prisoners who, until March 31st, were on the grossly deficient "E" diet. The preponderance of cases among the prisoners working chiefly in the sun is indicated in the following table. The two cases found suffering from pellagra on admission are omitted from the table.

TABLE V.—*Distribution of Pellagra Cases in the Three Sections of the Durban Prison Command.*

	Central Gaol.	Point Prison.	Congella Prison.
Average daily number of non-European inmates	698	505	405
No. of cases of pellagra	13	17	33
Percentage	1.9	3.4	8.2

Of the 13 cases which occurred in the Central Gaol, 10 occurred previous to the introduction of diet "F" for short sentence prisoners.

ETIOLOGY.

There is now fairly general agreement that pellagra is the result of dietetic deficiency. A pellagra-preventing dietary is necessary to prevent its occurrence. This pellagra-preventing property is possessed by most natural foods with the exception of oils and fats. It is stated to be located in a vitamin which has been named "P-P," and is believed to be the same as the vitamin necessary for the prevention of the occurrence of the canine disease known by American veterinarians as blacktongue.⁶ The "P-P" content of foods has not yet been worked out with the same degree of accuracy as in the case of the other vitamins. It is probably present in all vegetables and fruit in small amount. In "P-P" value Goldberger equates 2 lb. of tomatoes, a quart of buttermilk, 1/2 lb. of lean meat, and 1 oz. of powdered yeast.⁷ Maize (mealies) was found to contain very little, if any, of the preventive for both blacktongue and pellagra.⁸

The pellagra-preventing vitamin appears to be identical with vitamin B₂, which has a somewhat similar distribution among foodstuffs as vitamin B, now referred to as vitamin B₁. If the neuritic symptoms which result in rats from deprivation of vitamin B are prevented by presenting an alcoholic extract of yeast in which vitamin B₁ alone is present, the deficiency of vitamin B₂ was found by Chick and Roscoe to manifest itself.⁹

Though the etiology of pellagra is not yet completely cleared up, it is fairly certain that the central feature is a deficiency of a pellagra-preventing vitamin. The association of the disease with poverty or restricted maize diets is readily accounted for by the probable deficiency of "P-P" vitamin under these conditions. The occurrence of pellagra in certain individuals or groups of individuals and not in others on the same diet remains to be accounted for. Why, for instance, does pellagra occur among Durban prisoners and not among prisoners elsewhere in the Union on the same diet scale? It seems reasonable to suppose that a "P-P" deficient diet may produce a "sub-pellagic" state, which is readily converted into overt pellagra by other factors. Such a factor would be hard work in intense sunlight, such as the Natal prisoners are subjected to in the Point and Congella Prisons.

A state of affairs similar to that of scurvy among Bantu labourers on the Transvaal mines would appear to exist. These labourers will arrive on the mine apparently healthy, although it is known that they have been subsisting in the native territories on a diet grossly deficient in antiscorbutic value. The mine medical officer cannot detect any physical fault in such a native, yet hard underground work will sometimes produce scurvy within a few weeks, although he has during those weeks been receiving the liberal mine ration with its carefully supervised amount of vitamin C contained in germinated beans, vegetables, etc.

The fact that there are pellagrins in Natal who have never been subjected to gaol conditions suggests that a large portion of the native population are in a subpellagic state. Such individuals, when admitted to gaol, will readily be converted into overt pellagrins by a monotonous, deficient diet combined with hard work in intense sunlight.

It would appear to be necessary to protect Natal native prisoners from pellagra by means of the addition to the ration of a "P-P"-rich substance such as yeast, in the same way as it has been found necessary to prevent scurvy on the Transvaal mines by the use of germinated beans. The native prison diets are grossly deficient, as will be seen from Table IV. It is probable that a relatively insignificant factor may tip the scale in favour of pellagra. Such a factor may be the grossly inferior bean ration which was issued to the Durban prisoners. In any case, the disappearance of the disease after the introduction of a good bean ration is significant. The "P-P" value of these good beans has apparently been sufficient to prevent the appearance of symptoms.

SUMMARY.

