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What is penetrating traumatic brain injury? (pTBI)

Severe form of **head injury**, direct mechanical damage to the brain

Death of neuronal tissue, inflammation, infections and complications

High mortality and long-term disability

Currently **no direct brain repair therapy** available after an injury- only supportive measures and longer-term rehabilitation

What are emerging clinical solutions?

Complex and advanced therapies for neurorepair are being tested by many different scientists (chemists, engineers, biomaterial scientists) to be given early after injury. Examples include:

- Electrostimulation¹
- Biomaterial graft transplantation²
- Stem cell therapies³
- Nanotherapeutics⁴

What is the problem?

Creating accurate, inexpensive, simulative brain tissue models (specifically of head injury) requires complex **equipment, training, expertise, ethical permissions** etc.

Biomaterial scientists, engineers, chemists... Any scientist outside of the purely biological, can struggle to **effectively test their therapies** facing these **logistical problems**.

Research goal: Can complex brain tissue models be sent to a remote site using Hibernate™, a specialized transport solution?

What is Hibernate™?

Special chemical solution keeps cells alive outside of incubator (no equipment required)

Originally used in foetal neural tissue transplantation for Parkinson's disease trials⁵

Successful storage of neural cells at **room temperature BUT...**

Never been tested with complex mature brain tissue models



Methods

Step 1

Grow brain tissue sheet
10-14 days

Step 2

Control
Standard conditions

Storage in
Hibernate™
4 hours

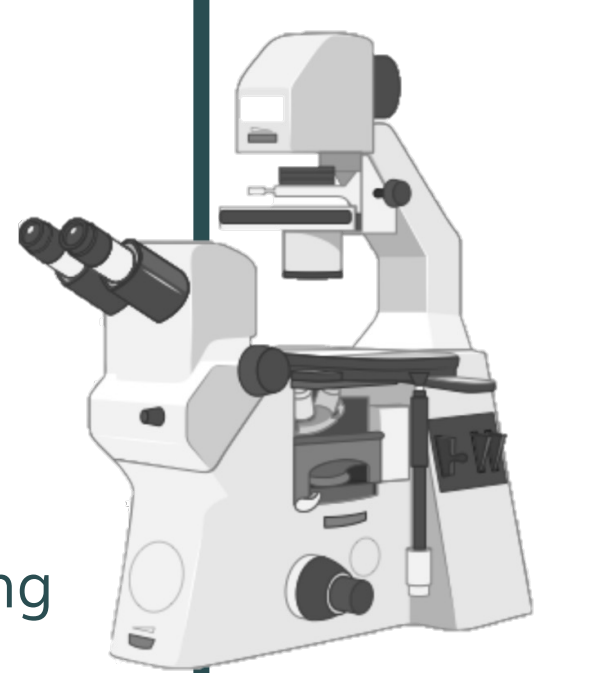
	Control Standard conditions	Storage Hibernate™
Incubator required	Incubator required	No equipment required
Temp	37 °C	Room Temp
Carbon dioxide	5%	Ambient (0.05%)

