The Brains of Britain

Facts about the brain and its spine

By

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Introduction

What follows are some of my personal views as someone daily faced with the challenges of those involved in caring for the victims of neurological disorders. I cover some of the majesty of the human brain and its all too oft fragile fortune. It is our most precious gift and too often we see it needlessly lost. I suspect some of what I write here will upset you for the facts are often very sad indeed. The situation has over the years upset me greatly.

Perhaps like me your upset can manifest itself in helping the Brain and Spine Foundation for it is a great cause. I hope so.

Much of it is also amazing and exciting. Here goes.

Operating with the great Professor Watkins. Two brain surgeons about to get serious. We have just gained access to the brain and are about to bring in the microscope. Our longest stretch on a single job was 23 hours. Even his legendary bladder needed a break.

The Human Brain: where you live

The brain is by far the most complex structure known to man. Being uncannily like a cauliflower in shape and size it weighs in at around 1.35Kg. Jammed full of nerve cells, or neurones as we call them, surprisingly it is quite numb. You can operate on it in awake patients and it/they feel nothing – always get an adult to help you. Utterly helpless it can't even move on its own. But don't be fooled.

It has a furious metabolism which demands a fifth of all the blood pumped by the heart. It thereby uses a fifth of all the oxygen you breathe just to keep you thinking. Over the course of a normal school day an average class has 17,500 litres of blood poor through their young brains. No wonder they learn nothing - it's all washed away.

Actually, in some ways brains are themselves rather childish. They will only metabolise a limited number of sugars. Demanding gallons of sweeties, a brain will not metabolise protein, fat or even eat its greens. It is really petulant too. If you go for a run your skin, guts and liver are gracious enough to give up nearly all their blood supply in favour of the muscles. The brain would strike if you tried that arrangement and faint. Mind you marathon runners can get troublesome diarrhoea towards the end as their guts give up from lack of oxygen; the so called "runners trots". And remember a brain is for life and it's not the kind of pet you can leave even for a moment. With no blood supply the brain switches you off in a few seconds and after four minutes gives you a one way ticket to eternity.

The Brain has one or two fatal, or in many patients disabling, design faults. First, it not only looks like a cauliflower but has the consistency and resilience of an over boiled one. The fact it is soft and squidgey makes it susceptible to all kinds of injury and absolutely useless as a building material. You might think yours was hopeless at geography but try hanging a door off it.

Delicate and gushing with blood is not a good combination for a thing you want to hang your life off for three score years and ten.

That is why God put it in a tough box up at the top of you, out of harm's way. But tough boxes don't expand and if just a few teaspoons of all that blood leak out of your pipe work into your head, as in a brain haemorrhage or blood clot, the pressure rises. If it doesn't stop leaking you blow your brains out - literally through the small holes in the bottom of the skull. An instant pass to the other side. To give you an idea try an upright beheading. The blood will spurt a good ten feet. Again, get an adult to help you and remember, you will only be able to observe the results of the experiment if you are the one with the axe.

