FIG. 1. Normal full-term placental tissue to show distribution of maternal and foetal erythrocytes. Haematoxylin and eosin $\times 400$.

FIG. 2. Normal full term placental tissue, after eight minutes' peptic digestion to show survival of foetal red cells within the villous capillaries. Haematoxylin and eosin $\times 400$.

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Mechanical rotary device for plating out bacteria on solid medium

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Most clinical bacteriological investigations start with streaking or plating out of material containing bacteria on to the surface of solid medium so that isolated colonies appear during incubation. Further plating of single colonies may be necessary to ensure purity of the culture, or to obtain larger amounts of the bacterium under study. Plating is usually carried out by streaking inoculum on to agar in such a way that a progressive surface dilution is obtained. Conventionally, sterilized wire loops, mounted in metal handles, are used for this purpose, though some workers favour the use of glass rods with rounded ends.

Whatever method is used, plating out is tedious and a time-consuming process, and may absorb a major proportion of the work of a busy laboratory; this article describes a mechanical device designed to eliminate much of the tedium and fatigue associated with the procedure.

DESCRIPTION OF THE MACHINE

The rotary plater is essentially an electrically driven horizontal circular metal turntable with a raised lip around the circumference. This is mounted on a central spindle, grooved at the end to fit on to a shaft in the motor so that the turntable can easily be detached and replaced for cleaning and sterilizing. Turntables of different diameters can be used to accommodate various sizes of petri dish.

The rotary unit is powered by a shaded-pole motor with 90 milliamps output and 20 Watts consumption which drives a heavy-duty gear base at a constant speed of 58 revolutions per minute, and this is mounted in a stove-enamelled metal case fitted with a switch and red warning light. There are 6 feet of flex and the unit is suitable for 200/250 volt main operation.

MODE OF OPERATION AND USES

An open petri dish is placed on the rotating turntable and the wire loop loaded by touching a colony; the user sits with one or both elbows resting on the bench top beside the machine and the loop handle is held so that the wire points towards the operator. The loop is lowered to touch the circumferential surface of the agar nearest to the operator and, as the dish rotates, it is drawn radially to the centre of the plate and lifted off. In this way, a spiral track is covered by the loop, and the distance between the coils of the spiral can be varied by increasing or diminishing the rate of radial traverse. As the loop moves

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FIG. 1. The rotary plating machine with a 4 in. diameter petri dish on the turntable. The spiral track of the loop is marked by solid linear growth.

FIG. 2. A culture of *Staphylococcus aureus* plated out on the rotary machine.

along its spiral track, the inoculum is gradually thinned out so that, on incubation, many discrete colonies develop towards the centre of the plate. When it is important to avoid risk of aerial contamination, the loop may be applied with the lid partly lifted so that the medium remains covered.

Judgment and practice are necessary for successful use of the plater as too heavy an inoculum will produce one long spiral streak with no colony differentiation; this fault may be overcome by applying a smaller inoculum than in conventional plating methods. One method of doing this is to apply a small inoculum to the circumferential edge of the agar with a straight wire and surface dilution is then continued with a sterile wire loop. Another fault that may become apparent when the rotary plater is first used is a tendency to rock the loop or allow it to oscillate about the horizontal plane; this causes lines of discrete colonies to alternate with solid linear growth. In our experience, this fault becomes less apparent with practice and the number of single colonies produced increases; the adept operator can carry out the whole operation using one single loop.

A wound or throat swab can be plated out by applying it to the agar, towards the circumferential edge of the rotating dish, the swab being rolled in the hand at the same time; plating then continues with a sterile loop. Other pathological material such as pus, faeces, sputum, or fluids may be applied directly with a wire loop. The tendency to produce solid linear growth when plates are inoculated from colonies can be utilized for routine antibiotic sensitivity testing as growth may be spread rapidly over the entire agar surface by applying a slow radial traverse of the loaded loop two or three times, and an even heavier surface inoculum may be obtained if

FIG. 3. Antibiotic sensitivity testing by Multodisk (Oxoid) after total surface spreading of the culture using the rotary plater.

TABLE
COMPARATIVE TIMES OF PLATING OUT BY CONVENTIONAL AND ROTARY METHODS

	Total Time of Plating Out for 20 Plates (min and sec)		Time of Plating of Each Plate Including Loop Flaming and Loading (sec)		Time of Loop Flaming and Loading per Plate (sec)		Actual Plating Time per Plate (sec)	
	Conventional Method	Rotary Plating	Conventional Method	Rotary Plating	Conventional Method	Rotary Plating	Conventional Method	Rotary Plating
Worker 1 (G.D.W.)	9 45 ¹	7 50	29.25	23.5	8.9	9.45	20.35	14.05
Worker 2 (R.F.W.)	10 46 ²	8 46	32.3	26.3	10.8	13.05	21.5	13.25
Worker 3 (J.M.B.)	13 25 ³	8 45	40.25	26.25	13.3	11.9	26.95	14.35
Average	11 31	8 35	33.9	25.35	11.0	11.46	22.9	13.88
			Approximate times (sec)		11	11½	23	14

¹Number of loops used and flamed per petri dish by each worker.

four equidistant radial streak inocula are applied to the medium beforehand.

The same technique of total surface spreading may be used for titration of bacteriophage. On incubating plates spread by this method whorls and ridges do appear in the bacterial growth and, for this reason, spreading of plates for phage typing is not recommended as minor reactions are difficult to read; however, titrations involving tenfold dilutions of phage can be interpreted easily. The rotary machine may also be used for spreading aliquots of dilutions used in surface colony counts. For this purpose, an appropriate volume of the diluted bacterial suspension is placed at the centre of the agar surface; then, with the plate rotating on the turntable, the drop is spread with an L-shaped glass spreader applied with a circular motion against the direction of rotation of the plate.

SAFETY AND TIME OF OPERATION OF THE ROTARY PLATER

SAFETY Despite the relatively slow speed of rotation of the machine, the possibility of spatter of bacteria on to adjoining surfaces during rotary plating was investigated. Open petri dishes containing nutrient agar were placed on the bench at one foot intervals up to a distance of 5 feet from the machine. A wire loop was then heavily loaded with colonies of *Chromobacterium violaceum* (NCIB 9131) and 20 agar plates were inoculated on the rotary plater with no intermediate flaming of the loop. The open plates on the bench were then closed and incubated; in no case were colonies of the chromobacterium recovered.

Spatter of inocula while plating out may occur when a wire is twanged by forcible contact with the edge of the

petri dish. In the conventional method of plating, where the wire loop is moved rapidly to and fro, there is much greater risk of twanging than in the rotary method, where the loop is moved steadily away from the edge of the plate.

TIME OF OPERATION Three workers, experienced in routine plating out, were selected, and the times of plating of 20 agar plates by the conventional method, and 20 using the rotary plater were compared, using stopwatches. The workers were selected on the basis that they used one, two and three loops respectively per plate in the conventional method; one loop only was used for each plate in the rotary method. Twenty plates only were inoculated by each of the methods to eliminate large variations in times of operation induced by fatigue.

The results of this experiment (shown in the accompanying Table) demonstrate that the mean of actual plating times is slightly under 23 seconds in the conventional approach, whereas this time is reduced to roughly 14 seconds by use of the rotary plating machine. The Table does not show differences in fatigue levels. Rotary plating involves little movement on the part of the operator, who leans his elbows on the bench top; the conventional method, which requires rotation of the plate in one hand and rapid to and fro movement of the loop in the other, causes much earlier fatigue in the operator.

The rotary plating machine is manufactured by Denley Instruments Ltd, 221 London Road, Burgess Hill, Sussex.

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