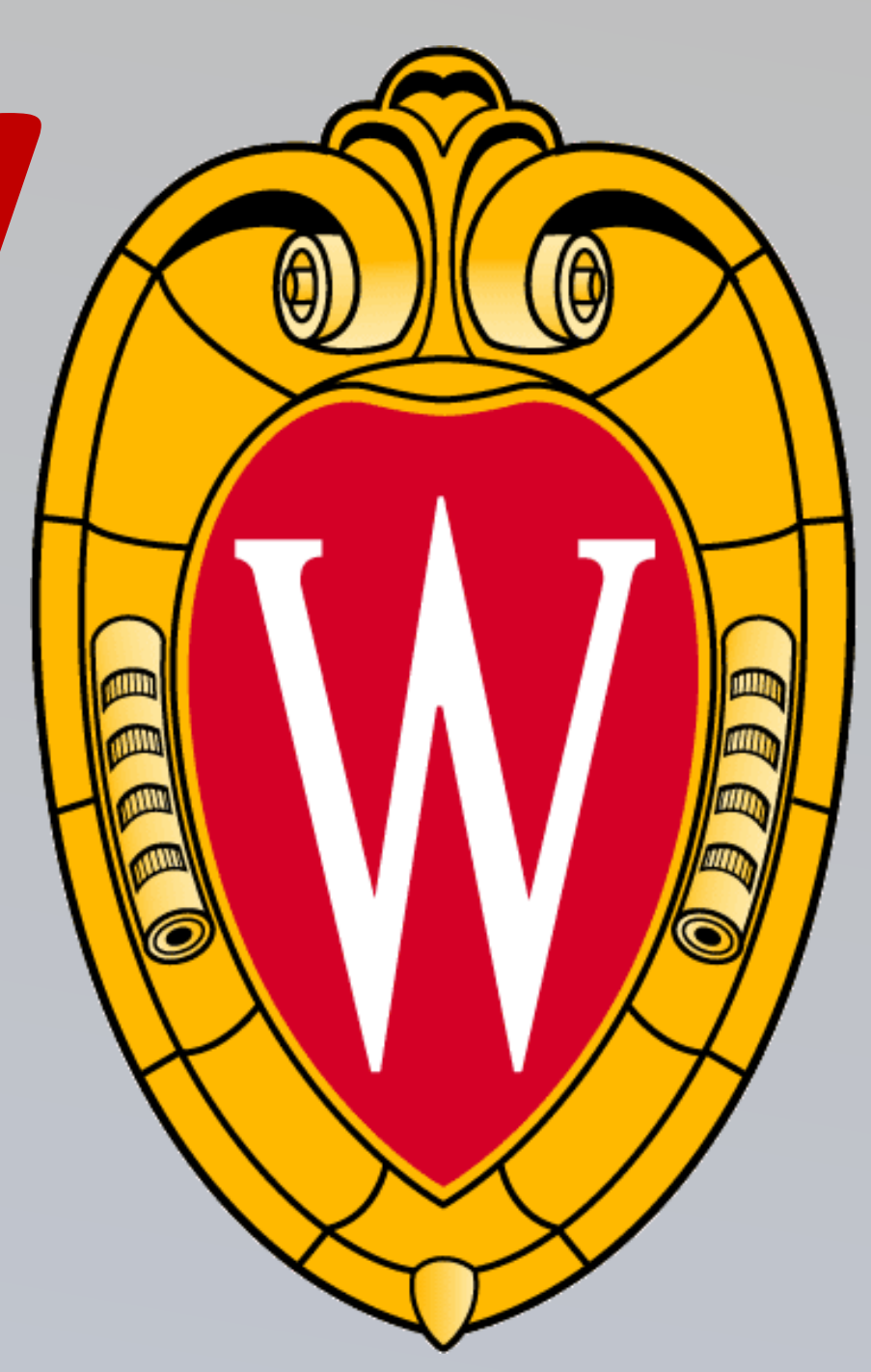


# Mechanical Neuro-Endoscopic Surgery



## Simulation Model

Team: Kimberli Carlson, Courtney Krueger, Alan Meyer, Anyi Wang

Client: Dr. Bermans Iskandar, UW-Madison Dept. Neurological Surgery

Advisor: Mitch Tyler

### Abstract

Endoscopic third ventriculostomy surgery is commonly performed on patients with hydrocephalus. This surgery occurs within the ventricular system, specifically the third ventricle, to alleviate cerebrospinal fluid (CSF) build-up. Medical students need to be able to practice this surgery before operating on real patients.

