Messages to Society

Co-chairs; Glenn Fredrickson, University of California, Santa Barbara and
Kazuhiro Sakurada, Nihon Schering Research Center

Group 1 :

Moderator; Mark Breyen, Medtronic, Inc.
Sujata Bhatia, DuPont Central Research & Development
Timothy Broderick, University of Cincinnati
Douglas Daum, Boston Scientific
Gregory Kovacs, Stanford University
Garrick Louis, University of Virginia
Norihisa Miki, Keio University
Mihoko Otake, The University of Tokyo
Steven Visco, Polyplus Battery Company

Discussion Topic:

How do we as developers of technology, device engineers, and as a biomechatronic device industry, deliver our life-sustaining and life enhancing therapies to emerging markets throughout the world?

There has been focus on drug companies in this regard, and the issues are magnified on the biomechatronic device side; however, this is a topic generic to many industries.

Messages to Society:

■The lack of these products in the developing world is a direct result of the economics in those countries.

■There are more pressing healthcare needs in those countries that will need to be prioritized before accessing our products becomes a priority ("food and then fibrillation").

■Exceptions would be where biomechatronics technology could solve some of those more pressing issues such as clean water, power needs, and infectious disease. The solutions for the developing world will need to be tailored to the specific issues within those countries. Individual and small group efforts among scientists and engineers may be necessary to draw attention and funding for the need.

■Scientists and engineers need outlets for volunteer efforts such as sabbaticals and organizations to partner with. Established systems for obtaining tenure within

universities and maintaining employment within companies may need to be considered to allow for this.

■Identifying product opportunities that may be profitable will be gateways to providing access. Biomechatronics that are diagnostic rather than therapeutic may be examples of these gateway products (e.g. infectious disease).

■Opportunities to design devices for reuse should be considered. Opportunities to manufacture or design systems with indigenous resources should be considered.

■We recognize that the developing world has unmet medical needs that could be met with Biomechatronic products.

Group 2:

Moderators; Drew Endy, Massachusetts Institute of Technology and Hiroki Ueda, RIKEN

Masanori Arita, The University of Tokyo

Brian Baynes, Codon Devices, Inc.

Karl Böhringer, University of Washington

Hideo Iwasaki, Waseda University

Tanja Kortemme, University of California, San Francisco

Gregory Kovacs, