Proceedings of the second biennial Cleveland Neural Engineering Workshop 2013

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Abstract

The Cleveland Neural Engineering Workshop (NEW) is a biennial meeting started in 2011 as an "unconference" to bring together leaders in the neural engineering and related fields. Since the first iteration of the meeting, NEW has evolved from “just getting together” to a more important purpose of creating, reviewing, and promoting a uniform strategic roadmap for the field. The purpose of this short report, as well as the companion 2015 and 2017 reports, is to provide a historical record of this meeting and the evolution of the roadmap. These reports more importantly establish a baseline for the next meeting to be held in June, 2019. The second Neural Engineering Workshop (NEW) was held in June 2013. The two-day workshop was hosted by the Cleveland Advanced Platform for Technology National Veterans Affairs Center, the Functional Electrical Stimulation National Veterans Affairs Center, and the Case Western Reserve University in Cleveland, Ohio. Participants identified seven areas of future focus in the field of neural engineering: active communications with users, advocacy (regulatory), network building (clinical practice), case studies (clinical and technical), early industrial feedback, value chain resources, engagement, and advocacy (funding). This proceedings document summarizes the meeting outcome.

Keywords: Neural, Engineering, Strategy, Infrastructure, Advocacy, Rehabilitation, Nervous system

Introduction

The goal was to bring together the neural engineering stakeholders with the specific purpose of developing a strategic plan, an infrastructure plan and best practices for the community. In June 2013 a select group of individuals were invited to participate in the Cleveland Neural Engineering Workshop (NEW). Individuals were selected based on their knowledge, contributions and advocacy to their respective fields. Action committees were comprised of 9–15 members. Each action committee was led by a provocateur(s) and included at least one executive committee member as a discussant (Table 1). Discussions from the members in attendance (Table 2) resulted in eight action items that the workshop identified as important to progress in neural engineering: active communications with users, advocacy (regulatory), network building (clinical practice), case studies (clinical and technical), early industrial feedback, value chain resources, engagement, and advocacy (funding). These items grew from initial discussion in the 2011 meeting (Table 3) and are summarized below.

Active communications with users

Members of the workshop voiced concerns regarding communication between scientists and end-users. Scientists do not fully understand end-users’ needs (the input specifications), while end-users are not sufficiently aware of available technologies. There is insufficient communication between the end-user and the research enterprise. Therefore, improved bidirectional communication with the end-user is needed. Improved communication methods, consumer education programs, and common collective messaging might achieve this.
Regulatory advocacy and reimbursement

The research community is insufficiently aware of Food and Drug Administration (FDA) regulations, upcoming changes to regulations, and the impact regulations have on research. Current regulations are predominantly designed for commercial interests to achieve marketing approval. Testing requirements are suboptimal for early-phase, academic research. Moreover, increased requirements are becoming prohibitive to academic clinical research. As single voices, researchers have limited capability to change or affect the FDA. Therefore, stakeholders must join together to voice their concerns, as well as partner with larger interests in order to address the needs of the community.

Network building for clinical practice

Members of the workshop recognized the complex challenges faced by clinicians when incorporating neural engineering into daily clinical practice. It was also recognized that inclusion of clinical colleagues in the development of neural technology would result in mutual benefits to scientists and clinicians. Building networks of clinicians interested in neural engineering may be an efficient and effective method to bridge the current communications gap. Clinician education is also an important step in building these networks and ultimately moving neural engineering into mainstream clinical practice. Therefore, there is a need for development of continuing education courses designed to train clinicians in neural engineering.

Clinical and technical case studies

There is a paucity of accurate and objective sources regarding success or failure of neural engineering technology.
This has led to dissemination of misinformation to stakeholders. Similarly, there is a lack of a “best practices collection” for clinicians and researchers. This has led to individual reallocation of time and resources to solve challenges that may already have been addressed with success by others in the field. Therefore, there is a need for development of a clinical cases data and resource module that is user-friendly and scalable for the future.

**Early industrial feedback**
The workshop members agreed, “We have a classical problem of building hammers and looking for nails.” The pathway from technology to implementation could be expedited if a feedback mechanism with industry was available early in the technology development process. Therefore, the community must develop best practices and create opportunities to engage in industrial feedback early on in the technology development life cycle.

**Value chain resources**
Corporations employ models of technology assessment - a technology value chain. The value chains for different companies are different. Having insight into the value chains and pathways may help optimize the research and design process. Therefore, the goal is to develop a resource of this information available to the community.