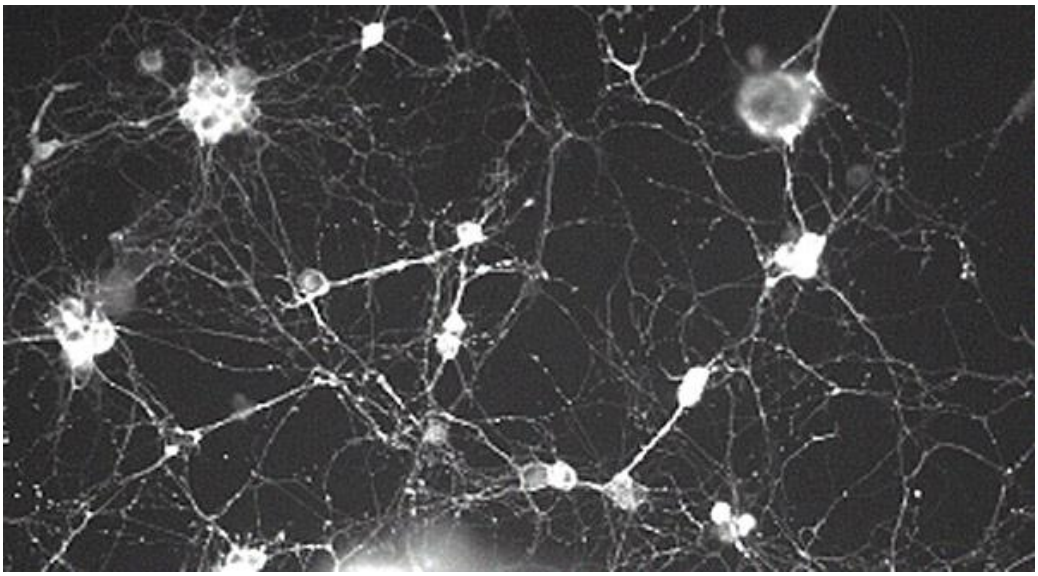
Why the "Brain and Spine Foundation"? Well, the brain is connected to the world via its spine. The spinal cord is like a motorway to planet earth with lots of trunk roads, or peripheral nerves, coming off. A few of these trunk roads sprout directly off the brain

itself. They do stuff like vision, smell, balance hearing, taste, a smile and pulling of the tongue. (The brain itself does pulling of the leg.) But the majority of the trunk roads leave from the spine and divide and divide into smaller and smaller roads eventually right down to the little mud tracks that supply the furthest corners of your bodily magnificence. There is nothing and nowhere that you have or do which is not controlled by these nerves. From the beating of your heart to the itching in your ear it all comes to you via this network. You cannot flip channels if you don't like the programme. You live what it gives.

And, there you have it, or do I mean, have you. The brain, its spine and their peripheral nerves is what constitutes the nervous system. The diseases and injuries which affect the nervous system are called the neurological disorders.

My old boss, Mr T. T. King, specialised in tumours at the very base of the brain – that is really tricky stuff for which you need several adults to help you. Like others he used to refer to the brain as the "Master Organ" – "Hamlyn," he said "that's as maybe but you will find as a surgical workplace it is often a bit of a struggle."

Indeed, here the fun needs to end. The statistics of disorders affecting the nervous system are quite sickening.



Nerve cells growing in the dish of one of my research fellows. You can see their cell bodies, the big white splodges, and the axons, long spindles, they are sending out in search of the their fellows. Enough of these connected in the right way and you have a human mind – or a guinea pig. Enough of this kind of work and we can make a paralysed victim of a spinal injury walk again, a stroke victim smile and a dementia victim remember their loved one.

How common are its disorders?

1. More people die or are left severely disabled by neurological disorders than either heart disease or cancer.
2. Head injury affects almost a million people a year in the UK – nearly half a million are kids – it is the biggest killer of teenagers and remains the biggest killer of males until their mid twenties.
3. Overall 12% are due to sports related injury – golf (being hit by the club) is the commonest.
4. Stroke will affect one in 10 of us. 11% of all NHS hospital beds are occupied by disabled stroke victims
5. Brain tumours develop in 5,000 of us each year. They are the commonest solid cancer to affect children. About 2,000 are benign and with complex surgery can be cured. The remainder are malignant and kill most of their adult victims – many are young adults in the prime of life. Though about half of the children affected can be saved, half are lost.
6. The range of neurological disorders affecting the **brain** is almost endless and they affect all age groups. They begin their onslaught even before we are born.

