. The antibacterial action of penicillin *in vitro* and *in vivo* appears to be primarily bacteriostatic, inhibiting the growth of the infecting organisms by preventing cell division and multiplication. This is probably achieved by interfering with some metabolic function in the early stages of bacterial development or by acting as an ineffective substitute for some essential metabolite which may have the nature of an enzyme or a vitamin, or even that of certain active groupings in the cell such as the SH group, the NH₂ group, or a COOH group. Glucose utilization for energy production and cell synthesis is an inevitable metabolic reaction, and substances like nucleic acid, thiamine, riboflavine, nicotinic acid, tryptophan, uracil, etc., besides being essential growth factors in the case of typical parasites like *Staphylococcus aureus*, are also parts of the prosthetic groups of oxidation enzymes involved in cellular respiration. In order to elucidate the physiological characteristics of the antibacterial action of penicillin the influence of some of the above substances was studied, and the results obtained with nucleic acid, which is a major constituent of the bacterial cells, are recorded in this note. It may be added that McIlwain (1941) has demonstrated nucleic acid antagonism to the antibacterial action of the acridine derivatives, and Krampitz and Werkman (1946) suggest

that penicillin may interfere with the metabolism of nucleic acids or nucleotides in the case of *Staph. aureus*.

Twenty-four-hour broth cultures of *Staph. aureus* were used in one loopful in duplicated sterile culture tubes containing a total volume of 10 ml., including nutrient broth and the test substance added in requisite amounts. The tubes were observed after twenty-four hours' incubation at 37° C. and the turbidity in the tubes due to bacterial growth was measured.

TABLE I.—Showing the Influence of Penicillin and Nucleic Acid on the Growth of *Staph. aureus*

Penicillin Alone (Units per ml.)	Growth in Broth	Nucleic Acid Alone	Growth in Broth	Penicillin (Units per ml.) and Nucleic Acid	Growth in Broth	Control in Broth
0.3	—	1/2000	+++	0.3 } 0.2 } 1/2000 0.1 }	+ ++ ++	+++
0.2	—	1/5000	+++	0.3 } 0.2 } 1/5000 0.1 }	+ ++ ++	+++
0.1	+	1/10,000	+++	0.3 } 0.2 } 1/10,000 0.1 }	+ ++ ++	+++
0.05	+	1/20,000	+++	0.3 } 0.2 } 1/20,000 0.1 }	+ ++ ++	+++

Table I shows the remarkable fact that nucleic acid has no particular growth-promoting influence on the organisms but is strongly antagonistic to the bacteriostatic action of penicillin. In the presence of added nucleic acid the penicillin either did not inactivate or side-track the cell nucleic acid or, even if it did, the organisms could still thrive on the external source of nucleic acid, thus nullifying the bacteriostatic effect of the drug. That penicillin bacteriostasis of *Staph. aureus* is reversible in the presence of added nucleic acid is clear from Table II.

TABLE II.—Showing the Reversibility of Penicillin Bacteriostasis of *Staph. aureus* by Added Nucleic Acid

Penicillin (Units per ml.)	Nucleic Acid added to Broth after 3 Hours	Nucleic Acid added to Broth after 6 Hours	Penicillin Control	Nucleic Acid Control	Control in Broth
0.1	1/1000 ++ 1/2500 ++ 1/5000 ++	1/1000 ++ 1/2500 ++ 1/5000 ++	+	+++ +++ +++	+++
0.2	1/1000 ++ 1/2500 ++ 1/5000 ++	1/1000 ++ 1/2500 ++ 1/5000 ++	—	+++ +++ +++	+++
0.3	1/1000 ++ 1/2500 ++ 1/5000 ++	1/1000 ++ 1/2500 ++ 1/5000 ++	—	+++ +++ +++	+++

+++ indicates very good growth. ++ indicates fairly good growth. + indicates scanty growth. — indicates no growth.