Step 3

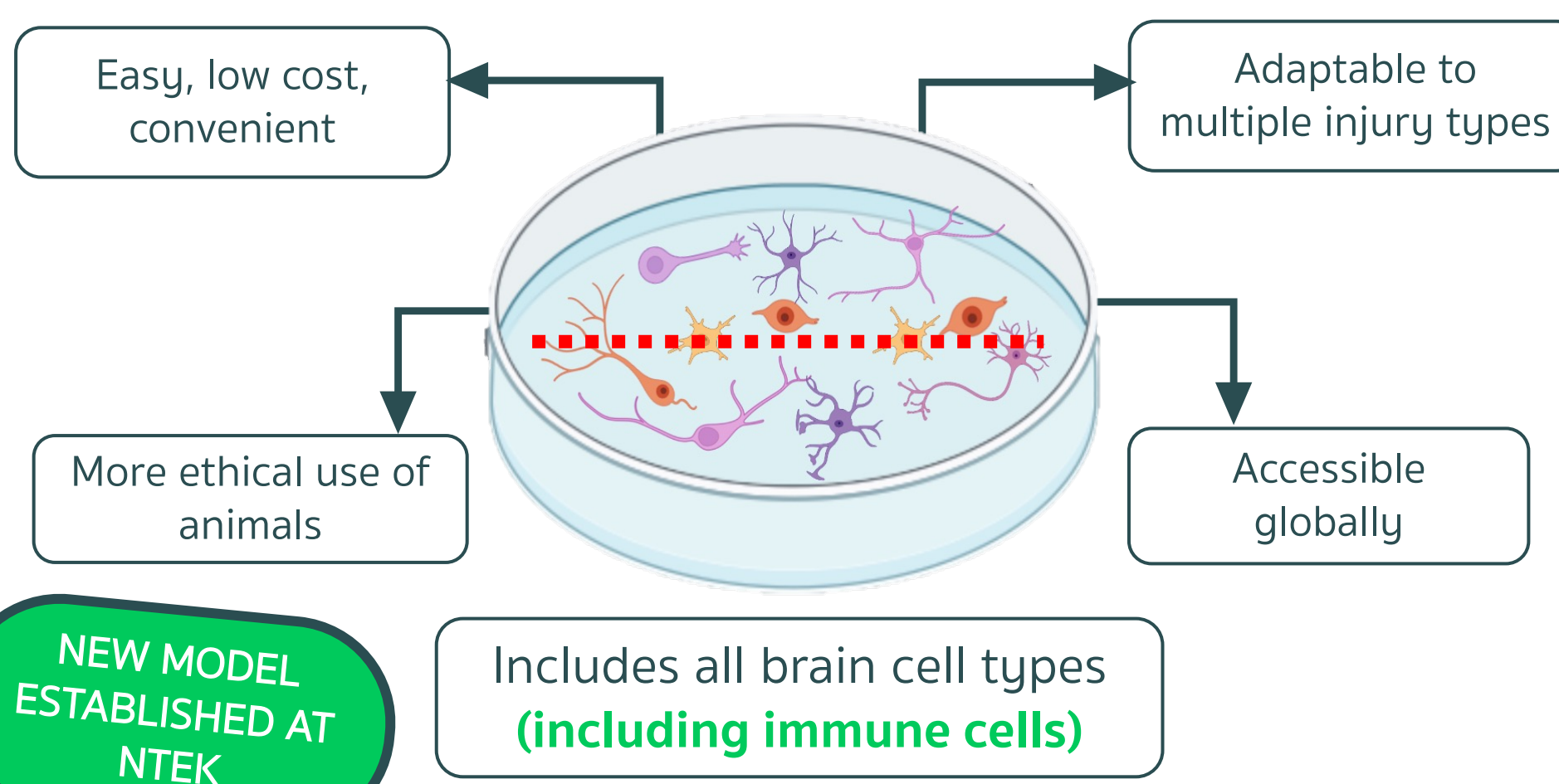
Assays

1. Cell adherence
2. Cell viability
3. Cell count, morphology and reactivity with following stains:

- Tuj1 (neurons)
- GFAP (astrocytes)
- MBP (oligodendrocytes)
- Iba1 (microglia)



