Submission to the RCS Commission on the future of surgery.

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I am a consultant Neurosurgeon at Queens Medical Centre, Nottingham. In addition to my usual duties I have a longstanding, and entirely amateur, interest in designing and developing neurosurgical instruments and other 'bits of kit'.

One of my main current projects is the design and development of a neurosurgical training simulator. With the increasing limitations on junior doctors' hours and the consequent reduction in surgical exposure, simulation training will inevitably have an increasing role. Until recently there was no neurosurgical simulator, the speciality having lagged behind many others in this respect. I therefore set about trying to design one.

The 'Realistic Operative Workstation for Educating Neurosurgical Apprentices' (Rowena) is a 3 part brain surgery simulator, based on, and named after, my daughter, Rowena.

It consists of a plastic head and neck with realistic skull base anatomy which forms the permanent base of the device. Onto this is fixed a 'cranial top' consisting of the skull, underlying dura, and overlying scalp; fixed together in a way that these important surgical planes dissect apart in a realistic manner.

Initial development of this consisted of persuading a British company to indulge me with my idea and then trying out a number of plastic hemispheres of different properties to find a format that cut and drilled like real bone. These were then covered in a variety of plastics in order to mimic the scalp and dura and, on many occasions after work, both I, and my children, would try out various mock craniotomies on these, which were clamped to a workmate in the kitchen.

Having found a formula that worked, a cranial vault was made and simply affixed to a basic plastic face that the company had 'knocking around'. Thus was born the first prototype. The response to a few test procedures was reassuringly positive and we decided that a new, definitive head and neck was required. My collaborator dismissed any idea of using my own 'ugly mug' and my daughter, Rowena, kindly volunteered. After a day of mould making the Rowena acronym was composed, somewhat tongue in cheek, in the car home.....and seems to have stuck.

After some experimental training courses there was a significant demand for a realistic brain with ventricles, which would enormously increase the number of procedures that could be taught. This was similarly developed via a number of 'plastic footballs' before the final version was produced with full ventricular anatomy. This was one of the longest stages of development as we had to find a plastic that was firm enough to maintain its shape and yet would cleave in the same way as real brain.

Using this simulator trainees can practise all the basic, and some of the more complex, neurosurgical procedures; starting with positioning the head in a 3-point headrest, working through burr holes and basic flaps, ventricular access and drains, intracranial pressure monitors, right up to complex flaps across the midline and some posterior fossa approaches.

The ventricular system enables it to be used to teach neuroendoscopy and, as it is CT and MR compatible, it can be used with the image guidance systems which are becoming an increasing part of modern Neurosurgery.
Mock haematomata, tumours and fractures have also been used, and we already have a paediatric version with fontanelles and open sutures.
The cranial top is essentially a consumable, and once drilled and sawed to destruction, is inexpensively replaced, whilst the brain has a significantly longer lifespan.
In 2014 it won the FSB East Midlands Business Innovation of the Year Award, also becoming a National Finalist (one of 12 out of 1000 entries), as well as the East midlands Chambers of Commerce Excellence in Innovation Award. In 2015 it was one of three finalists in the East Midlands Medilink Innovation Awards.
Since 2012 we have run a total of 10 simulator courses at QMC, each over 2 days with 8 delegates, so over 80 trainees have been through this one course. Others have been set up in Sheffield, Birmingham, Liverpool, Glasgow, London, the Royal College of Surgeons, and the Manchester Neurosurgical Boot Camp (which all new trainees must now attend). Simulators have been sold to Australia, Russia, and, last summer, we ran our first workshops in Europe, in Nijmegen, The Netherlands, and this will be followed by one for Dutch trainees this autumn.
With each course we try and develop the role of simulation in neurosurgery further; most recently introducing some validated assessments of delegate's performance to see how they improve, as well as the use of 'Pivothead' video glasses to record individual simulated operations.
Moving forward we have asked whether neurosurgery could, or should, move more towards the kind of training systems that the airline industry has long used where simulation is of a very high degree of fidelity and is extensively used for both initial training as well as continuing professional development, with professional trainers and much greater awareness of human factors.

Links.
www.neurosurgical-training-simulator.com
Trent Simulation and Clinical Skills Centre Website:Courses:Rowena
www.deltasurgical.co.uk

