

Progress Report on the IFMBE Working Group in Neural engineering
Submitted by Karen Moxon
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OLD BUSINESS

ITEM 1: List of Participants
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Item 2: Definition of Neural engineering

The working group has arrived at a working definition of Neural Engineering with the important and clear understanding that this is a living definition, unlikely to satisfy all members of the community and should be reevaluated and updated often.

Neural engineering includes at least the following:

1. Applications of Engineering To Neuroscience
 - ?? Neuro-electronic Interfaces:
 - Electrode technology (both in-vivo and in-vitro)
 - Stimulating electrodes
 - Recording electrodes
 - Neural Prosthetics
 - Neural Rehabilitation
 - Neurorobotic s
 - ?? Neural Tissues Engineering
 - Electrode tissue interfaces
 - Neural regeneration, growth and guidance
 - ?? Signal Processing
 - Imagining
 - EEG Rhythms
 - Field Potentials

- Evoked Potentials
- ?? Spike train analysis
 - Information theory
 - Population analysis
 - Non-linear and non stationary time series analysis
 - Dynamical Systems analysis
- ?? Computational Modeling
 - Single Cells
 - Networks of Cells
 - Neural Systems

2. Applications of Neuroscience to Engineering

- Neuromorphic Engineering – including artificial retinas, cochlea, noses, etc. and applications in robotics
- Connectionist Neural Networks and Applications
 - Artificial Networks
 - Neuromimetic Models
 - Neural Computing

Item 3: MBEC Special Issue on Neural Engineering

We have decided it best to finish our definition of neural engineering (Item 2) and then tackle the Special Issue. We hope to complete the above definition by end of July. We will then use this as an outline for the special issue. We expect to prepare a one-page flyer describing the content type and some confirmed contributions (from within our group) to give a flavor of the Special Issue. Once the details with the publisher are sorted out we can then distribute this flyer to potential authors and thereby find out how much interest there would be in contributing.

Item 4: Face to Face meeting of the Working Group

Some members of the working group (Wim Rutten and Karen Moxon) met at the 1st International Conference on Neural Engineering, Capri Italy. A second meeting is planned for the World Congress in Australia to be held in August of 2003. The chair, Karen Moxon, will not be able to attend. David Lily, will chair the meeting.

Item 5: Stated Objectives of the Working Group

To assist with the definition of the working group we have developed two objectives for the group. We are in the process of developing goals to meet these objectives. The first three goals are outlined above in items 2, 3, and 4.

1. To raise awareness among the scientific and engineering community of the advances of neuronengineering
2. To examine the education structure of neural engineering programs and make recommendations

Item 6: Bulletin Board to Enhance Communication among Participants

We have implemented a bulletin board to enhance communication among the participants. There were several problems with maintaining good communication within the group, distributing information and maintaining timely feedback. The bulletin board lets members post information directly and has been divided into five discussion groups:

1. Defining Neural engineering	0	3	public, unlocked
2. MBEC Special Issue	1	3	public, unlocked
3. Meeting Schedule	0	2	public, unlocked
4. Membership	0	2	public, unlocked
5. Working Group Objectives	0	1	public, unlocked

Members can login in, read messages posted and reply immediately to any message or post a new message. We expect this to enhance communication considerable.

NEW BUSINESS

ITEM 7: Review of Current Activity in the Neural engineering in the Community

It was suggested that before we begin to set up goals for the working group, including the MBEC issue, we take stock of what is currently on-going in neural engineering. The following constitutes a summary of the neural engineering community. While unlikely to include everything, the clear result of this survey is that there is an enormous amount of activity in this field and it appears to be increasing exponentially.

1. **Conferences:** To date the field of Neural engineering is alive, well and rapidly expanding with great representation at conferences.
 - a. IEEE/EMBS 1st International Conference on Neural Engineering, March 17-21, Capri, Italy. The conference was a huge success. This conference will be repeated every other year and will be in Washington DC in 2005.
 - b. IEEE Engineering in Medicine and Biology conference continues to have tracks devoted to neural engineering that runs in parallel with the main conference. Dominique Durand is Chairing this effort.
 - c. World Congress, Sydney, Australia, 2003 will have tracks devoted to neural engineering. Nitish Thakor is chairing this effort.
2. **Books:** There are at least three new books in making.
 - a. Semiconductor Technology for Medical Technology, Marcel Dekker, in press - not strictly devoted to neural engineering but a lot of what they will have will be neural.
 - b. Advances in Network Electrophysiology Using Multi-Electrode Arrays Taketani and Baudry, Kluwer Academic/Plenum Publishers, in press
 - c. Six Volume Series on Neural Engineering Metin Akay, Wiley/IEEE Press, in press

- d. Handbook of Neuroprosthetic Methods (CRC Press), W.E.Finn and P.G. LoPresti, 2003
- e. Neural Engineering (MIT Press) , C.Eliasmith and C.H.Anderson , 2002

3. **Journals:** There are several journals devoted to neural engineering.

- a. IEEE transactions on Neural Systems and Rehabilitation ,
- b. Bioelectronic Systems and Biosensors
- c. Biocybernetics
- d. Potential New Issue: Neural Engineering, The Institute of Physics Publishing.

4. **Special Issues:**

- a. IEEE Transaction of Biomedical Engineering Special Issue: Brain Machine Interfaces, eds Nicolelis and Principe , in Press.
- b. IEEE Proceedings July 2001 Special Issue on Neural Engineering
- c. Annual Review of Biomedical Engineering. Selective electrical interfaces with the nervous system, vol. 4, pp. 407-452, Rutten W.L.C. (2002).
- d. EURASIP Journal on Applied Signal Processing Special Issue on Neuromorphic Signal Processing and Implementations , June 2003
- e. other relevant journals with select articles: Nature, Nature Neuroscience, MBEC, IEEE Transactions on Nanobioscience (new),

5. **Courses:**

European Summer School on Neuroengineering, June 16 to June 20, 2003 at Telecom Italia s Future Center in Venice, sponsored by Telecom Italia Learning Services (TILS), and the University of Genoa (DIBE, DIST, Bioengineering course).