Though the Bantus are largely and often almost exclusively maize-eating, pellagra has been rare in South Africa. There have been only three outbreaks of any significance—namely, in 1906 in Zululand, in 1912-13 in Pretoria Mental Institution, and a recent outbreak among Durban prisoners. These and a few isolated cases of which anything is known are tabulated.

The prison diet scales are uniform throughout the Union. The diets for natives consist largely of maize or mealies and are physiologically deficient. They are grossly deficient in "P-P" value. The fact that this diet resulted last year in pellagra in Durban and not in other parts of the Union must be attributed to contributory factors. Such a factor might be hard work in intense sunlight to which prisoners in the Congella and Point Prisons are submitted. In these two prisons the incidence of pellagra was higher than in the Durban Central Gaol, the inmates of which labour chiefly in the shade.

If the existing deficient prison diets are to be continued, it will be necessary under present conditions in Durban to supplement them by means of a substance rich in "P-P" vitamin, such as yeast. A similar procedure has been found effective in scurvy prevention among Transvaal mine labourers, who are protected from the scurvy brought out by hard underground work by the addition of highly antiscorbutic germinated beans.

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THE BEAUFORT ARTIFICIAL LIMB WITH RECENT MODIFICATIONS.

BY

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THIS limb is simple in construction, moderate in price, and satisfactory in use. It was invented in Rome in 1851, by an Italian nobleman—Count Beaufort. His attention had been drawn to the need of an efficient artificial limb, at a moderate cost, to replace the old-fashioned "peg leg," which did not meet the requirements of the workmen. The Beaufort limb was made by a working carpenter without any special training in limb making. Additional help in the construction and distribution of the Beaufort limb was given by General Maxwell, a retired artillery officer, then living in Rome. His knowledge of physics enabled him to explain how to shape the Beaufort foot correctly, and his interest in the disabled workmen led him to form a small society to aid them with money.

MECHANICAL FEATURES.

Both the "thigh" and "below-knee" portions of this artificial limb consist of two side bars, an "inner" and an "outer." They are shaped to correspond to the outline of the leg which had been amputated. Each pair of bars is held together and strengthened by "distance pieces." (See Figs. 1 and 2.)

The upper ends of the "thigh bars" are united at the back by a well-padded half-hoop of iron. On this the patient bears his weight, when standing or walking, as a patient with a tuberculous knee-joint does on the ring of a Thomas's knee splint.

Joints are provided at the level of the knee on each side, to allow the limb to bend. The joint on the outer side is provided with a lock, by means of which the wearer can

FIG. 1.

FIG. 3.

FIG. 2.

easily fix the limb in the straight position, when he wishes to stand or walk, and he can as easily release it.

Beaufort Foot.—The foot consists of a block of wood, curved on its under surface. On each side a slot is cut, into which the side bars are securely fitted. (See Fig. 3.)

From this brief description of the main features of the Beaufort limb it will be evident that no attempt is made to copy exactly the shape of the human leg. This disadvantage, from an aesthetic point of view, is not important, because artificial limbs are concealed, in any case, by the clothes of the wearer. It is well to bear in mind, however, that, although the expensive artificial limbs now in use have joints at the knee and ankle, they have no mechanism to take the place of muscles. The curved sole of the Beaufort limb affords the wearer a satisfactory resemblance to the normal movement of the body in walking.

MEASUREMENTS FOR THE ABOVE-KNEE LIMB.

The following measurements should be taken: The length of the stump from the fork to the end. The circumference (1) at 1 inch below the fork, (2) at the middle of the stump, (3) at 2 inches from the end, and (4) upon the pelvis between the great trochanter and the crest of the ilium (for the pelvic belt). The outline of the foot.

MATERIALS AND INSTRUMENTS REQUIRED.

1. *For the leg bars:* A block of tough wood, such as beech, 24 by 12 by 1½ inches. Mark its long edges "A" and "B" and its short edges "C" and "D."
2. *For the foot (large size):* A block of well-seasoned wood, such as beech, 10 by 4 by 4 inches.

FIG. 4.