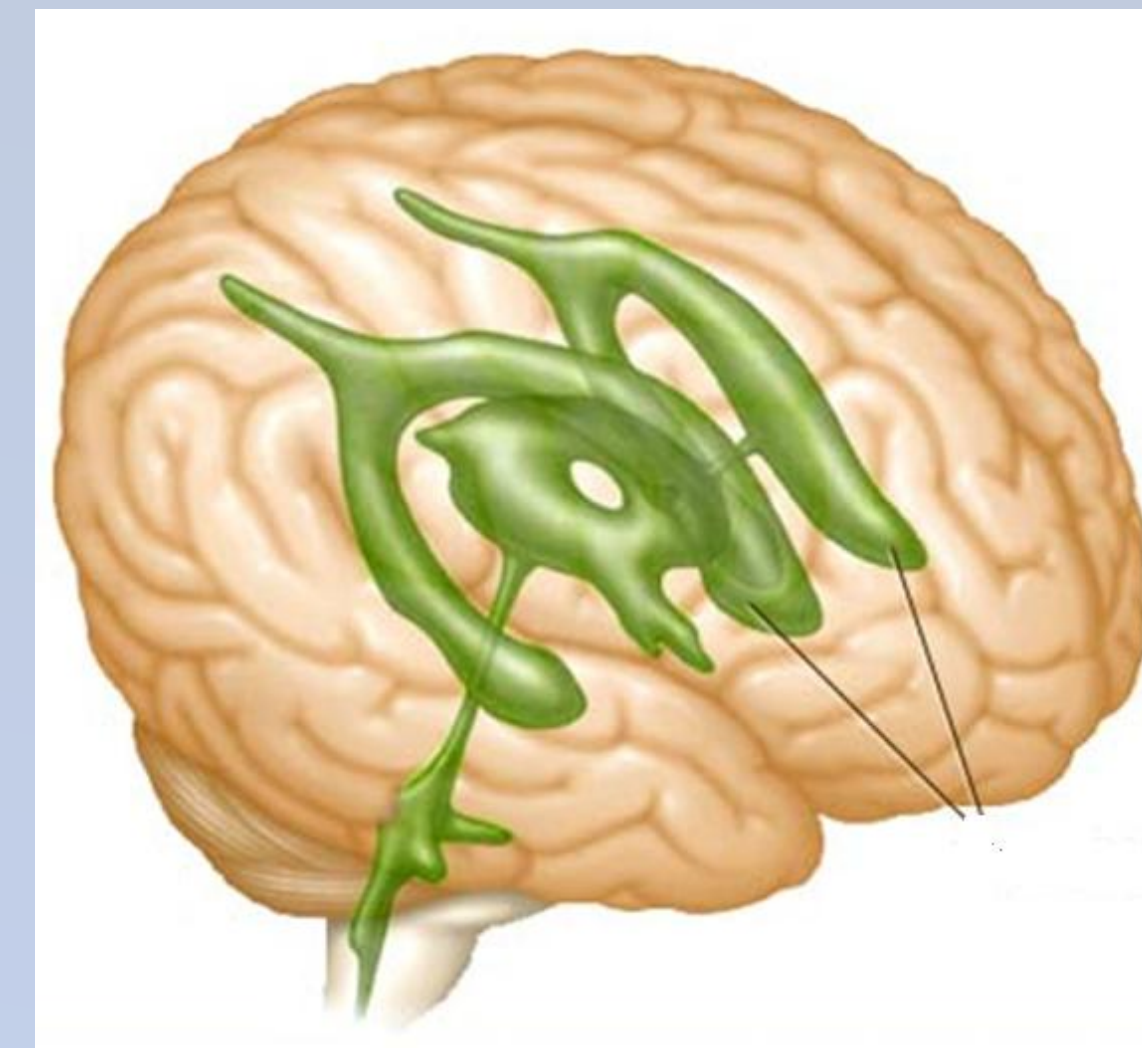


Figure 1. Ventricular system in body. Four main ventricle cavities.

