Ireland

Remarkable story of maths genius who had almost no brain

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Under the Microscope Prof William Reville Look up brain in a standard reference. It will tell you that the vertebrate brain is that part of the nervous system that resides within the skull. In humans it is an approximately 1.3kg mass of pinkish-grey tissue composed of about 10 billion nerve cells linked to each other and responsible for the control of all mental functions.

The brain is the control centre for movement, sleep, hunger, thirst, and all vital activity necessary for survival. All human emotions are controlled by the brain.

Now let me ask you a "no-brainer". Is your brain really necessary? If the answer is a blindingly obvious yes, then you are not familiar with the work of the late Dr John Lorber (1915-1996) professor of paediatrics at Sheffield University. More than 20 years ago the campus doctor at Sheffield University was treating a student of mathematics for a minor ailment. The student was bright, having an IQ of 126. The doctor noticed that the student's head seemed a little larger than normal and he referred him to Dr Lorber for further examination.

Dr Lorber examined the boy's head by Cat-scan to discover that the student had virtually no brain. The normal brain consists of two hemispheres that fill the cranial cavity, some 4.5cm deep. This student had a layer of cerebral tissue less than 1mm deep covering the top of his spinal column. The student had a condition called hydrocephalus in which the cerebrospinal fluid (clear colourless fluid in the spaces in and around the spinal cord and the brain) becomes dammed up in the brain instead of circulating around the brain and spinal cord.

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The cerebrum constitutes about 85 per cent of the weight of the normal brain. It is generally accepted that the large surface area (cortex) and development of the cerebrum accounts for the superior intelligence of humans compared with other animals. The cortex consists of grey matter (information processing), 3-4mm thick, containing nerve-cell bodies that in turn covers an inner bulky mass of white matter (information transmission) containing insulated nerve cells. Physiologists and neurologists have mapped the cerebral cortex, identifying regions responsible for motor movements, sensory processes, memory and other cognitive functions.

In hydrocephalus the cerebrospinal fluid, which circulates through brain channels called ventricles builds up pressure that balloons up the ventricles pressing the overlying brain tissue against the cranium. This insult from within causes a loss of brain matter and many hydrocephalics suffer intellectual and physical impairment. But, a significant fraction of patients escape impairment despite grossly abnormal brain structures.

Hydrocephalus is usually fatal in the first months of childhood and, if an individual survives, he/she is usually seriously handicapped. However, the Sheffield student lived a normal life and graduated with an honours degree in mathematics.

Dr Lorber systematically studied hydrocephalus and documented over 600 scans of people with this condition. He divided them into four groups: people with nearly normal brains; those with between 50 per cent and 70 per cent of the cranium filled with fluid; those with 70 per cent to 90 per cent of the cranium filled with fluid; those with 95 per cent of the cranium filled with fluid. The latter group constituted less than 10 per cent of the study and half of these people were profoundly mentally disabled. However, the other half had IQs over 100.

Roger Lewin published an article in the prestigious journal Science, December 12th, 1980, describing and discussing Dr Lorber's work. Some sceptics claimed that Dr Lorber misinterpreted the Cat scans and others complained that he had not exactly quantified the amount of missing brain tissue. Lorber replied that he would hardly make such astounding claims without the backing of substantial evidence and commented on the lack of precise quantitation - "I can't say whether the mathematics student had a brain weighing 50 grams or 150 grams, but it is clear it is nowhere near the normal 1.5kg and much of the brain he does

have is in the more primitive deep structures that are relatively spared in hydrochephalus".

Dr Lorber concluded, "There must be a tremendous amount of spare capacity in the brain, just as there is with liver and kidney". He also said "the cerebral cortex of the brain is probably responsible for a great deal less than most people imagine". Some neurologists agree with Dr Lorber, but most would go no further than accepting there is a possibility that the deep structures are more important than currently thought. Some neurologists also claim that invoking spare brain capacity to explain Dr Lorber's results is simply an cop-out to gloss over something that simply isn't understood.

Hydrocephalus has been induced in cats in order to study the structure of the altered brain. The cat experiments show that hydrocephalus preferentially damages the white brain matter. The relative sparing of the grey matter may, at least partly, explain the retention of normal functions in many severely hydrocephalic individuals.

Lorber also noted that if you implant a shunt, which releases cerebrospinal fluid pressure, in a young hycrocephalic child you often see complete restoration of overall brain structure, even in cases where initially there is no detectable brain mantle.

I certainly cannot explain Lorber's observations, except to note that in some cases the brain shows itself to be amazingly adaptable and capable of servicing the body in a manner equivalent to the familiar "normal" brain, even though its volume and structure is remarkably compressed and distorted.

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