3. *Two strong brass "bagatelle" hinges,* 4 inches long, 5/8 inch broad, 1/8 inch thick, strong brass screw nails, and tools for insertion. (See Fig. 2.)

4. *A band saw, a bow saw, or a keyhole saw,* to cut out the bars from the large block, and to shape the small block for the foot.

5. *An "attaché case bolt."* This consists of two sections. (See Fig. 6.)

6. *For the thigh corset.* (1) A rectangular piece of strong, pliable leather, such as cowhide; length equal to the distance from the "fork" to a point 4 inches above the knee level; breadth 1 inch less than the circumference of the thigh at the fork. (Feel for the knee-joint at the upper edge of the head of the tibia.) (2) Several eyelets, special forceps to cut out the holes, and "closing" forceps to fix the eyelets in position. (3) Laces to close the corset. (4) A pelvic leather strap to surround the pelvis of the patient. (5) A small strip of bridle leather, 3 inches long and 1 inch broad, to be fixed vertically to the top of the outer bar by a screw nail at each end to keep the pelvic strap in position. (See Fig. 2.)

7. *A piece of hoop-iron,* 1 inch broad, 1/8 inch thick, and in length three-quarters of the circumference of the thigh just below the tuber ischii. This is required for the support of the tuber ischii. (Fig. 2.)

8. *Distance pieces.* These are short transverse bars of wood, about 3/8 inch thick, fitted into the side bars of the artificial limb, to afford the necessary rigidity. The length of these pieces is governed by the breadth of the stump. (See Figs. 1 and 2.)

9. *For drawing the contour lines.* Obtain three or four sheets of firm white paper, in length equal to the distance from the crest of the ilium to about 2 inches below the knee-joint, in breadth a few inches broader than the thigh.

INSTRUCTIONS FOR MAKING THE BEAUFORT LIMB.

Side Bars.

The shape of these bars is obtained (1) by tracing the contours of the sound thigh and leg on paper; (2) by cutting out the patterns thus traced; and (3) by reversing the patterns.

FIG. 5.

FIG. 6.

The reversed patterns afford the contours required for the artificial limb.

1. *Contour for the Upper Outer Bar.*—Lay a sheet of the required paper on a firm, smooth surface and place the patient's thigh upon it. Then, with a long pencil held vertically, trace the outline of the thigh on the outer side, from the crest of the ilium to a point 2 inches below the level of the knee-joint. Mark the position of the knee-joint.

2. *Contour for the Upper Inner Bar.*—Trace similarly the inner side of the leg from the "fork" to a point about 2 inches below the knee-joint. Mark the position of the knee-joint. Lift the patient's leg, and draw a line between the marks which indicate the knee-joint. Mark the surface of the paper with a cross. Then cut the paper along the contour lines, and the line

which indicates the knee-joint. Reverse the paper. In this position its contours will correspond to those of the amputated leg.

3. *Contour for the Lower Outer Bar.*—Lay the leg upon another sheet so that its upper edge is 2 inches above the level of the knee-joint. Then, with a long pencil held vertically, trace the outer side of the leg from the upper edge of the paper downwards to a point 1 inch above the outer ankle. From that point continue the line straight to the sole of the foot.

4. *Contour for the Lower Inner Bar.*—Draw a similar contour in every detail on the inner side of the limb. Mark the paper to indicate the level of the knee-joint on each side. Lift the leg, and indicate this surface by a cross. Then cut along the contour lines, and the line which indicates the position of the knee-joint.

To obtain the contour of the bars required reverse the paper patterns by laying the marked surface downwards.

To shape the upper outer bar: Place the above-knee portion of the reversed paper pattern upon the block of wood as follows: (1) Let the edge of the pattern at the knee level lie upon edge "C" of the block of wood. Then, while it still lies over that edge, move the pattern towards edge "A" of the block till its most prominent curve comes to about 1 inch distant from edge "A." Mark the contour of this pattern on the block. (2) Now, while the knee level of the pattern is still lying over edge "C," move the pattern towards edge "B" for 3/4 inch and mark the contour on the wood again.