### Design Requirements

The model must:

- Simulate endoscopic third ventriculostomy
- Weigh less than 5 kg
- Be usable with 6.2mm diameter endoscope
- Be disposable
- Be anatomically correct

### Final Design

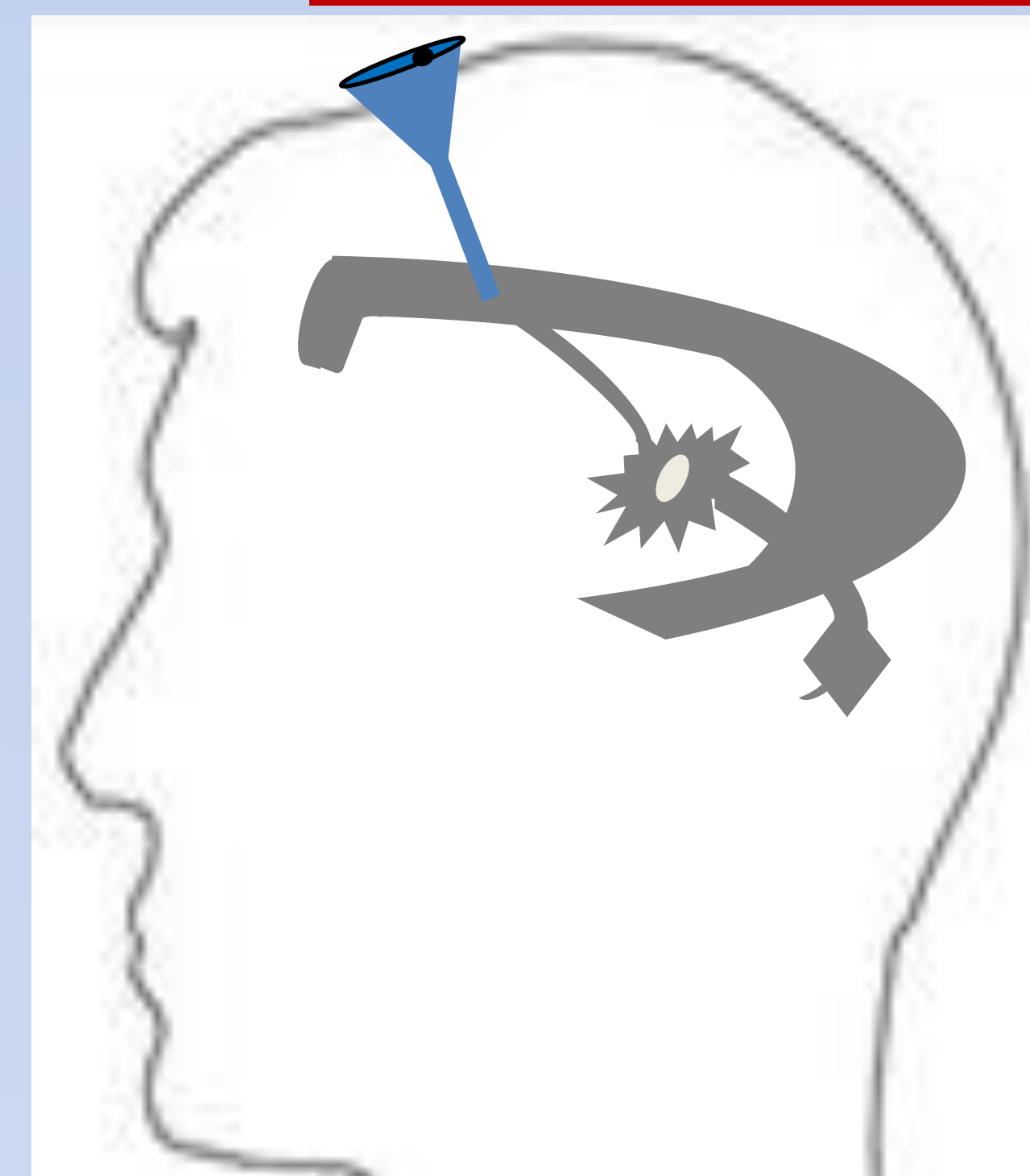


Figure 4. Fluid-filled ventricles concept.