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DELTA SURGICAL

NEW PRODUCT INTRODUCTION

Rowena™

Realistic Operative Workstation for Educating Neurosurgical Apprentices

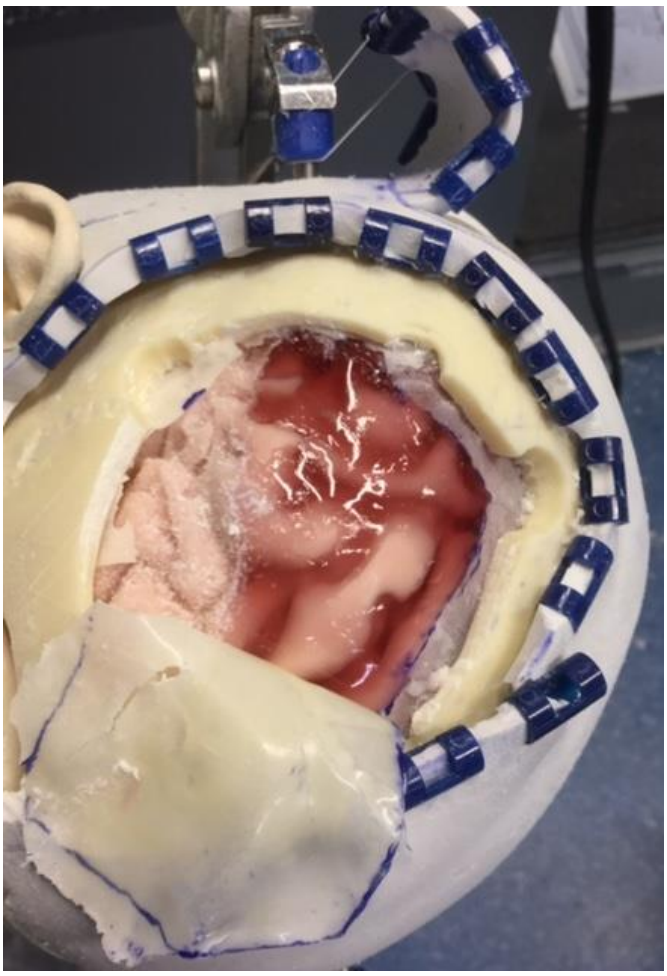
Rowena™

Designed by a practising Neurosurgeon, Rowena™ is a two-part plastic neurosurgical simulator for teaching basic surgical techniques and approaches.

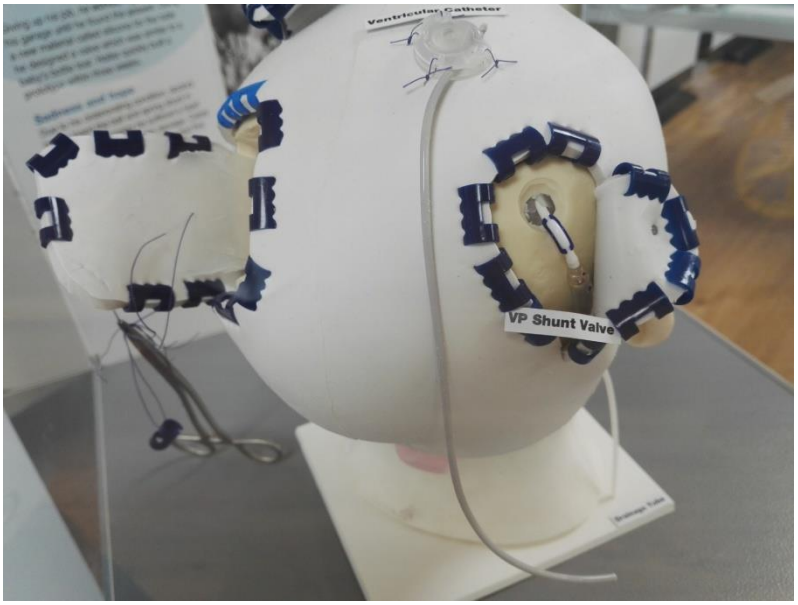
It consists of a moulded plastic base with realistic internal skull anatomy on which is fixed a replaceable upper cranium with scalp, bone and dural layers. Inside the skull is a realistic plastic brain.

"Contact Delta Surgical to purchase this impressive new product"

'Rowena' Neurosurgical Simulator Leaflet.



Simulated subdural haematoma in ‘Rowena’ simulator



‘Rowena’ Simulator used to demonstrate different neurosurgical procedures.

Craniotomy using the Rowena simulator.

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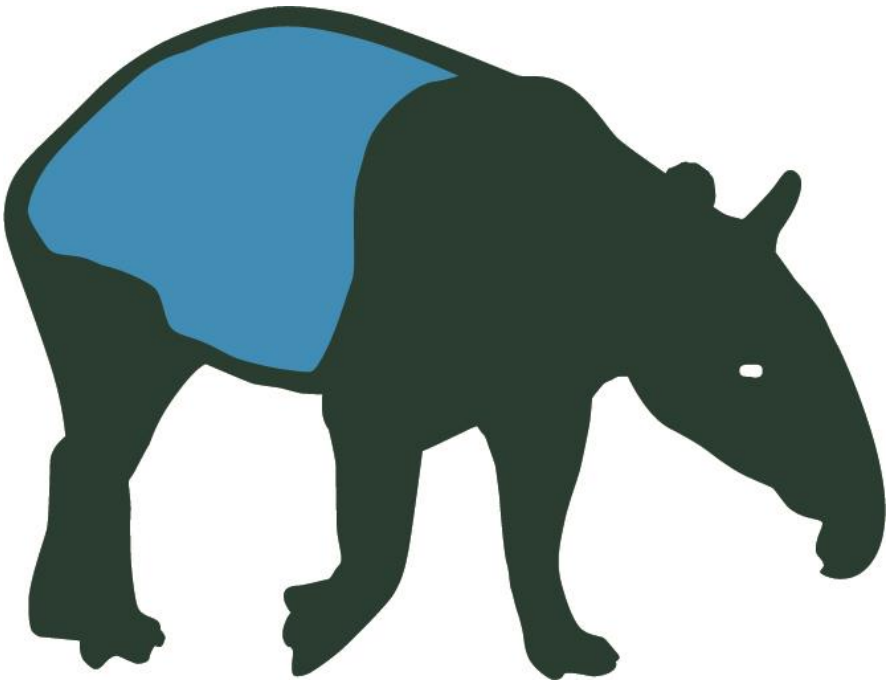

Neurodesign logos.