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Sveikata, Lukas; Bègue, Indrit; Guzman, Raphael; Remonda, Luca; Bassetti, Claudio L.A.

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Changing the landscape of neurological education

The substantial burden of brain diseases is expected to increase in the coming decades.[1,2] According to updated analyses, the burden of brain diseases has previously been underestimated and, in fact, affects more than 50% of the European population, and its resulting costs are estimated to be about 45% of the annual European health budget.[3] Despite the urgent need for a highly skilled and interdisciplinary workforce to address this burden, interdisciplinary training programmes remain inadequate.

With the clinical research landscape rapidly evolving, there is a growing need for specialised training that addresses the multidisciplinary nature of brain health and disease. Combining basic and clinical research to understand pathophysiology is increasingly important, as are team science, decentralised clinical trials, artificial intelligence, and interdisciplinary clinical training. Therefore, there is a pressing need to incorporate research and clinical training across neuroscience disciplines, including psychiatry, early and throughout the careers of specialists in brain medicine.

To address this gap, the Swiss Federation of Clinical Neurosocieties, which comprises 18 societies, including the Young Clinical Neurosciensists Network, developed the Swiss Brain Health Plan (SHBP) 2023–2033.[4] This plan incorporates the Swiss Brain Health Strategy, which is aligned with the European Academy of Neurology Brain Health Strategy launched in coordination with WHO in 2022.[5,6] The SHBP outlines objectives and proposes a framework for raising awareness about brain health, advancing research on brain health determinants, implementing brain health promotion and prevention strategies, empowering patients and caregivers, and improving interprofessional training. The SBHP aims to establish a person-centred, integrated, and cost-effective public health approach by leveraging synergies between health-care domains.

To this end, Swiss societies for three neurology specialties—neurology, neuroradiology, and neurosurgery—are redesigning their residency training programmes to introduce an interdisciplinary programme (known as a common trunk programme). This initiative will allow doctors in training to rotate between clinical neuroscience subspecialties, enabling them to expand their professional expertise, and will educate a new generation of specialists by breaking down silos.

In parallel, the University of Bern and the SBHP task force have introduced an online postgraduate education programme known as the Certificate of Advanced Studies in Brain Health.[7] This 1-year programme is now open for the 2024–25 class of specialists across health-care disciplines. The programme will cover four modules: introduction to brain health; brain disorders and their risk factors; brain health interventions; and brain health implementation. Faculty members across clinical neuroscience disciplines are involved, and the programme aims to enhance participants' expertise in designing action plans and preventive strategies to address the challenges of brain diseases in society.

We are thrilled to see the progress being made in implementing the national brain health plan. The introduction of brain health education programmes worldwide will be vital for bridging the gap between specialties and training the next generation of brain specialists and clinician-scientists. This is an exciting time for advancing our understanding and promoting brain health, and we encourage continued innovation and research in this promising area.

LS is Vice-Chair and IB is Chair of the Young Clinical Neuroscientists Network within the Swiss Federation of Clinical Neurosocieties (SFCNS). RG is Vice-President and President-Elect of the SFCNS. LR is the current President of the SFCNS. CLAB serves as Chair of the International Faculty for the Certificate of Advanced Studies in Brain Health at the University of Bern and was the founding and first president of the SFCNS (serving from 2009 to 2013). LS reports a fellowship from the University of Geneva and funding from the Alzheimer's Association (AACSF-22-922907). We declare no other competing interests.

**Lukas Sveikata, Indrit Bègue, Raphael Guzman, Luca Remonda, Claudio LA Bassetti*
lukas.sveikata@hug.ch

Neurology Division, Department of Clinical Neurosciences, Geneva University Hospital, University of Geneva, Geneva 1205, Switzerland (LS); Neuroimaging and Translational Psychiatry lab, Synapsy Center for Neuroscience and Mental Health Research, Department of Psychiatry, University of Geneva, Geneva, Switzerland (IB); Department of Neurosurgery, University Hospital Basel, University of Basel, Basel, Switzerland (RG); Department of Neuroradiology, Kantonsspital Aarau, Aarau, Switzerland (LR); Medical Faculty, University of Bern, Neurology Department, Insel Gruppe Bern, Bern, Switzerland (CLAB)

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Dealing with the reproducibility crisis in neuroscience from the grassroots

Brain disorders are arguably the final frontier of medicine. Barriers that previously hindered the study of brain disorders can now be overcome through advances in induced pluripotent stem (iPS) cell technology. However, despite nearly two decades of research, the field of stem cell modelling has generated non-generalisable cellular phenotypes that often depend on the differentiation protocol adopted or the cell line used. The availability of multiple patient iPS cell lines and the ability to genetically engineer isogenic controls have been useful, but incomplete, solutions. A major problem is that there has been little harmonisation in experimental approaches (despite a growing number of new or adapted protocols).