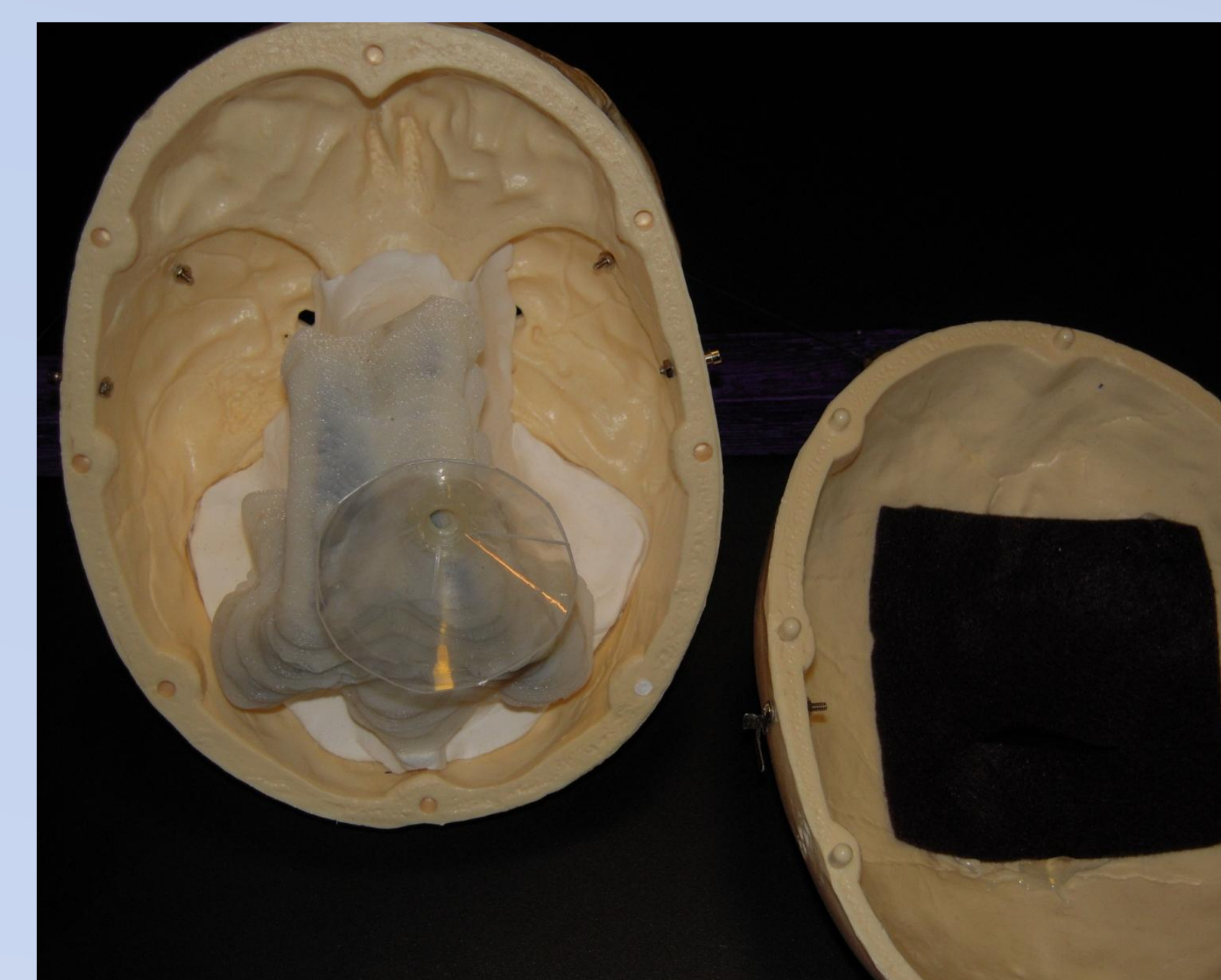


Figure 5. Interior of final prototype.