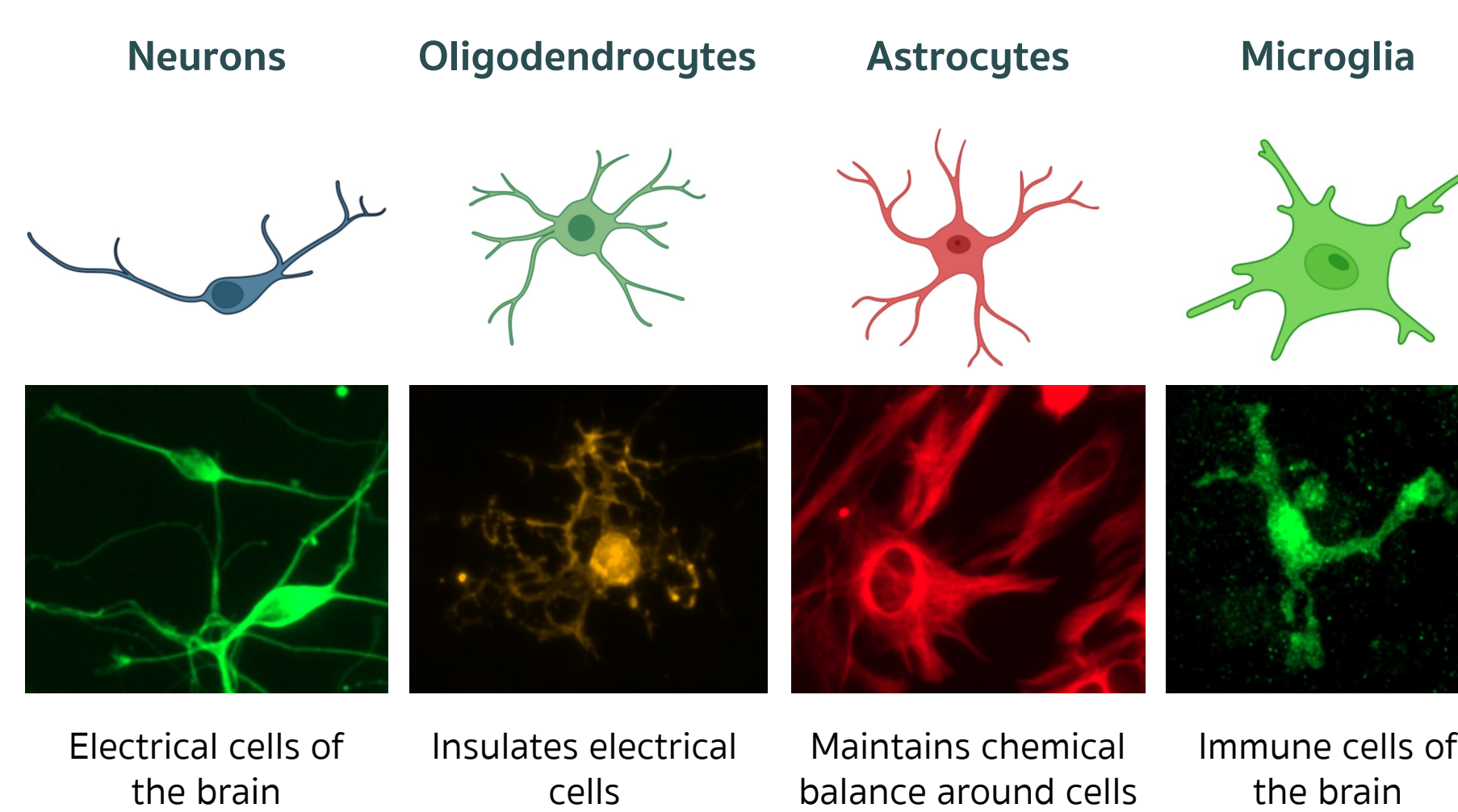
Which brain injury model was chosen?