**Engagement**
There are significant challenges to securing funding in this space. One reason may be the lack of involvement by stakeholders. General funding development and the

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**Table 3** List of ClevelandNEW 2011 workshop participants

| Name             | Institution (in 2011)               | Name             | Institution (in 2011)               |
|------------------|------------------------------------|------------------|------------------------------------|
| Ajiboye, Bolu    | Cleveland FES Center               | Lavik, Erin      | Case Western Res Univ              |
| Batista, Aaron   | Univ of Pittsburgh                 | Lujan, Luis      | Cleveland Clinic                   |
| Bikson, Marom    | City Univ of New York              | McIntyre, Cameron| Cleveland Clinic                   |
| Bourbeau, Dennis | Univ of Pittsburgh                 | Mohseni, Pedram  | Case Western Res Univ              |
| Bretl, Timothy   | U. Illinois at U-C                 | Moran, Dan       | Washington Univ                    |
| Brose, Steven    | Cleveland FES Center               | Murphy, Todd     | Northwestern Univ                  |
| Bruns, Tim       | Univ of Pittsburgh                 | Naqvi, Hassan    | Cleveland Clinic                   |
| Butson, Christopher | Med Col of Wisconsin             | Otto, Kevin      | Purdue Univ                        |
| Capadona, Jeffrey | Case Western Res Univ             | Peckham, P. Hunter| Cleveland FES Center               |
| Carney, Paul     | Univ of Florida                    | Perreault, Eric  | Northwestern Univ                  |
| Chestek, Cynthia | Stanford University               | Pinault, Gilles  | Louis Stokes Clev VA               |
| Cui, Xinyan      | Univ of Pittsburgh                 | Putnam, David    | Cornell Univ                       |
| Dorval, Chuck    | Univ of Utah                       | Sachs, Nich      | Northwestern Univ                  |
| Dukelow, Sean    | Univ of Calgary                    | Schiefer, Matthew| Case Western Res Univ              |
| Fridman, Gene    | Johns Hopkins Univ                 | Shenoy, Krishna  | Stanford Univ                      |
| Gaunt, Robert    | Univ of Pittsburgh                 | Shoham, Shy      | Technion                           |
| Gilbert, Ryan    | Rensselaer Polytech Inst           | Sloan, Andrew    | University Hospitals               |
| Gliha, Karen     | n/a                                | Slutzky, Marc    | Northwestern Univ                  |
| Gliha, Tom       | n/a                                | Stegemann, Jan   | Univ of Michigan                   |
| Gustafson, Kenneth | CWRU & Cle VAMC                  | Sutter, Maria    | n/a                                |
| Hasenwinkel, Julie | Syracuse Univ                    | Taylor, Dawn     | Clev Clinic & Cle VA               |
| Helms-Tillery, Stephen | Arizona State Univ          | Triolo, Ronald   | CWRU & Cle VA                      |
| Hess, Allison    | Case Western Res Univ             | Tylet, Dustin    | CWRU & Cle VA                      |
| Ho, Chester      | Univ of Calgary                   | Ustin, Jeffrey   | MetroHealth Med Cntr               |
| Hoyen, Harry     | MetroHealth Med Cntr               | Wang, Wei        | Univ of Pittsburgh                 |
| Jarosiewicz, Beata | Brown Univ                     | Weber, Doug      | Univ of Pittsburgh                 |
| Kelly, Clay      | Louis Stokes Cle VA               | Wheeler, Don     | n/a                                |
| Kirsch, Robert   | Cleveland FES Center              | Yu, Byron        | Carnegie Mellon Univ               |
| Kusiak, Audrey   | Dept of Veterans Affairs          | Zorman, Christian| Case Western Res Univ              |
subsequent review process for awards would greatly benefit from improved engagement by researchers and leaders in the field. Currently, community leadership does not sufficiently engage in professional obligations such as review panels, advocacy in congress, and other national service-related activity. Therefore, the goal of this action committee is to engage in support and service.

Advocacy for funding
Currently, there are assumptions and misinformation regarding funding, as well as lack of clarity by the research community, as to the appropriate funding mechanisms for their work. Ideally, a resource would be generated that would supply or connect the community to: funding resource road maps, information graphics, and other guides that are or may become available. This one-stop-shop of funding information should also be used to collect user feedback to assist in identifying funding mechanism appropriateness and utilization. In addition to appropriately allocating funding, it is of utmost importance that the research community provides information and justification for additional investments in new opportunities. Therefore, this action item will support consumer advocacy, veteran services organizations, Congress and appropriate lobbying organizations.

Abbreviations
FDA: Food and Drug Administration; NEW: Neural Engineering Workshop

Funding
U.S. Department of Veterans Affairs. Award Number: Cleveland FES Center. Recipient: Dustin J. Tyler, PhD.
U.S. Department of Veterans Affairs. Award Number: Cleveland APT Center. Recipient: Dustin J. Tyler, PhD.
National Institute of Child Health and Human Development. Award Number: R13HD078115. Recipient: Kenneth Gustafson, PhD.

Authors’ contributions
KA, BA, TD, JF, KG, KK, NK, AK, BL, MM, EP, DW, JW, and DT wrote the paper. All authors read and approved the final manuscript.

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interest.

Publisher’s Note
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Received: 19 September 2018 Accepted: 8 October 2018
Published online: 05 December 2018