### Features of Final Design

- Rapid prototype ventricle cast:
- MRI scans used to create 3D image of ventricles
- Prototype using ABS plastic ventricle cast
- Ventricular cavities with endoscope opening
- Thin wall for puncturing to relieve pressure
- Funnel guided entry:
- Ensure proper angle of entry
- Material-covered opening
- Fluid Filled:
- Siphoning and replacing CSF
- Use mineral oil to simulate CSF

### Creating the Ventricles



Figure 6. 3D image of ventricles .

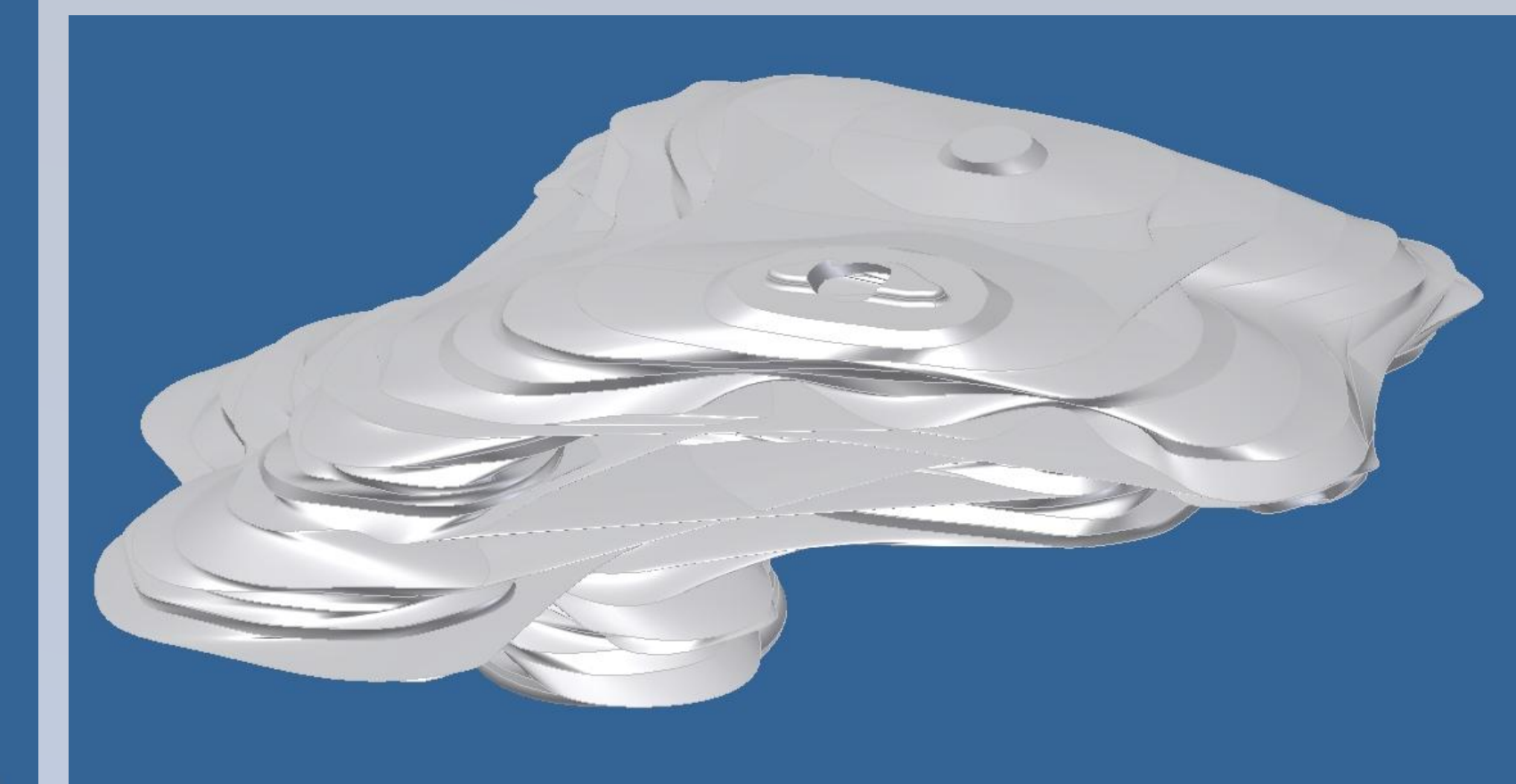


Figure 7. 3D image of ventricles.