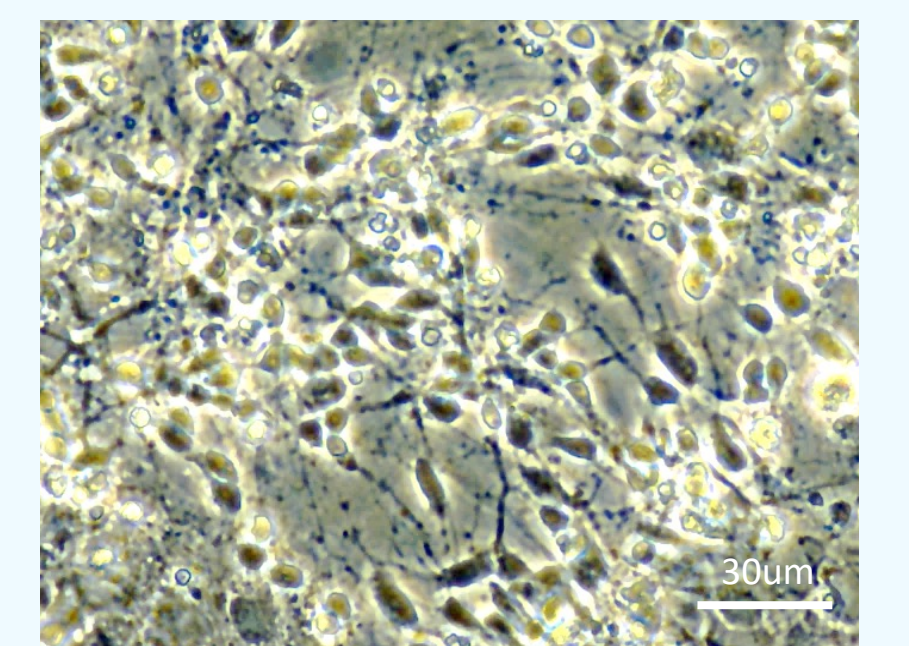
Mixed cellular brain tissue sheet

What were the findings?

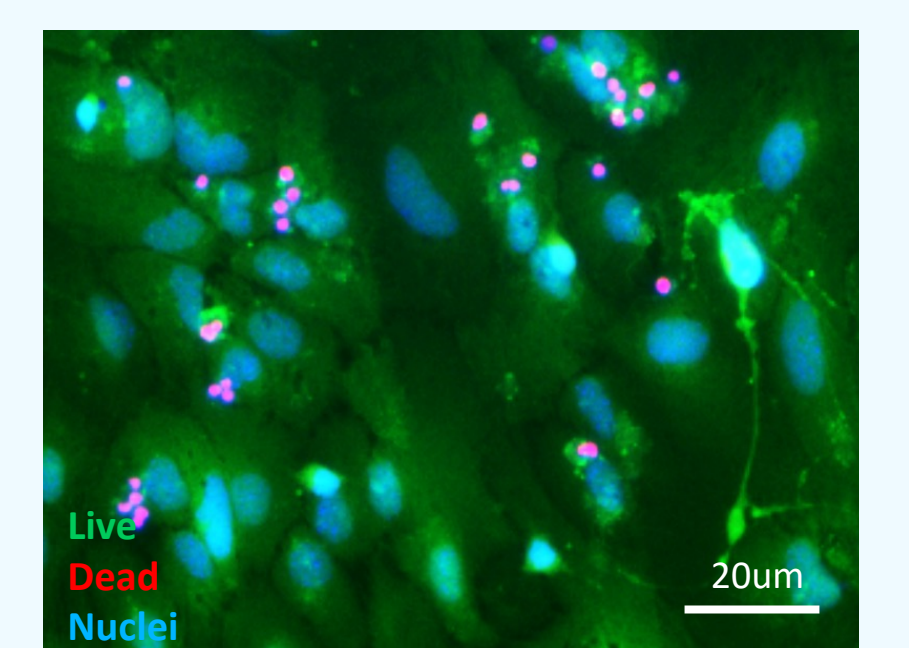
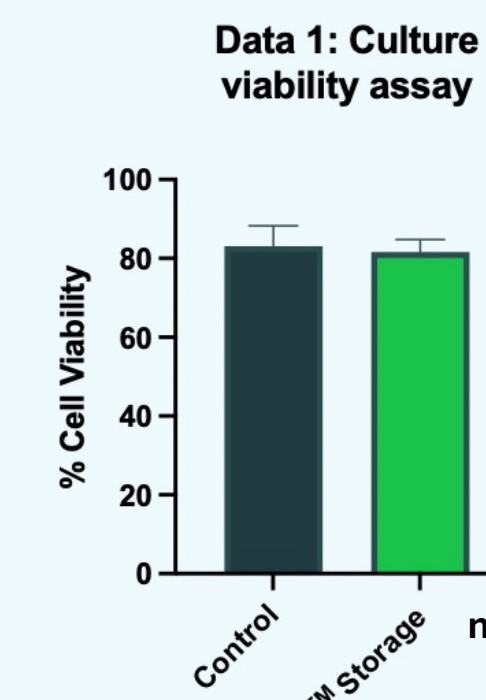
All the major brain cell types survive storage at room temperature



