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THE CEREBRAL CORTEX

Neurophysiology is adept, as is true also of certain other biological sciences, at concealing simple concepts behind long names. Relatively complex apparatus has been used to obtain results, and much apparatus has in a sense produced so little understanding of many problems that confront the neurophysiologist. It is therefore useful to read a book on neurophysiology which attempts to put this in order, and moreover to stimulate further research.[1]

Less is known about the functions of the normal cerebral cortex than any other organ in the body. An intelligible picture of the normal function has still to be constructed. There are obviously good reasons for the slow progress in this branch of neurophysiology; there is the anatomical complexity of connections within the cerebral cortex, and its intimate connections with other parts of the nervous system. It is stated that there are 50,000 cell bodies beneath one square millimetre of the cortical grey matter, many of which are in a state of continual activity. The electrical changes are so small that only the response of many cells firing together can be recorded. The behaviour of single units has mostly been derived from records of the action of large groups of cells. There is rarely either histological or geometrical homogeneity of cells. There is irregular and almost random entanglement of many neurones of dissimilar shape and different function. Stimulating electrodes applied to the central nervous system must always excite numerous cells at one time. Although it is possible to stimulate individual cells with micro-electrodes, it appears that many separate cells of a functional group must be stimulated before excitation will spread along normal routes. Thus, in general, the neurophysiologist is usually forced to deduce the function of single cells from records of the discharge of many thousands of units. Artificial stimulation is used which seldom emulates the excitation that occurs naturally.

Isolation of living cerebral cortex from the rest of the nervous system does not produce results that are easy to interpret. Nevertheless much experimental work has been done, using different techniques, including the study of 'slabs' of isolated cortex. Incompletely isolated areas of cerebral cortex have also been studied, which were capable of responding to both artificial and physiological stimuli.

There are electrically excitable cells outside the central nervous system that are capable of spontaneous activity, i.e. they are capable of discharge at moments which are not dictated by the precise times at which electrical energy is supplied from outside the system.[1] Isolated heart muscle, gut, and uterus are examples of systems with a rhythmic activity not requiring external electrical driving. There is not the same certainty with regard to sites of spontaneous discharge within the central nervous system. Many workers have assumed that some cells within the cerebral cortex are capable of spontaneous discharge. Technically the design of experiments to demonstrate the presence of such cells is extremely difficult, and interpretation is open to the effects of personal bias. It is difficult to design experiments which clearly reveal spontaneous activity within the central nervous system, and more difficult to interpret their results without prejudice. Small differences in experimental procedure could undoubtedly account for divergent observations.

The so-called higher functions of the nervous system have mostly eluded measurement. No one can safely define intelligence, voluntary activity or consciousness. The problem of memory is a baffling one. A neurological mechanism for the establishment of simple memory would need to have certain properties, as proposed by Burns.[1] Many hypotheses have been put forward, which stimulate thought and research. It is possible that developments in some other branch of science may assist the neurophysiologist and the psychologist in understanding the mechanism underlying learning.

1. Burns, B. D. (1958): *The Mammalian Cerebral Cortex*. London: Edward Arnold.

STIKSTOF

Gedurende 1936 is 'n slagoffer van caisson-siekte, of saamgeperste-lug-siekte, met sy inmekaargetrekte senuweegestel (pynlike ledemate en buik, duiseligheid, jeuk, en daling in bloeddruk), uit diep water opgepik. Weens die verligting wat suurstof hierdie pasiënt by 'n vorige geleentheid verskaf het, was sy eerste versoek dan ook dat sy huidige toeval sou swig voor onmiddellike suurstof-toediening. Sy dokters het egter sy pleidooi van die hand gewys, sy vorige ondervinding is as versinsel bestempel, en hy is boonop verdink van denkbeeldige simptome en selfs verslawing aan verdowingsmiddels![1] Hierdie geskiedenis behoort so af en toe onder die aandag van dokters gebring te word, al is dit dan slegs as voorbehoedmiddel teen professionele verwaandheid.