Organisms that were exposed to penicillin and became non-viable could actually be rendered viable by subsequent exposure to nucleic acid. It is interesting to note that a strain of *Streptococcus viridans* and a strain of *Bacillus subtilis* gave exactly similar results.

Nucleic acid thus appears to be of paramount importance for the growth and multiplication of organisms like *Staph. aureus*, *Str. viridans*, *B. subtilis*, etc. Penicillin probably acts by interfering in some way with one or more phases in the metabolism of the organisms which involve nucleic acid function. Probably penicillin forms inactive complexes with nucleic acids which aid in the utilization of the energy material essential to the nutrition of the parasite, and when the inhibition is rendered reversible by nucleic acid addition the latter, besides making good the cellular needs, also helps to lower the effective concentration of penicillin, thus restoring the cells to a condition in which growth is again possible. Metabolic interference by penicillin in phases where nucleic acids play an important part

in cellular processes appears to be the prime factor in penicillin bacteriostasis. These studies are being pursued further.

We gratefully acknowledge our indebtedness to Prof. V. Subrahmanyam and Major K. P. Menon for their kind interest and helpful criticisms, and to the Council of Scientific and Industrial Research, under whose auspices this work is being carried out.

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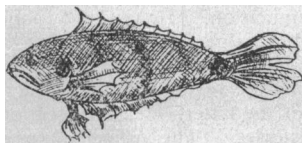
A "Fishing" Story

Strange cases come our way from time to time in surgical practice, but I think that the following case is worthy of record.

CASE REPORT

A Malay villager was admitted to the Malacca General Hospital on Feb. 27, 1947, in a very distressed state, with laryngeal obstruction. There was a marked stridor and retraction of the intercostal spaces. He was throwing himself about on the stretcher and was very difficult to examine, and of course quite unable to give any history. This, however, was freely and willingly given by about six of his relations simultaneously. It appeared that an hour previously the man had been drawing in his net in a rice field. Holding up the edge of his net, he peered over to inspect his catch, whereupon a fish leaped out of the water into his mouth and disappeared down his throat. All efforts on the part of friends and relations to dislodge the fish proving fruitless, it was decided to bring him to hospital.

On examination the tail of a fish could be clearly seen over the base of the tongue. This was grasped in sponge-holding forceps;



but traction only resulted in the tail coming off, making matters worse than ever. The body almost filled the pharynx. Palpation revealed the fact that the long spiked dorsal fin of the fish was extended and firmly imbedded in the posterior pharyngeal wall, which was fast swelling up, and the patient was becoming cyanosed. He was taken to the theatre, his struggles being controlled by 5 ml. of thiopentone intravenously, and a low tracheotomy was performed. Breathing through the tube having been established, it was found that his jaws were firmly closed and could not be opened. He was therefore deeply anaesthetized by open chloroform over the tracheotomy tube, and the mouth opened. By forcing an index finger down alongside the fish the finger-nail could just reach the gill. Then by a process of "bipolar version," one finger inside and one outside the pharynx, the fish was "turned" from "breach" to "vertex" and successfully delivered. There was severe laceration of the posterior pharyngeal wall, which was swabbed with flavine and left to granulate. The tracheotomy tube was removed on the second day and recovery was uneventful.

The fish, which measured 13 cm. in length and 8 cm. at the greatest circumference, is known in Malaya as ikan betok. It frequently leaves the water, and is credited with being able to climb a tree. The Malay villagers affirm that when one is fishing for ikan betok one should "not laugh but keep one's mouth shut." The accompanying photograph shows its approximate shape.

I am indebted to the Director of Medical Services, Malayan Union, for permission to publish this case.

R. M. B. LOWIS,
Acting Surgeon, Negri Sembilan, Malayan Union.

A Case of Bilateral Syme's Amputation

The following case is published as a surgical curiosity rather than a recommendation for the revival of an obsolescent operation. It was of interest to me because, although I had never seen Syme's amputation performed and could not obtain advice as to the form of surgical boot necessary for the stump, I was able to get a man walking on two stumps with crude boots made by a local shoemaker.

