Rutgers Neuro Engineering Group
RUNEG

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Rutgers University Neuro-Engineering Group

Public Progress Report for Dissemination 2016

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EXECUTIVE SUMMARY

RUNEG was created in March 2014 to facilitate translational research in the development of devices that enhance central and peripheral nerve regeneration, restoration of motor and sensory function, and transmission of neural signals by brain-computer interfaces.

RUNEG was conceived and implemented by Joachim Kohn, Board of Governors Professor of Chemistry, and is currently supported by internal funds provided by Rutgers University.

Since its inception, RUNEG has supported collaborative research efforts with industry. RUNEG has also built new collaborative ties between researchers from neuroscience, chemical biology, imaging, stem-cell technology, nanotechnology, and computational modeling, as well as physicians.

The success of RUNEG is being measured by its ability to increase the number of collaborative research projects among Rutgers faculty as well as by its ability to increase the number of collaborative projects between Rutgers faculty and industry. Quantitative measures of RUNEG's impact are the number of new external awards made to RUNEG faculty teams; the number of industrial projects created; and the number of new, collaborative publications that are authored by teams of RUNEG faculty.

PROGRESS REPORT

1. Outreach to faculty from RBHS

We reached out to faculty from RBHS to increase RUNEG's ability to bring benefits to faculty across all Rutgers campuses. Four new faculty from RBHS have joined the 13 founding faculty from Rutgers/New Brunswick to bring the total number of RUNEG faculty members to 17.

2. International Outreach

We invited Professor Antonio Merolli from the Catholic University in Rome (Italy) to join the New Jersey Center for Biomaterials as an International Scholar. Dr. Merolli is the Editor-in-Chief of the journal "Journal of Materials in Medicine" and one of only 300 global "Fellows of Biomaterials Science and Engineering". He will engage at Rutgers in a wide range of neuroscience-related research activities.

3. Public Events and Visibility

Since March 2014, RUNEG organized 2 Industry Showcases and issued one formal press release.
A highly visible RUNEG Special Session will be part of the 2016 Symposium on Biomaterials Science. This session will include presentations from both the academic and industrial members of the group. Our keynote speaker will be Dr. Alex Aimetti, the Senior Director of Medical Education of InVivo Therapeutics, Inc. a Boston-based company that specializes in the treatment of spinal cord injury. The meeting is endorsed and financially supported by the USA Society for Biomaterials.

RUNEG is also regularly featured in the NJCBM blog, and is visibly represented on the web at http://www.njbiomaterials.org/runeg.htm.

4. Collaborative Faculty Interactions:

RUNEG has facilitated the receipt of federal or state funding in the amount of $1.8 M during its first two year of operation. RUNEG interactions and funding has also led to 9 publications by RUNEG faculty.

5. Internal Research:

RUNEG places great value on the creation of new interactions between Rutgers faculty. The seeding of such interactions creates a pipeline for future proposals and publications. It increases the sense of community among the neuro-engineering faculty. Four new interactions grew out of several internal RUNEG faculty meetings.

6. RUNEG Seed Funds to support faculty interactions with industry:

RUNEG's seed fund program is designed to assist faculty to develop research directions and preliminary data that will be attractive to potential industrial sponsors. The rationale of this seed fund program is to allow faculty to deviate from their federally funded research programs to create ideas and data that would lead to future support from industry. Since all seed fund recipients leverage federal grants to cover the cost of their academic research, the industrial seed fund program only needs to provide sufficient support to facilitate the creation of ideas and data of interest to specific potential industrial partners. Thus, the seed funds available to RUNEG at this point, are strategically provided to faculty who can identify a potential industrial sponsor and have federally funded research programs. In the past 12 months, seed funds have been awarded to four different projects in collaboration with three different industrial sponsors.

7. Potential Next Steps:

In the coming year, key plans for growing RUNEG into a self-sustaining program at Rutgers include:

1. The establishment of a formal administrative structure
2. RUNEG Session at the 2016 Symposium on Biomaterials Science in October
3. Seed Funding for faculty-industry collaborations
4. Matching funding for Industry commitments
5. Building Industry collaborations
6. Creation of a focused Industrial Advisory Panel for advising on and generating RUNEG activities

Appendix
RUNEG Facilitated Research Publications
(RUNEG members are highlighted in the author listing)

Carlson, AL, Bennett NK, Francis NL, Halikere A, Clarke S, Moore JC, Hart RP, Paradiso K, Wernig M, **Kohn J**, **Pang ZP***, **Moghe PV** Generation and transplantation of reprogrammed human neurons in the brain using 3D microtopographic scaffolds, *Nature Communications*, 7:10862. doi: 10.1038/ncomms10862., 2016.

M. Ezra, J. Bushman, **D. Shreiber**, M. Schachner and **J. Kohn**, "Porous and Nonporous nerve conduits: The effects of a hydrogel luminal filler with and without a neurite-promoting moiety", Tissue Eng Part A, 2016, 22(9-10), 818-826.

S. Singh, M. C. Lo, V. B. Damodaran, **H. M. Kaplan**, **J. Kohn**, **J. Zahn** and **D. Shreiber**, "Modeling the insertion mechanics of flexible neural probes coated with sacrificial polymers for optimizing probe design", Sensors, 2016, 16(30).

B. Clements, J. Bushman, N. S. Murthy, J. Hershey, C. Pastore and **J. Kohn**, "Design of Barrier Coatings on Kink-resistant Peripheral Nerve Conduits", Journal of Tissue Engineering, 2016, 7, 1-14.

H. M. Kaplan, P. Mishra and **J. Kohn**, "The overwhelming use of rat models in nerve regeneration research may compromise designs of nerve guidance conduits for humans", J Mater Sci Mater Med, 2015, 26(8), 226.

Shah S, Liu JJ, Pasquale N, Lai J, McGowan H, **Pang ZP***, **Lee KB***. Hybrid upcoversion nanomaterials for optogenetic neuronal control. Nanoscale. 2015; doi: 10.1039/C5NR03411F PMID: 26415758

NL Francis, NK Bennett, A Halikere, **ZP Pang**, **PV Moghe** Self-Assembling Peptide Nanofiber Scaffolds for 3-D Reprogramming and Transplantation of Human Pluripotent Stem Cell-Derived Neurons ACS Biomaterials Science & Engineering, 2016 (in press)

De Filippis L, Halikere A, McGowan H, Moore JC, Tischfield JA, **Hart RP**, **Pang ZP.** Ethanol-mediated activation of the NLRP3 inflammasome in iPS cells and iPS cells-derived neural progenitor cells. Mol Brain. 2016 May 10;9(1):51. doi: 10.1186/s13041-016-0221-7.

Kim T, Shah S, Letao Y, Yin PT, Hossain M, Brian C, Choi JW, **Lee KB.** Controlling differentiation of adipose-derived stem cells using combinatorial graphene hybrid-pattern arrays. ACS Nano. 9:3780-3790. 2015.