Brain tissue sheets show **healthy adherence and viability** after storage

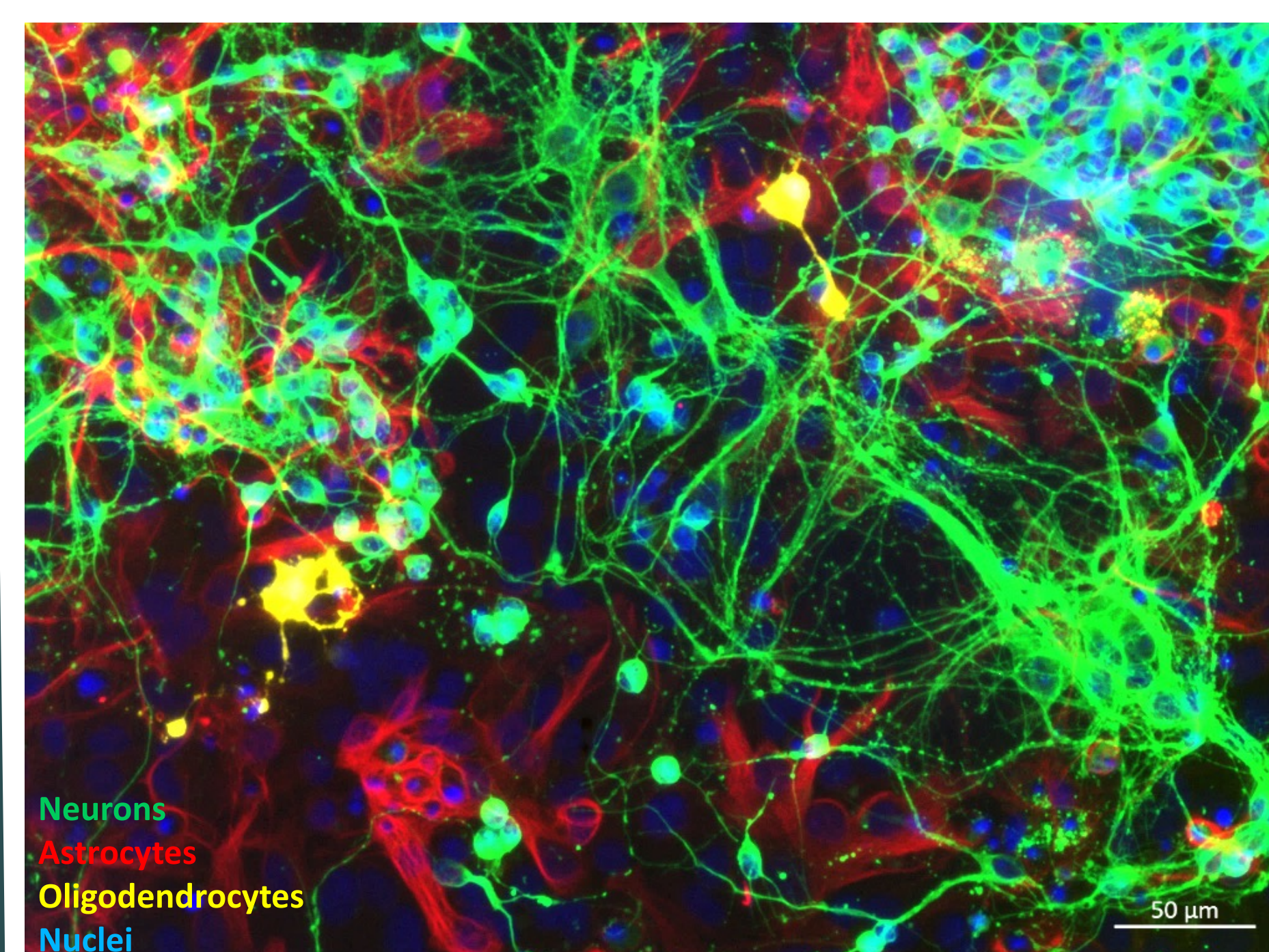


Hibernate™ storage