N.B.—To provide a greater thickness of this bar for the knee lock put a mark 1/4 inch nearer edge "A" in advance of the first contour line, and carry a new line for 3 inches towards the trochanter end of the bar at the same distance—that is, 1/4 inch in advance of the first contour line. Then taper the line gradually nearer to the first contour line till the two lines join. (See Fig. 4.)

To shape the lower outer bar: Repeat this procedure, including the extra thickness for the knee lock, but carry the additional line towards the foot, instead of towards the trochanter.

To shape the upper inner bar (not to be thickened): Place the pattern of the inner side of the thigh on the block with the "knee level" laid over either side "C" or

side "D," as is most convenient. Advance the pattern till its most prominent part is within 1/2 inch from the adjacent long edge. Mark this contour on the block of wood. Then, while still keeping the knee level of the pattern lying over the required short side of the block ("C" or "D"), withdraw the pattern for 3/4 inch from the first contour line and mark a second contour line on the wood. This interval will correspond to the required bar when cut out by the narrow-bladed saw.

To shape the lower inner bar: Trace upon the block of wood the contour line taken from the inner side of the leg, from the level of the knee-joint downwards to a point about 1 inch above the ankle. From that point continue the line straight to the sole of the foot. Repeat the same contour at a distance of 3/4 inch from the previous one. With a narrow-bladed saw cut vertically through the block of wood, following the contour lines marked on the wood.

Beaufort Foot.

The correct formation of this part is essential. The curvature of the sole is of great importance. Mark one end of the foot-block as the heel, and the other as the toe. Determine which surface is to be the sole. On the sides of the block describe an arc of a circle, the distal edge of which reaches the lower margin of the block, while its radius is equal to the length of the sound leg from the knee-joint to the ground. Upon the circumference of that arc mark off a length equal to that of the sound foot. This section of the circle will indicate the curve required for the foot. Lastly, shave away the wood till the plane reaches the curved line. Nail a strong layer of durable leather upon the sole. (See Fig. 5.)

Attaching the Side Bars to the Foot.—On each side of the shaped block, at a position which corresponds to that of the inner ankle, cut a slot down to the sole 1 1/4 inches broad and 3/4 inch deep, to receive the straight lower ends of the bars. Secure them in position with glue and two screw nails on each side. Shape the fore part of the foot to resemble an instep. Round off the corners of the block. (See Fig. 3.)

FIG. 7.

Knee-joint.

(a) For the two inner bars, one above and one below the joint. With strong screw nails fix the plates of one of the hinges upon the posterior surfaces of these inner bars. Make sure that the interlocking edges of the brass plates lie over the line of the knee-joint. This will allow the lower bar to bend backwards towards the upper one, or vice versa. (b) For the two outer bars, one above and one below the knee-joint. (Note that this joint has the lock attached to it.) Fix a hinge to the posterior surfaces of these bars, as described under paragraph (a). (See Fig. 2.)

The "Attaché Case Bolt."—This appliance has two portions, which can be easily clamped together or released by the fingers of the wearer acting through the clothing. The straight edges of the foot-plates of the lock are placed on the front surface of the bars with their edges in contact with one another, over the line of the knee-joint. Fasten the foot-plates securely with screw nails to the upper and lower bars respectively. (See Fig. 6.) When no stump intervenes connect the bars above and below the level of the knee-joint with distance pieces. (See Figs. 1 and 2.)

Bearing of Weight.

(a) *Tuber-bearing Half-ring.*—Rivet this half-ring to both upper bars, at the level of the top of the inner one, thus leaving a sufficient projection on the outer bar for the attachment of the pelvic strap. Pad this half-hoop well with felt, on the top edge and inner surface. (See Fig. 2.)