CASE REPORT

An African adult male was brought into Tanga Hospital on Sept. 28, 1945, with a history of his foot having been bitten by a wild cat. He had been living for many years in a leprosy settlement maintained by the Universities Mission to Central Africa. On examination his general condition was good and he had a cheerful disposition, remarkable in a destitute person afflicted with a crippling disease. The left foot had been bitten through, leaving the metatarsals projecting from a mass of gangrenous muscle. The right foot was in the slow process of destruction by necrosis and ulceration often associated with leprosy. The fingers of both hands were stunted and deformed as a result of a similar process in the past. The wound was dressed daily with eusol and soon became clean. The metatarsals separated as sequestra, and a smooth granulating area covered the proximal half of the foot. On Nov. 21 a Thiersch graft was applied to this area and took well. It was hoped at first that it would be possible to get him walking on this stump, but the skin was too thin and soon ulcerated over bony points in contact with the ground. Moreover, the other foot was painful, and even with the aid of crutches weight-bearing was almost impossible.

On Feb. 1, 1946, I performed Syme's amputation of the right foot, as the sinuses showed little signs of healing. The head of the third metatarsal on dissection was found to be lying as a sequestrum in a cavity of brown pus. The wound healed by first intention and the patient was highly pleased with the result. The stump seemed so much more satisfactory than the skin-grafted left foot, complete with calcaneus and mid-tarsal bones, and I decided that a second Syme's amputation was indicated. On May 27 the left foot was amputated. Less skin was available to make a good flap, and part of the graft had to be incorporated in the line of incision. The stump healed after slight sepsis, but was not quite so satisfactory as the first.

Throughout his period in hospital he was encouraged to exercise his legs, and he had no contractures of knees or hips. He took part in our daily ward gymnastics to the strains of "Colonel Bogey" and "Blaze Away" played on the hospital gramophone. It was not until August, 1946, that a physiotherapist was sent to Tanga and systematic skilled attention became available. On Aug. 15 the patient first stood on his bare stumps and took a few steps with assistance in the ward. Meanwhile the problem of suitable boots had been under consideration, and at last I persuaded an Indian shoemaker to attempt something which finally looked like a pair of elephant hoofs (see photographs). These boots were fitted on Sept. 2.

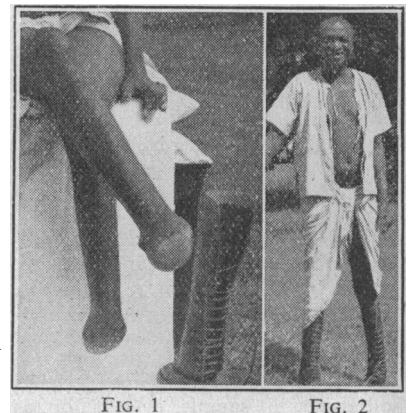


FIG. 1.—After amputation, showing also the improved "boots."
FIG. 2.—The patient ready for walking.

For the first time for 13 years, one of which was spent in hospital, the patient walked unaided for a short distance. This was increased daily under the supervision of the physiotherapist. Unfortunately, in a few days the left stump became chafed by the rough leather inside the boot and threatened to ulcerate where the scar was close to the bone edges. The physiotherapist knitted him footless socks, and cotton-wool padding was inserted to protect the stump. He was then able to walk for about a quarter of an hour without fatigue, though he was unable to stand alone.

Shortly afterwards I was transferred from Tanga to a distant part of the country and have not seen him since. I last heard that he was progressing slowly and that it was difficult to persuade him to stay in hospital. What his ultimate fate will be it is impossible to foretell, but I think the immediate result is as satisfactory as could be expected. Where conditions of life are primitive there is still a place for primitive methods in surgery.

I wish to thank Miss Q. C. Brown, physiotherapist, for her assistance and the Director of Medical Services, Tanganyika, for permission to publish this case.

L. H. CANE, M.B., B.Ch.,
Medical Officer, Tanganyika Territory.