FOETUS	- Spina bifida, neural tube defects
BABY	- Cerebral palsy, intra-ventricular haemorrhage, hydrocephalus, febrile convulsions
KIDY	- Brain tumour, autism, polio, dyslexia
TEENAGER	- Epilepsy, meningitis, encephalitis, head injury,
YOUNG ADULT	– Brain haemorrhage, multiple sclerosis, motor neurone disease, headache and migraine, schizophrenia, endogenous depression, OCD
OLDER ADULT	- Dementia/Alzheimer's, stroke, Parkinson's

Then there are all those disorders which affect its **spine –** the bran's motorway to the world:- Spinal injury and paralysis, neck pain and brachalgia (pressure on the nerve to the arm usually from a slipped disc in the neck), back pain and sciatica (pressure on the nerve to the leg usually from a slipped disc in the back), myelopathy (a dementia of the spinal cord), myelitis (like multiple sclerosis of the spinal cord), spinal tumours.

Finally, we must not forget the **peripheral nervous system** – the branches that come off from the brain and its spine:- Carpel tunnel syndrome, the neuropathies (these progressively make you go numb and paralysed), peripheral nerve injury

7. Overall there are 3.5 million suffers of neurological disorders in the UK.
8. Often neurological disorders don't kill you. They often leave you with a legacy we call disability. This may be mild, moderate or incapacitating. It may be mental or physical or both. It is often permanent.
9. The neurological disorders are the commonest cause of serious disability by far. Those affected in a population at any one time (the prevalence) far out number those permanently affected by all other conditions put together i.e., cancer heart disease, diabetes.
10. It is glorious if you survive a cancer. Not so glorious if you are left maimed by the physical and mental ravages of a neurological disorder. One in 100 families have members fulltime dedicated to looking after the disabled victims of head injury and another one in a hundred looking after a stroke victim. More now live with dementia. So it is that a neurological disorder may well take out two or three people at a time as victims and carers.
11. Each year 5,000 of us get brain tumours. We think of breast cancer as a plague with deaths running at 15,000 a year in the UK. But, brain tumour is rare compared to other neurological disorders.
12. Each year 130,000 of us have a stroke – remember 11% of our hospital's beds are occupied by its disable d victims.
13. Just under a million of us go to hospital with a head injury each year – more people are admitted with head injury than appendicitis or broken bones. Head injury is the commonest cause of admission to a surgical bed in a UK hospital.
14. We will all have headaches.
15. During a lifetime most of us are knocked out.
16. By any account the neurological disorders are the most common conditions to kill and maim our population.

So what care is available?

You would predict that the neurological disorders being the most common would be at the heart of medical training and provision. In fact we live with a sickening under provision. Great Britain should have a government health warning. You bring your brain here at your peril. No other advanced nation takes such a scandalous and cavalier attitude to its chief natural resource.

1. Of the 760 acute hospitals in England and Wales just 32 have Neuro Units – doctors who specialise in the medicine (neurologists) and surgery (neurosurgeons) of the nervous system.

