Until a few years ago the only worthwhile operation for Parkinsonism was complete division of the lateral column of the spinal cord at the level of the second cervical segment (Oliver, 1950), but arrest of tremor was obtained at the cost of weakness of the arm and leg and some sensory loss on the opposite side and, furthermore, this operation was applicable to unilateral Parkinsonism only (Oliver, 1953). The results of this operation were confirmed by other workers (Sjöqvist, 1954; Gaches, 1955). Walker (1949) had tried the effect of dividing the pyramidal fibres in the cerebral peduncle; sensory loss was avoided, but there was considerably greater weakness of the arm and leg than after the cervical operation.

A revolutionary advance in the surgical treatment of Parkinsonism was fortuitously initiated when Cooper (1953, 1954), while exposing the cerebral peduncle to carry out Walker’s pedunculotomy, accidentally damaged the anterior choroidal artery and was obliged to coagulate it. (The anterior choroidal artery arises from the internal carotid just above the posterior communicating artery and is adjacent to the cerebral peduncle). The operation was then abandoned, but the patient was nevertheless found to be free from tremor on the opposite side, and none of the anticipated neurological disturbances were produced on this occasion. According to experimental work on the anterior choroidal artery (Abbie, 1933), at least a hemiplegia and homonymous hemianopia were anticipated. As a result of this unexpected experience Cooper continued for a time deliberately to coagulate the anterior choroidal artery for Parkinson’s disease. The beneficial effects were attributed to infarction of the globus pallidus as later demonstrated by Mettler, Cooper, Liss, Carpenter and Noback (1954). This operation was, however, soon given up in favour of more certain and less risky methods of attacking the
globus pallidus, such as injection of procaine in oil (Narabayashi and Okuma, 1953) and injection of alcohol (Cooper and Pouloukhine, 1955).

In this work empiricism quickly outstripped scientific knowledge and theory. Thus destruction of cells in the ventral lateral nucleus or the caudal ventral nucleus of the thalamus has been found to be more effective than lesions placed in the globus pallidus (Cooper and Bravo, 1958), although the globus pallidus may still be a worthwhile target when lesions placed in the thalamus are inadequate. The operation relieves symptoms on the opposite side. It is carried out on both sides for patients with bilateral symptoms, although at least six months should elapse before treatment of the second side.

There are several ways of locating the nuclei and several ways of inflicting the lesions, but, although there is some variation in the position of the nuclei in relation to the chosen cerebral landmarks, it is exceedingly dangerous to magnify such anatomical variation by use of inaccurate apparatus. Stereotaxic methods which accurately localize the targets in three planes are essential (Spiegel, Wycis, Marks and Lee, 1947; Talairach, Hécaen, David, Monnier and Ajuriaguerra, 1949; Leksell, 1949; Bennett, 1960). Stereotaxis can hardly be better defined than it was by R. H. Clarke in 1912 in the patent specification of his, the first, stereotaxic apparatus: 'This invention relates to what may be termed stereotaxic surgical apparatus for use in performing operations within the cranium.
of living human beings . . . (it) is designed to enable
a so-called probe . . . to reach, with absolute
precision and by the shortest path, any predeter-
mined point within the cranium through a com-
paratively small opening formed in the wall of the
latter, the primary object being to obviate the
necessity of extensively laying open or partially
dissecting the head and removing considerable
portions of the cranial contents in order to gain
access to the exact spot whereat the actual opera-
tion is required to be carried out'.

Almost any patients can be treated by the com-
bined use of the Bennett (1960) stereotaxic
apparatus (Figs. 1, 2 and 3) and the modified Oliver
(1958) cup and ball (Fig. 4); the former ensures
accuracy to 1 mm. without the necessity for any
calculations and the latter allows gradual destro-
ction of the target zones over several days. A
detailed description of this technique has been
published elsewhere (Bennett, 1960). The essen-
tial principles are as follows: two immedi-
ately adjacent burr-holes are made in the skull on
the side opposite that to be treated to accommodate
the cup and ball apparatus (Fig. 4). The stere-
taxic apparatus is used (a) to place the balls in
their cups so that their channels point to the
chosen targets, and (b) to measure the depth to
which cannulae have to be passed to reach the
targets. Each ball is then firmly fixed in position
and the scalp is sutured over the cup and ball
apparatus (Fig. 4). On subsequent occasions the
stitches are removed under local anaesthesia and
injections of a viscid alcoholic mixture (Etopalin
0.2 ml.) are given into the appropriate part of the
thalamus.

Although some neurosurgeons still regard relief
of tremor as the primary aim, restoration of func-
tion is the desire of most patients, with relief of
tremor of secondary importance (Oliver, 1953).
Sometimes oculogyric crises and hyperhidrosis are
relieved, but dysarthria and excessive salivation are
not. With the use of accurate stereotaxic technique
and graduated destruction of the appropriate
nuclei, restored or improved function and abolition
or reduction of tremor and rigidity can be obtained
in most patients of any age with unilateral or
bilateral disease, provided there is no associated
mental deterioration and they are fit enough to
stand a light general anaesthetic for a little over an
hour in the sitting position.

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Stereotaxis in the Treatment of Parkinsonism

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doi: 10.1136/pgmj.37.429.423

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