nuclei produced dissociated sensory loss and there were frequent recurrences of pain.

2. The palaeo-spino-reticulo-thalamic tract terminating in the thalamic intralaminar nuclei including n. centre median and parafascicularis.

3. Fibres passing from the posterior thalamus in the region of the n. limitans portae of Hassler to the second somatosensory cortex in the parietal operculum.

Eleven cases were described in which thermocoagulation lesions were produced stereotactically in either the second or third systems for painful lesions involving the brachial plexus in 10 cases and the sacral plexus bilaterally in one case. Preliminary stimulation studies produced a sensation of heat contralaterally from the posteroventral nuclei and of paraesthesiae from the intralaminar nuclei. Tegmental stimulation and lesions caused diplopia in the two patients so treated. All patients obtained some degree of relief, which in six cases was excellent. Survival time did not exceed six months and no conclusions were drawn in relation to the possible long-term effects of such procedures.

EXPERIMENTAL AND CLINICAL EVALUATION OF A BRITISH CRYOGENIC LESION MAKER

J. W. MCINTOSH (Stoke-on-Trent) described a cryogenic probe designed by H. G. Clark and Brodie Hughes, based on the Joule-Thomson effect, and manufactured by the Hymatic Engineering Company. The instrument consisted of a vacuum insulated probe 1.9 mm in diameter employing B.O.C. nitrogen at 2,000 lb/sq in. The escaping nitrogen gas passed through a heat exchanger to cool the entering gas. A copper-constantin thermocouple at the probe tip recorded temperature and the single control of the instrument was a reducing valve regulating gas pressure. The instrument had been tested by the makers at three times the normal working pressure.

The minimum temperature achieved using nitrogen was -100°C but the gas Argon would produce a lower temperature. The dimensions of the uninsulated tip of the probe were 1.9×2.4 mm, which produced an ellipsoidal volume of frozen tissue. Any application requiring a larger lesion, as in hypophysectomy, would require a probe of larger diameter. As constructed at present the instrument cannot be sterilized by autoclaving because of the low melting point of the solders used in its construction.

The probe was tested in a series of experiments in the cat brain based on a technique described by Mark and his colleagues (1961). This consisted of placing the tip of the probe by a stereotaxic technique at different distances from the Edinger-Westphal nucleus. The effect on the pupil of cooling at various temperatures was observed and recorded photographically. These experiments showed the reversibility of cryogenic lesions related to temperature and range from the surface of the probe and the size and shape of lesions at different rates of cooling. Satisfactory results of this technique using Leksell's stereotaxic instrument were described in 13 patients suffering from Parkinson's disease and one patient suffering from spasmodic torticollis.

REFERENCE

Mark, V. M., Chato, J. C., Eastman, F. G., Aronow, S., and Ervin, F. R. (1961). Localised cooling in the brain. *Science*, **134**, 1520.

VISUAL IMPAIRMENT IN 'LOW PRESSURE' HYDROCEPHALUS

J. BLOCK (Dundee) discussed the possible mechanisms by which visual impairment results from opticochiasmatic arachnoiditis. Two patients were described in detail in whom progressive deterioration of visual acuity and fields, after a severe head injury in the first case and tuberculous meningitis in the second, suggested the diagnosis of arachnoiditis, which was confirmed at operation in the first case. However, in both cases ventriculography showed considerable ventricular dilatation. The first case showed high pressures, of the order of 400 mm CSF and bone changes of raised intracranial pressure, whereas the pressures recorded in the second case were normal. Vision in both patients was significantly improved by ventriculoatrial shunt. It was suggested that the effect was not due to a reduction of slightly raised 'general' intracranial pressure but that there may have been a local pressure effect in relation to the optic chiasm and nerves. Local cystic swellings of two types were described, either a distended third ventricle compressing and distorting these structures from above or an arachnoidal cyst filling from the basal cisterns and causing compression from below. Such an arachnoidal cyst had been demonstrated in the first patient and the residual bitemporal field defect was very suggestive of a lesion compressing the chiasm in the midline.

FIVE MODES OF SUBTRACTION USING ARTIFICIAL SLOW FLOW CAROTID ANGIOGRAPHY

H. VERBIEST (Utrecht) described special aspects of radiographic and photographic subtraction using a recently developed technique of percutaneous artificial slow flow carotid angiography. This method depended upon occlusion of the ipsilateral common carotid artery below the site of puncture by means of digital compression during the injection of the contrast medium and for three seconds thereafter. A distinction was made between angiographic subtraction and photographic (or electronic) subtraction.

Angiographic subtraction was related to the angiographic technique, selective suppression of vascular filling revealed abnormalities in the resulting vascular pattern and might also produce visualization of anastomosing vessels not seen in the routine angiograms. Although the latter was due to angiographic subtraction the result could also be termed an 'addition phenomenon'.

The following photographic subtraction techniques were described:

Subtraction of skull structures from the compression angiograms resulted in better visualization of the angiographic pattern.

Subtraction of compression angiograms from the routine arteriogram in cases of visualization of the middle and anterior cerebral arteries in the routine angiogram