2. Out of some 20,000 consultant specialists just 140 are neurosurgeons and about 500 neurologists.
3. As a result only 15% of head injury victims are actually admitted to hospital and fewer than 5% *of those* ever see a specialist. Even when in hospital the vast majority (95%), in Britain, get cared for by orthopaedic and gut surgeons. The guidelines for head injury management in the UK state that if a victim deteriorates after admission, then, they should see a specialist i.e., get put back in an ambulance and driven to the nearest hospital or county which actually has a specialist trained in this field – remember the brain only has a four minute warning bell before catastrophe.
4. We only treat our brains this way. Brain surgeons don't treat fractures. – "Hello Mr Smith, I am a brain surgeon and you have a broken leg. I'm going to try a plaster of Paris. It has been a while since I've done one but I will do my very best. Later, if the leg looks like it's about to drop off I will see if I can find an actual orthopaedic surgeon. O.K.? – mmmm Look it's not as if we're talking about something important like your brain and your other leg looks great." You are right to think it is a bad joke but, break your brain in this country and that is what you get, 95% of the time.
5. About the same percentage of stroke victims ever see a neurologist i.e., 5%
6. There are no brain surgeons in the whole of Kent, Cornwall and North Wales.
7. If you are head injured, in Dover, Folkestone, Ashford, or Canterbury, Margate, Whitstable, Gillingham, Rainham, Faversham, Maidstone, your ambulance will not stop until it gets to Denmark Hill in South London.
8. You may have heard of "the golden hour". This is the first vital bit of care which in the case of severe head injury determines the final outcome – dead or daft vs fit and healthy. In the UK 95% of us spend it in the back of an ambulance or in the hands of generalists. Not much golden about that then.
9. If you live in these towns and have a brain tumour, however bad your disability or young your child, you will have to travel every day to Maidstone to have your radiotherapy and if you need an operation or heaven forbid if you want to see the surgeon, you're off to London again. We are not talking about some remote backwater here but one of the most populated areas in Europe, Kent. You would be twice as likely to wake up with a brain surgeon at the end of your bed in Greece, Portugal and Spain than you would in Britain. In Cornwall, South Wales and Kent you stand no chance at all.
10. Most head injury, stroke and brain tumour patients requiring surgery or in-patient neurology get a few days at the specialist centre and then if they are not fit enough to survive at home, they go back to their local hospital, which if they are lucky will have a neurologist visiting once a week. You're back with the well meaning generalists, orthopaedic and gut surgeons.
11. .The outcome in non specialist hands is bad. One third higher rates of permanent disability and death from strokes if care is on a general medical ward compared to a specialist stroke unit. And remember, a stroke unit is not just a corner of a general ward where they keep the stroke patients.
12. No other advanced nation (OECD countries) has less than twice the number of neuro specialists per head of population. Many have more than ten times the

number. Go to Greece and Portugal for your fit and you are twice as likely to get specialist care than in the UK. Or Japan; there you will find nine times as many specialists as you get here.

13. A few years ago one in ten head injury victims died not because of the lack of neuro units but because basic support was mishandled at the local hospitals before and during transport to the neuro unit. The front line staff did not know what to do. The situation may be better now but don't bet on it. At the same time training of qualified doctors was introduced to reduce the problem, neurosurgery and in some cases neurology too was removed from the core curriculum of students still in medical school. It is now not only possible but for many normal to qualify in medicine from British universities without even meeting a brain surgeon let alone studying with one. Deadly but true.

What stops change?

1. If a hospital has no neuro specialists the medical advisory board is unlikely to vote for one. The board will be full of orthopaedic surgeons, guts surgeons, cancer specialists and heart specialists. They will vote for more of what they have – orthopaedics, guts, cancer and heart.
2. If a primary care trust is composed of general practitioners who have never worked on a neuro unit they won't appreciate the need to have one nearby.
3. If none of the country's doctors have worked in a country where neurological disorders are cared for by people trained in the subject they will think it normal.
4. If all the patients meet are doctors who think it quite normal to be doing it this way they too might be fooled in to thinking it is normal or at least safe.
5. If you are fed a diet of heart disease and cancer you may still have room in your mind for kiddies but who has ever heard of the neurological disorders.
6. If the neurological disorders are sold as lots of different disorders – there are over 40 charities covering diseases from trigeminal neuralgia to Huntington's chorea - without a single big brand name like the British Heart Foundation or Cancer Research, the public never learn that it is in fact not the heart but the nervous system which is "Britain's biggest lady killer".
7. If you go to see a Health Minister as I did – Tessa Jowell when she held that brief- and present these facts on behalf of the Brain and Spine Foundation, she will say something along these lines: "I am a here to represent the public. Their agenda is heart disease, cancer and surgical waiting lists. When your problem is on their agenda it will be on mine. Must dash."
8. As long as intelligent and otherwise demanding Britain's are content to go into hospitals with serious conditions of the brain, its spine and peripheral nerves and have orthopaedic surgeons, abdominal surgeons, cardiologists, respiratory physicians, gastroenterologists and any other well but inappropriately qualified doctor, do the best they can, we shall continue with the current system.