Two exemplar, week-long, hands-on workshops from leaders in the field directly address this challenge. Permitting approximately 25 early-career clinicians and scientists to interact, these workshops allow trainees to access pioneering laboratories, adopt their protocols, and subsequently act as ambassadors for the learnt standardised techniques in their own institutes. The annual Stanford Brain Organogenesis workshop, run by Sergiu Pașca's laboratory at Stanford University, is a fantastic immersive opportunity to learn about organoid and assembloid modelling. Not only does this knowledge transfer enrich disease models, insofar as it allows for the better study of the diverse cellular milieu, organoids and assembloids also permit long-term (thus more mature) cultures and circuit formation. Mark Cookson and Michael Ward's highly successful iPS Cell Neurodegenerative Disease Initiative, established in 2021 via partnership between the US National Institutes of Health and The Jackson Laboratory, has generated an open repository of neurodegenerative disease variants from well characterised reference iPS cell lines with favourable cell culture, differentiation, and genome editing properties. This year, they inaugurated a workshop brilliantly run by William Skarnes, and funded by the Chan Zuckerberg Initiative, which allowed attendees to implement their quality control workflows.

This knowledge sharing will elevate neuroscience—eliminating the risk of studying cells that lack clonality, become karyotypically abnormal in culture, or display on-target genomic defects (including insertions and loss of heterozygosity)—thus allowing neuroscientists to determine molecular mechanisms that represent more promising drug targets. These types of workshops are unique and invaluable, and should be facilitated as much as possible and with the widest reach.

I declare no competing interests.

Arpan R Mehta
amehta001@dundee.ac.uk
MRC Protein Phosphorylation & Ubiquitylation Unit, Dundee, UK

For more on the **iPS Cell Neurodegenerative Disease Initiative** see https://www.jax.org/jax-mice-and-services/ipsc

For more on the **Stanford Brain Organogenesis workshop** see http://www.brainorganogenesis.org/workshop.html

Jules Froment's neurological statuettes

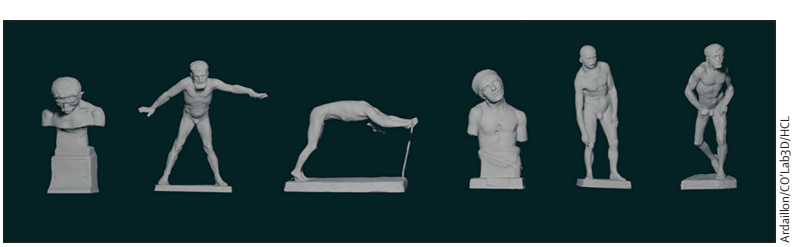
Jules Froment (1878–1946), the renowned neurologist from Lyon, France (appendix p 1), is famous for his work on Parkinson's disease[1,2] and the depiction of Froment's sign[3] and the Froment's manoeuvre.[4] In the 1920s, he oversaw the creation of plaster statuettes depicting various movement disorders including antecollis, cerebellar ataxia, camptocormia, laterocollis, Pisa syndrome, and hysterical dragging gait. These statuettes are inventoried in the collection of the Musée des Hospices Civils de Lyon (Lyon, France), with the objective to preserve and disseminate Froment's work.

The statuettes represent a convergence of art and cutting-edge technology (figure). The sculptor is unknown, but these statuettes bear some resemblance to those created by Paul Richer (1849–1933) from the same era.[5] These models provide valuable opportunities for education and research within the fields of movement disorders and physical therapy. To facilitate broader access, the three-dimensional (3D) files are available online for the international medical community.[6] A video showcasing each rotating 3D statuette is also available (video).

See **Online** for video

We thank Serguei Piotrovitch-D'Orlik from Musée des Hospices Civils de Lyon, and Emmanuel Broussolle for their historical expertise.

We declare no competing interests.



Ardaillon/COLab3D/HCL

Figure: **Digital three-dimensional rendering of the six statuettes**
Scanning and rendering were done by use of the CO'Lab 3D platform at the Hospices Civils de Lyon (Lyon, France). The structured light technology, alongside scanning software (EXScan S) and volume editing software (MeshMixer), were used for the scanning process. Slicer software was then used to adjust the printing characteristics and setting parameters (such as 15% density and a layer thickness between 0·2 mm and 0·3 mm). The models were then printed using a fused deposition modelling 3D printer with polylactic acid (a biosourced polymer), at scales of 100% and 50%, requiring 20–48 h for each statuette.