(b) *Leathern Corset.*—Wrap the longer portion of the leather transversely round the thigh from the fork down to a point 4 inches above the knee level. This will cause overlapping of the leather on each side, especially near the knee. Draw lines on the leather where the two sides meet. Make it fit comfortably over the thigh. Cut away enough superfluous leather to leave in front a gap of 1 inch from top to bottom. This allows for stretching of the leather and shrinking of the thigh. Cut away superfluous leather at the top and bottom to make the upper and lower borders of the corset horizontal. Attach the corset to the side bars by two rivets on the inner side of each bar. Make the upper border of the corset lie inside the half-hoop ring. Fix the eyelets down the front for closing the corset, and insert a lace for tightening. Secure the leather pelvic strap to the top of the outer thigh bar by the leather loop, which must be screwed vertically to the bar. (See Figs. 1 and 2.)

FIG. 8.

MEASUREMENTS FOR THE BELOW-KNEE LIMB.

Length of stump from the tubercle of the tibia to the end of the stump. Circumference (1) of the thigh 1 inch below the fork, (2) of the thigh 4 inches above the level of the knee-joint, (3) of the stump at the level of the tubercle of the tibia, (4) at the mid-point of the stump, and (5) at 2 inches above the end.

CONSTRUCTION OF THE ARTIFICIAL LIMB FOR THE BELOW-KNEE AMPUTATION.

Provide the following: (a) A tuber-bearing ring as described for an artificial limb for a thigh stump. (b) Side bars, the joints and locks as for a thigh stump. (c) A foot (see Fig. 3). (d) A leather corset to support the thigh as in the case of a thigh stump. (e) A leather corset to embrace a below-knee stump, similar in construction and attachment to that described for a thigh stump; length, from the tubercle of the tibia to half an inch below the end of the stump; breadth, (a) equal to the circumference of the head of the tibia at the level of the tubercle, and (b) equal to the circumference at the lower end of the stump. (N.B.: A leather pelvic strap is not an essential part of a below-knee leg.) (See Fig. 7.)

SYME'S AMPUTATION: MEASUREMENTS FOR SYME'S LIMB.

Take a contour of the affected limb from below the head of the fibula downwards, round the end of the stump, and up to the same level on the inner side. Note circumference (1) just below the head of the fibula, (2) at the mid-point of the stump, (3) at its narrowest part, and (4) at the bulb end. Note diameters at the end of the stump from side to side, and from back to front. Measure the length and breadth of the sole of the sound foot.

CONSTRUCTION OF THE BEAUFORT "SYME'S AMPUTATION" LIMB.

Make the foot as described for a thigh stump, except that the depth of the foot-block must not be more than 2 inches. Make the two side bars the same in thickness and breadth as pre-

viously instructed, except that the length of the bars must not reach higher than to a position half an inch below the head of the fibula. Fit the bars into slots in the foot, as indicated in Fig. 3.

Socket.—Procure a piece of strong leather—length, from above the bulb of the stump to below the head of the fibula; breadth equal to the circumference of the stump. Rivet this leather to the inner sides of the bars. Insert eyelets for lacing the socket. The end of the stump, which is not enclosed, rests on a soft pad on the top of the artificial foot. Line the socket down the front with felt, or similar substance.

CHOPART'S AMPUTATION.

This amputation only requires the patient's boot to be filled up with firm stuffing to replace the lost portion of the foot.

THE TREATMENT OF PNEUMONIA IN CHILDREN BY SUBCUTANEOUS OXYGEN.

BY

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THE active treatment of pneumonia has long been augmented by the administration of oxygen. Those of us who have given the gas by intranasal catheter or inverted funnel have advocated it for its psychological rather than for its therapeutic benefit.

The value of oxygen administered subcutaneously has been by no means definitely authenticated, and therefore, with the object of investigating the immediate effects on the patient, and the more lasting effect on the course of the illness, 179 children admitted to my wards in Booth Hall Infirmary, Manchester, between November, 1928, and April, 1929, were treated with relatively large doses of oxygen injected into the subcutaneous tissues. Each case of acute pneumonia, irrespective of the type, etiology, or severity of the disease, coming under my care received oxygen as early as possible. It should be observed that the ages of the children varied from a few weeks to 16 years, and that the hospital recruits its patients from poorer-class Manchester districts where in winter child debility is widespread.

As a control, I have made notes on 89 consecutive cases admitted to Dr. I. A. Milne's wards during the same period to which subcutaneous oxygen was not administered.