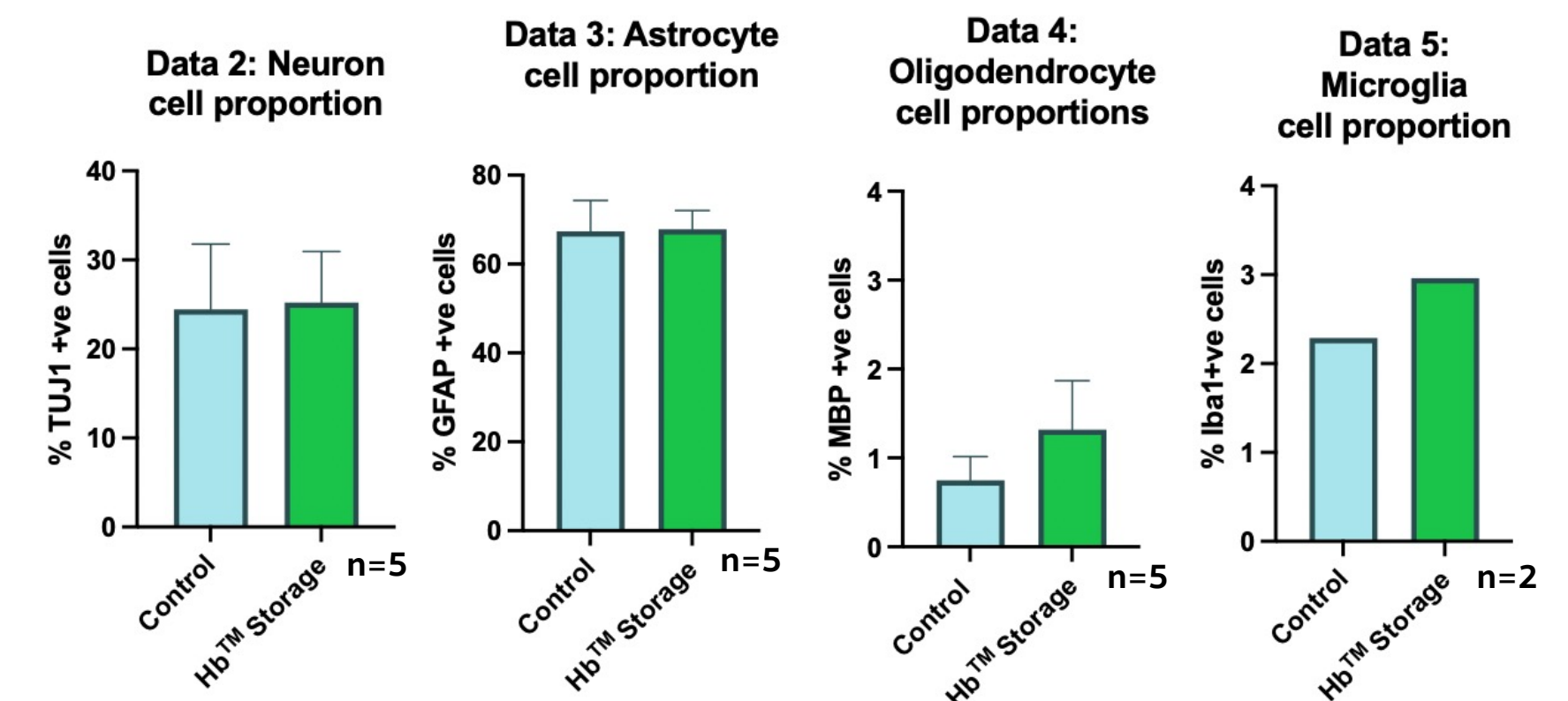
Hibernate™ storage

Cell numbers, shapes and reactivity are unaltered after storage at room temperature