9. The current system measures deaths but doesn't lump all the neurological ones together. They are all dealt with separately and very often stroke is put together with heart disease!
10. The current system does not emphasise disability. Michael Watson, the boxer, was left half paralysed, spent months in hospital, had five operations, spent almost a year in a rehabilitation hospital and had several fulltime carers in addition to his amazing family when eventually he went home. He didn't count because he didn't die? Ask him? He is a very lovely man I am sure he will tell you. Where did he go when he lapsed into coma? The nearest hospital to be placed on a breathing machine. Was he lucky? No, the 32 out of 760 meant he, like most of his fellow patients, had to be put back in the ambulance and drive around town looking for a hospital able to treat his complication – a blood clot – of the commonest cause of admission to a surgical bed in the UK – a head injury.
11. Because the cost of a life time with carers is met by the social services budget it is not the problem of the Department of Health. The disability costs do not factor in the NHS equation. Neurosurgery is expensive, but if you save a teenager from being dependant for their whole life on a team of careers and an otherwise working family it is incredibly cheap by cardiac and cancer standards. But those costs are in another department. The NHS has to balance its books and disability does not count. Neurosurgery is better value for money than most treatments for heart disease and cancer but to the NHS it is expensive. Until the Social Services costs and lost earnings/tax revenue are connected with the treatment costs no Minister wishing to hold down the post will allow it to deter them from delivering "an NHS on budget" in spite of the fact that the proper care of neurological disorders is fantastically cheap compared to almost all other forms of medicine if only you measure it right.

Surely the brain is untreatable?

Not so. It is in fact easy to treat. Our challenge is to find the patients. Here is one example.

Transient ischemic attack or TIA was given this name by a murderous ninny. It is a collection of symptoms that often warn of a forthcoming and largely preventable stroke. If it had been called Brain Attack we would all have got the message just like we all know that chest pain spreading down the left arm means a heart attack is coming. But, you don't need an angiogram, stent, bypass and then a transplant to treat it. Just a simple ultrasound scan – the thing we look at babies with in Mum's tum – and then a little dose of daily aspirin. This reduces the stroke rate by one third, has virtually no risks and costs peanuts. Remember, 11% of hospital beds are occupied by stroke victims. A lot of the deaths and disability are a result of the lack of awareness of the warning symptoms.

Specialist units reduce the disability from stroke in those who are unfortunate enough to have one. This is not a marginal effect on survival but a reduction of a third. No new science needed here just the application of what we know today – we know what to do, how to do it and how to train people in its delivery. We simply fail to do it.

Why do research?

Put simply the neurological disorders now represent the most exciting frontier of modern medicine. Here is where you find the soft fruits, ready to pick. This is not a field of knarled, high altitude pickings such as is now left in the fields of heart disease and cancer. A pound spent on the neurological disorders will deliver more from the laboratory into the ward than it will in any other field. The gains are potentially huge and we are successful at it.

1. A few years ago the only way to stop a weak blood vessel bursting and killing people (subarachnoid haemorrhage – affects 25,000 often young adults per year) was to open the skull and operate under the brain to seal the vessel. A third died, a third were left disabled and a third recovered to lead a normal life. A new treatment whereby the blood vessel is repaired from inside using a tiny probe passed up to the vessel in the head from the groin was developed a few years ago. Recently a trial to compare how good this was compared to the traditional operation had to be abandoned early because the new treatment was so good.
2. Certain brain tumours, using another new technique of computer guided beams of irradiation, are now routinely and successfully treated without surgery. The surgeon who trained me saw half of the patients die during surgery when he started out. Unfortunately this applies only to a few but it is a real start.
3. Some research is fundamental and yet is frustratingly close to delivering not one but two Holy Grails of modern medicine.
    a. **Neuro-protection.** If we could protect nerves cells in a damaged but not dead area of the brain – so called neuro-protection- much of the disability from head injury and stroke, spinal cord injury and multiple sclerosis etc, etc, could be prevented. We have discovered a drug which does this to the tune of 20% in subarachnoid haemorrhage and another which seems to do it in laboratory models of spinal cord injury.
    b. **Neuro-regeneration.** If we could make dead nerve cells re-grow – so called neuro-regeneration - we could cure all those people who already have Alzheimer's, motor neurone disease, head injury and stroke, spinal cord injury and multiple sclerosis etc, etc, as well as all the other neurological disorders – all 3.5 million of them, all 11% of those beds freed for the orthopaedic surgeons.