In each series simple expectorant and counter-irritant remedies were employed as seemed indicated in each particular case. All were nursed in open-air pavilions in charge of the same sisters. To my regret, several patients who had received treatment were removed by parents before recovery was complete.

Dosage.

Mr. T. S. Kirk¹ found that the area of skin raised from the chest wall by 100 c.cm. of oxygen slowly injected was equal to the area covered by the palm of a man's hand. This rule was found to be fairly accurate, and was followed in this series, 50 to 200 c.cm. being injected at a time. Generally two or more doses were given. If on the day following the first treatment the temperature had not fallen, or if it had fallen and then became raised, as was a frequent occurrence, a second dose was administered. The average aggregate dosage was: up to 5 years of age, 200 c.cm.; from 6 to 10 years, 300 c.cm.; from 10 to 16 years, 400 c.cm. It was interesting to remark that whereas the absorption commenced in a few minutes, an oxygen emphysema was almost invariably felt for twenty-four hours or longer.

Method.

Rubber tubing was connected up to a cylinder of oxygen, and, with aseptic precautions, the gas was allowed to escape slowly through a hypodermic needle under the skin. About five minutes were taken to run in 100 c.cm. Specially warmed oxygen appeared to be without additional advantage. The hypodermic puncture was sealed with collodion, as the oxygen readily escaped. This simple procedure was unconnected with pain or discomfort, older children describ-

ing the sensation as similar to that produced by water trickling over the skin. In no case was there associated shock or other general disturbance, or abscess formation.

Immediate Effects.

Within four hours after the injection the temperature, as a rule, fell—sometimes to normal. This was accompanied by a partial fall in the pulse rate. The lowering in the pulse and respiration rates was less obvious than the temperature fall. Dyspnoea was eased. If cyanosis was a feature, within an hour the colour was improved. In four cases of pulmonary tuberculosis with cyanosis treated by this method a similar phenomenon was noted. Unfortunately, in all four relief was transitory, and the course of the disease either was not affected or it was expedited. No improvement occurred in the congestion of the face of a girl suffering from acute rheumatic myocarditis. The patients soon became less distressed (roughly in four to twelve hours), and as a rule slept comfortably. On the following day the general condition was improved except in some of the fatal cases. In no case did a crisis take place, the temperature falling by lysis.

In the first 50 cases—where it was possible without interfering with sleep—the temperature and pulse and respiratory rates were taken half-hourly for forty-eight hours. Nothing other than the remarkable variability in these phenomena was noted.

An early necropsy was performed on the body of a patient who died a few hours after administration. There was no evidence of oxygenation of the pulmonary tissues; the blood was dark, the bright redness described by Mr. Kirk not being observed.

Death Rate.

The following table indicates the percentage death rates in the various types of pneumonia.

	Oxygen Series.		Control Series.	
	Number.	Death Rate	Number.	Death Rate
		Per cent.		Per cent.
Total number of cases ...	179	25	83	25
Broncho-pneumonia ...	130	33	54	33
Lobar pneumonia ...	49	2	35	2
Primary pneumonia ...	121	23	71	20
Secondary pneumonia ...	58	28	18	33
Influenzal pneumonia ...	22	9	7	14

It is thus apparent that it cannot be claimed that the use of subcutaneous oxygen has a beneficial influence on the mortality.

Late Effects.

Pyrexia.—The average length of the febrile stage was shorter in the oxygen group.

	Oxygen Series.	Control Series.
Average length of febrile stage in all cases ...	10 days	13 days
Average length of febrile stage in broncho-pneumonia	10 days	15 days
Average length of febrile stage in lobar pneumonia ...	11 days	11 days

Duration.—The average length of the course of the disease was lessened in the oxygen series. The criterion of this was taken as the interval of time elapsing after onset before the chest was definitely cleared of adventitious sounds.

	Oxygen Series.	Control Series.
Average time in which chest cleared in all cases ...	23 days	29 days
Average time in which chest cleared in broncho-pneumonia	21 days	31 days
Average time in which chest cleared in lobar pneumonia	21 days	26 days