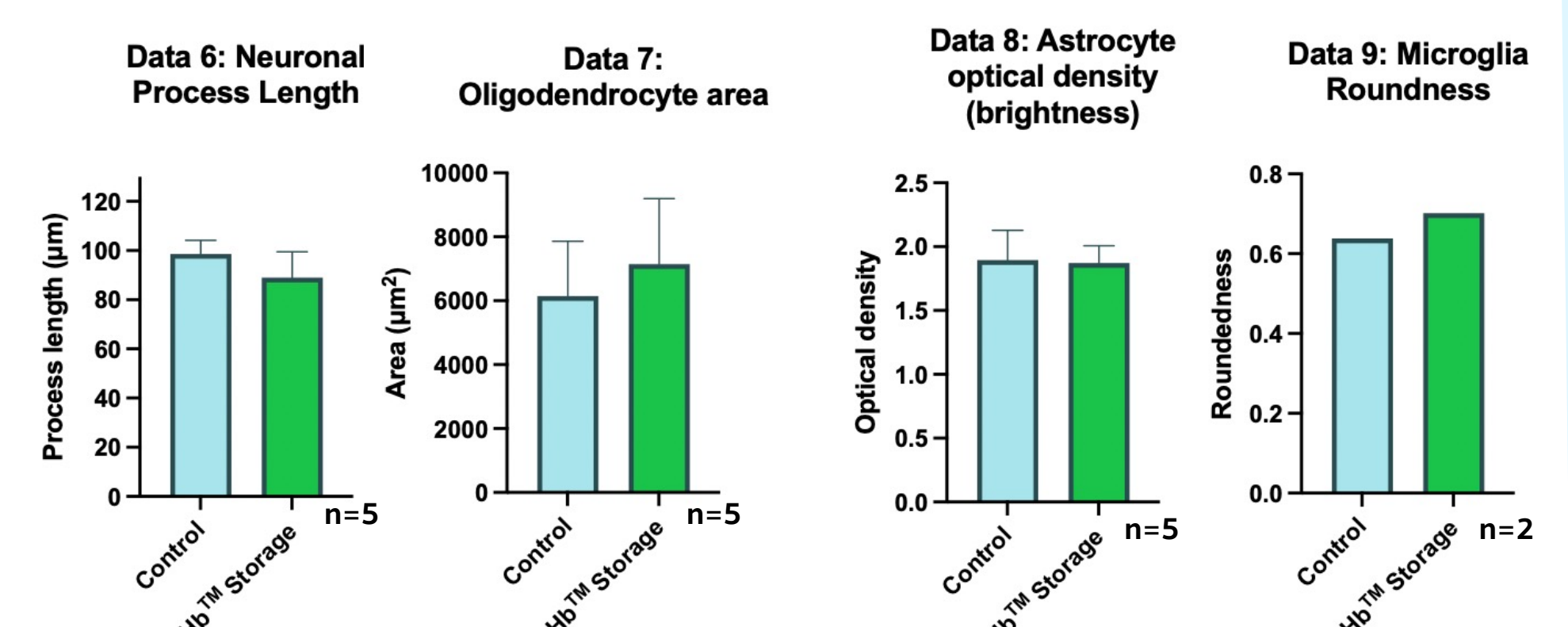


Hibernate™ storage

Cell proportions:



Cell morphology:



Conclusions

Hibernate™ **CAN** be used as a storage and transport solution for brain tissue models **without needing cold chain transport**

We believe this will ease the research bottleneck in not just head injury **BUT ALL** neuroscience research

This approach can **strongly encourage inter-disciplinary collaboration** within multiple avenues of neurotherapeutics that cannot advance without multiple teams working together