- AutoDesk Inventor 2010 was used to create 3D image
- Ventricles on scans isolated and lofted together:
- Formed 3D image of ventricular cavities
- Obtained anatomically correct interior of ventricular cavities
- Image saved as an STL file and printed in ABS plastic

### Future Work

- Use different imaging method to obtain rapid prototype of hydrocephalic brain
- Create rapid prototype using DuraForm Flex material
- Add additional structures outside ventricles

### References

- [1] Aesculap. (2010). "Aesculap Neurosurgery MINOP Neuroendoscopy Systems." Retrieved on October 8, 2010 from: <http://www.aesculapusa.com/>
- [2] Pope, R. E. (2010). Neuroendoscopy. Retrieved on October 8, 2010 from: <http://www.spinesurgeon.com.au/index.htm>
- [3] Fields, A. (2010). Interview. UW-Hospital Medical Physicist. October 29, 2010.

### Background

- 4 Ventricles cavities in ventricular system:
- Aqueducts connect the ventricles
- Produce cerebrospinal fluid (CSF)
- Hydrocephalus is swelling of the brain due to build-up of CSF:
- Caused by tumors, edema, tissue swelling
- Build up of CSF in aqueducts
- Endoscopic third ventriculostomy removes blockages
- Current method of surgical practice:
- Cadavers
- First real surgery on patients
- Existing devices not specific for endoscopic third ventriculostomy

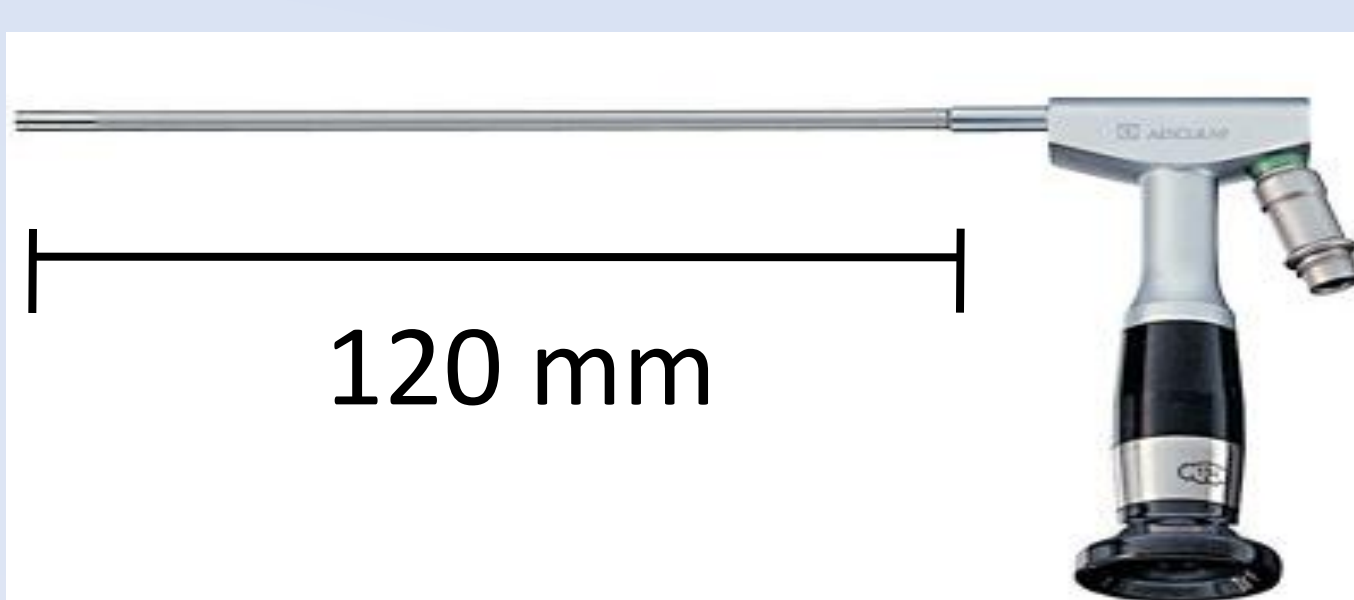


Figure 2. Endoscope used in surgery.