But will we ever do this? Yes. In a laboratory dish we can make this happen. We can make cells connect to each other. In models of spinal cord injury we can make nerve fibres grow down microscopic tubes implanted into the injured area - we just can't get them out the other side yet!

4. Other areas are equally exciting. The ability of living tissue to interface with and thereby control, robotics is a rapidly developing science. This technology may allow us to control legs cut off from neurological control by spinal injury. Likewise, there is a group in Copenhagen who have evidence to suggest that sciatica is due to discs being weakened by bacteria before prolapsing raising the prospect of us treating the condition with a simple course of antibiotics. We are not there yet, the answers may be round more than one corner but the corners are not many and not long.
5. Not all research needs to take place in a laboratory. Some needs real people. The Brain and Spine Foundation has completed research with school children and teenagers returning to school after brain injury – the injury may be from an accident or left by a meningitis, a brain tumour or relate to severe epilepsy. Around five thousand have to try this each year in the U.K..

> *All too often children look normal having made a full physical recovery but the return to school exposes persisting behavioural and learning difficulties. Some areas of the brain may not be used until later stages in growth so the effect may not be seen for a year or two. Every school has a SENCO (special educational needs coordinator); a teacher who is responsible for coordinating the school's programme for children who are struggling. For every 18 Schools there is an Educational Psychologist who advises the SENCO on difficult cases. Research has shown that the needs of brain injured children are beyond them. Currently these children often fail. Exhausted families who have survived the initial traumas see their child spiral into a social and educational decline which all too often tears the family apart and creates a monster out of an illness. The school soon cannot cope, detention follows failure and ASBO's follow exclusion. Did you know that prison is the final resting place for substantial numbers of adults hospitalised with brain injury as a child?*

The Brain and Spine Foundation has developed a half day training programme with 8 of the 147 Education Authorities England and Wales which has identified the areas where children fall down, teaches the Authority's Educational Psychologists how to recognise the early signs of failure and gives them the skills to teach the SENCO's how to address them. As each Educational Psychologist covers 18 schools, for every hundred we train 1800 schools can cope better. When you haven't got much money it pays to spend it wisely - 8 down 139 to go.

Now for a short play:

BSF fundraiser:	Give us a quid mate?
Donor:	Will it work?
BSF fundraiser:	We think so – 100% of those trained report they can help these children better.
Donor:	Does it matter?
BSF fundraiser	You tell me.

What help does The Brain and Spine Foundation give?

1. The telephone help line puts a specialist at the end of the phone for any victim of a neurological disorder, their family and their carers. This award winning service is utterly unique, available nationwide and is free to the user. Faced with questions on neurological disorders it is where the government funded telephone advisory service ***NHS Direct*** refers you.
2. This is matched with a comprehensive written and web based information service – again free to the user and available nationwide.
3. If you have a neurological disorder we will not let you down however rare your particular trouble may be.
4. If you are a teenager with epilepsy, a brain tumour or recovering from a head injury, all this is perhaps a bit daunting and certainly a lot boring. So, you can try our Web chat room. Meet people who are on your road. March together with people of your own age who really understand.
5. There are 8 billion pages of information on the Web. This is too much information and much of it biased or wrong. That is why the Brain and Spine Foundation has invested in a research programme to identify the information needs of patients, families and carers, and is now close to completing a directory of validated sites. We will sign post you straight to the good stuff.
6. We train the front line doctors. Even if Britain were to double the number of specialists in the UK tomorrow still only 1 in 10 victims could see a specialist. The state of our health services, both NHS and private, are such that at least 90% of you will never even see a specialist so it is vital that our accident and emergency and general practitioner workforce have high quality post graduate training available to them. The Brain and Spine Foundation has developed and delivered a specialist programme with Bath University to do just that.
7. The Brain and Spine Foundation has produced a training video which teaches student and doctor alike how to examine the cranial aspects of the nervous system – a unique tool available to all medical schools.
8. The Brain and Spine Foundation has just invested £40,000 in developing a training web site which will develop interactively into the future and train frontline doctors in the recognition and treatment of common neurological problems – how to go from the warning symptoms to the cure.
9. The Brain and Spine Foundation has of course done the vital work on children's brain injury described in point 5 of the preceding section.
10. The Brain and Spine Foundation has invested in research programmes which have discovered how brain tumours spread into the adjacent healthy brain tissue bringing closer the day we can stop them, explored the potential for screening for weaknesses in blood vessels that cause stroke and have provided vital clues in the cellular changes which may unlock the secret of neuro-protection in head injury.

