Do-It-Yourself Neuroscience

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The life sciences became a technology-dominated field many decades ago, and nowhere is this more apparent than in neuroscience. Today's scientists employ powerful machinery and sophisticated appliances to test their hypotheses – equipment that is so prohibitively expensive as to render individual researchers unable to work, unless part of some larger body or organisation able to provide funding. While this dependence on costly instruments is already one of the most constraining factors for the established scientific communities of the Western hemisphere, it bears truly dire consequences in resource-deprived conditions, such as in developing countries struggling to establish functioning education and science systems of their own. In a new paper publishing in the Open Access journal *PLOS Biology* March 20, Tom Baden, Andre Maia Chagas and their colleagues describe efforts to help alleviate this structural problem by making the technologies of science affordable and accessible.

The paper, "Open Labware: 3-D Printing Your Own Lab Equipment," describes the innovative paths taken by two organisations of neuroscientists – Teaching and Research in Natural Sciences for Development (TReND) in Africa and Backyard Brains in Latin America – to help produce a remedy. Drawing on recent technological and cultural advances, they organise workshops and summer schools to teach aspiring young researchers a Do-It-Yourself (DIY) approach to Neuroscience. This "Open Labware" approach is based on ever-increasing interactions between scientific communities and the global "maker movement". DIY- and Open Source-inspired "makers" have long been utilising 3D printing and other developments in electronic technology to design and build their own technical solutions. Lab equipment can be made affordable this way, too.

Instruments like micropipettes, manipulators and microscope adapters can easily be assembled from 3D printed plastic parts and materials readily available in any given general store. The benefits of this approach are twofold: the quality of these appliances is good enough to perform many basic experiments and a worldwide culture of sharing assures that any kinks and flaws are quickly identified and removed by the community. Furthermore, many designs undergo a rapid evolution as each user adapts them to their own specific needs. Making one's own lab tools also contributes to a better understanding and empowered usage.

This development, and the steep decline in 3D printer prices, makes "Open Labware" particularly attractive for developing countries such as Uganda and Tanzania in Africa, and Chile and Mexico in Latin America. TReND and Backyard Brains teach the programming and basic electronics skills needed and have held over 100 (neuro-)science outreach events, science camps, workshops and lectures, with more than 10,000 students, parents and teachers enthusiastically taking part. Tübingen neuroscientist Baden (Werner Reichardt Center for Integrative Neuroscience – CIN) of TReND and his colleagues recommend integrating more aspects of the design and use of Open Labware into science curricula, and making 3D printing readily available at schools and universities. If the widespread lack of expertise in using these low-cost, high-efficiency technologies can be overcome, they expect the maker movement to make substantial contributions not just in neuroscience but in other resource-intensive life science fields.

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Competing Interests: Authors GG and TM are founders of Backyard Brains (www.backyardbrains.com), a company specializing in the design and distribution of Open Labware.