Nes ons normalerweg deur die neus asemhaal sonder om juis besonder bewus daarvan te wees, is dit 'n feit dat ons gedurigdeur deur 'n atmosfeer wat 78% stikstof bevat, omring word. Hierdie doodgewone verskynsel maak egter 'n hele aantal nuttige kliniese kunsgrepe moontlik; almal berus op die moontlikheid dat stikstof in die verskeie liggaamsdele deur suurstof vervang kan word, en hulle sluit vandag in die roetine van reiniging van stikstof van vlieëniers in afwagting op snelle vlug tot besondere hoogtes van die hemelruimte.[2] Stikstof is veel meer geredelik oplosbaar in liggaamsvet as in meer waterige weefsels. Op dié manier verskyn talle lugblasies vereers in weefsels buite die bloedvate ten tyde van 'n vinnige dekompressie, hetsy deur ontsnapping vanuit 'n duikboot of deur 'n oormatig vinnige opstyging bo die oppervlakte van die aardbol. Dit is goed bekend dat vet duikers meer onderhewig is aan caisson-siekte, en die olierige wit stof van die brein en rugmurg word veral getref in die vernietigende uitdeining van die uitsettende stikstofblasies.

Stikstof is verder meer oplosbaar in vet-oplosmiddels as in water. Berekenings wat gebaseer is op oplosbaarheidskoëfisiënte openbaar dat 100 ml. di-etiel eter versadig met stikstof by 0°C., 17 ml. stikstof sal prysgee wanneer daardie bottel teen 'n temperatuur van 20°C. oopgemaak word — die eter ,kook' immers duidelik vir 'n rukkie elke keer as 'n nuwe bottel oopgemaak word. Wanneer, soos tans soms die geval is, eter voorsien word in groot dromme, bring hierdie feit mee dat 'n gevaar van brand ontstaan deur die verspreiding van hierdie swaar, eter-versadigde stikstofdamp oor die vloer en meubels.

Soos reeds in hierdie *Tydskrif* in 1959 vermoed is,[3] kan ons nou wetenskaplike sekerheid[4] aanvoer dat die toediening van suiwer laggas vir een minuut absoluut veilig is en met geen anoksie gepaard gaan nie, op voorwaarde dat sulke toediening voorafgegaan word deur suiwer suurstof-toediening sonder die moontlikheid van herasemhaling van uitasemingslug. Dit stel 'n nuttige tegniek voor in die onvoorbereide, ambulante pasiënt wat behoefte het aan kort chirurgiese ingrepe. Dit kan met welslae toegepas word in die vrou ten tyde van sterk kraampyne, vir die induksie van narkose wat voortgesit word deur eter, en ten slotte in die pasiënt met 'n beperkte kardiale omset wat derhalwe sal baat by die hoë suurstof-spanning ten tyde van 'n narkose-induksie deur slegs laggas.

Daar is feitlik geen end aan kliniese toepassings van ons huidige kennis van stikstof se rol in die menslike liggaam nie. 'n Onverwagte steier- of skavot-funksie in die longe is geopenbaar deur die snelle optrede van atelektase na die afsluit van 'n brongus, hetsy op eksperimentele of gewone kliniese manier, in die teenwoordigheid van 100% suurstof toediening; iets wat omtrent 40 keer langer neem as die longe deur lug gevul is. Dieselfde meganisme laat toe dat lug in die pleurale of peritoneale holtes veel vinniger geabsorbeer word as daarin geslaag kan word om 100% suurstof vir geruime periodes aan die pasiënt toe te dien.

Teen voldoende aantal van atmosfere druk oefen stikstof 'n bedwelmende uitwerking uit, nes die geval is met die onaktiewe monatomiese gasse, maar die feit dat helium en stikstof nie sonder meer onderling vervang kan word in die fisiologie nie, is onlangs duidelik uitgewerk in eksperimente op embrios van kuikens.[5] Miskien dui dit slegs op die geweldige onderskeid in die soortlike digtheid van die betrokke gasse. Hoe dit ook al sy, sulke eksperimente dui ongetwyfeld op die weg na die waarheid t.o.v. retrolentale fibroplasie, waarvan ons kennis vandag feitlik beperk is tot die waarneming dat stikstof blykbaar die toestand by vroeggebore babas verhoed bloot deur 'n verdunningseffek (van die suurstof) en dat die toestand niks anders te doen het met suurstof as sodanig nie.

1. Porter, W. B. (1936): J. Amer. Med. Assoc., **106**, 992.
2. Middleton, R. H. (1959): *Bends and Denitrogenation in High-Altitude Flight Operations*. (USA Airforce)-WADC Technical Report 58-625, ASTIA Document AD 212561, March.
3. Mostert, J. W. (1959): S.Afr. T. Geneesk., **33**, 840.
4. Heller, M. L. en Watson, T. R. (1962): Anesthesiology, **23**, 219.
5. Allen, S. C. (1961): Physiologist, **4**, 2.