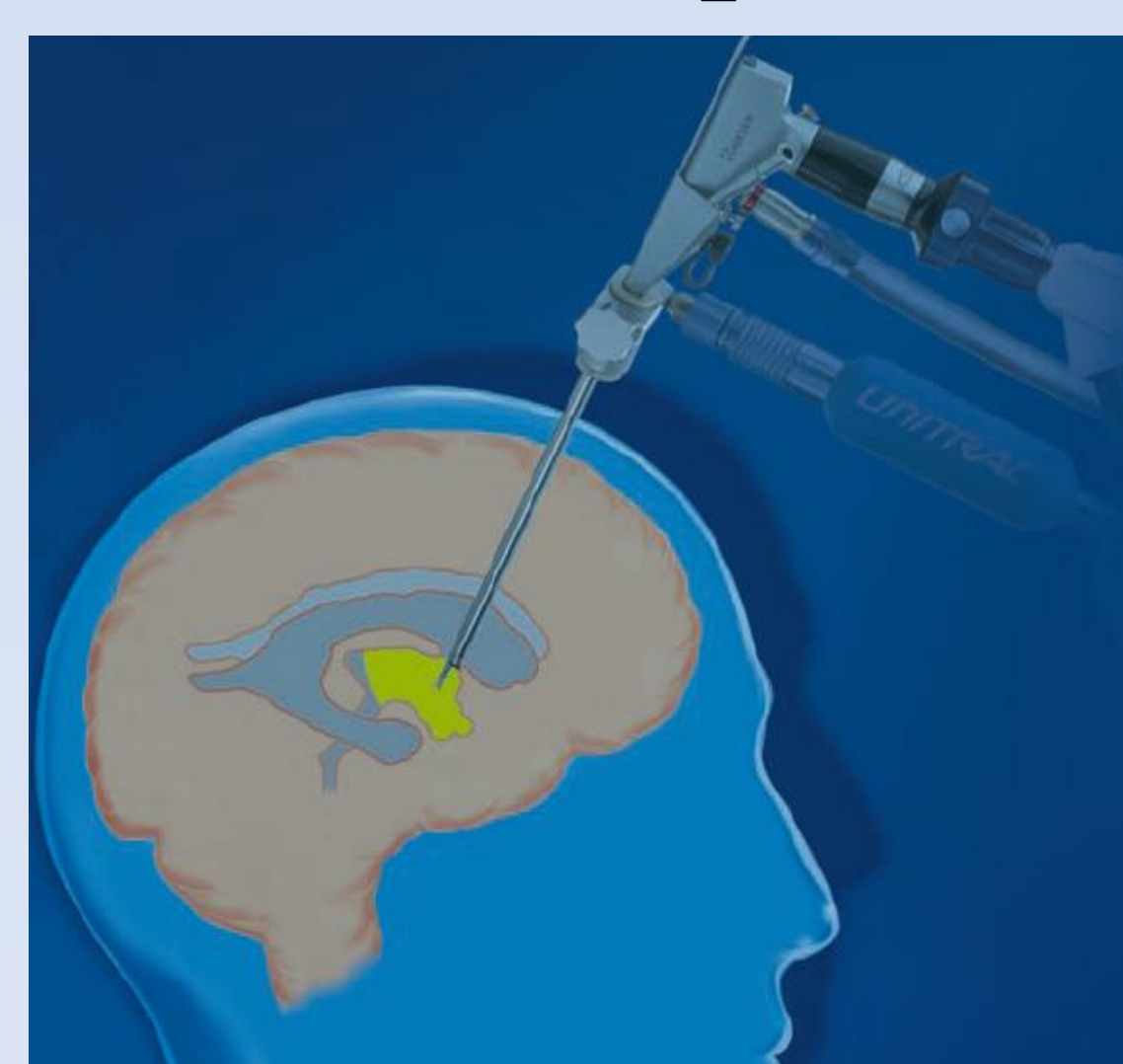


Figure 3. Endoscopic third ventriculostomy.