11. The Brain and Spine Foundation invested in training researchers. Being specialised we are better at it than the big non-specialist charities. We identified promising individuals who had had funding turned down by the Medical Research Council or The Wellcome Trust. One, the neurosurgeon Peter Hutchinson, was so successful that he is now permanently funded in his research at Cambridge University. He developed a treatment to reduce the build up of pressure that crushes the brain after head injury. His discoveries are saving lives, giving teenagers and their families a fighting chance, every day.
12. Let us also not forget the wider contribution of Britain to the neurological disorders.
    a. It was a Londoner of that name who described Parkinson's disease,
    b. Brain scans, both CT and MRI were invented in Britain,
    c. British University workers discovered how nerves conduct messages from A to B – Professor J.Z. Young of UCL
    d. British University workers discovered how one nerve talks to another - Sir Bernard Katz UCL
    e. British University workers discovered how to make nerves grow down tubes - Professor J Priestly QMUL
    f. It was a British neurosurgeon who first successfully separated twins joined at the head - Mr John O'Connell Saint Bartholomew's Hospital
    g. It was another British neurosurgeon who set the standard for safety worldwide in sport related head injury - Professor Sid Watkins The Royal London Hospital.
    h. The neuro-protective effect of the drug used in subarachnoid haemorrhage was discovered by a Cambridge neurosurgeon, Professor John Pickard.
    i. Perhaps most famous is the Glasgow team of Jennet and Teasdale who invented the method now used in every hospital across the world to measure the depth of coma in any unconscious patient what ever the cause. The answer to "is the patient getting better?" and "is our treatment working?" is answered, in thousands of hospitals, for millions of patients across the globe, everyday of the week by their work – the Glasgow Coma Score. Even British medical students have heard of this.

    I could go on – and on. But, I have just given you some recent, personal highlights here. I was taught by Young and Katz at university, trained by Watkins in neurosurgery, have researched with Priestly and was appointed to O'Connell's post. Hutchinson and I trained together. Teasdale was an early Trustee of The Brain and Spine Foundation. Along with Professor John Pickard and a colleague of ours, Donald Shaw, we founded it in 1992. **This is a new science, a genuinely modern medicine. You can make it happen by donating to the Brain and Spine Foundation**

How efficient is the Brain and Spine Foundation

1. It raises a little over £500,000 per year. (Compare that to £50 million for the British Heart Foundation and £100 million to Cancer UK)
2. For this The Brain and Spine Foundation delivers the telephone helpline 20 hours a week, answers to a huge and increasing number of e-mail enquiries, over 20 booklets, a constantly changing web site, the chat room for teenagers and kids, training programmes for frontline doctors and schools, makes vital discoveries in the fight against our biggest killers, launches people who would have been lost into a lifetime of lifesaving research, and vitally raises awareness of the need to do so much more of all this.
3. The work of the Brain and Spine Foundation reduces deaths and disability in Britain.
4. For every pound donated we currently deliver £5 pounds to the mission.

You have lots of competing interests on your time and money. But remember: even if only half of what you have read is true, what goes on now is still appalling and what might be is still thrilling.

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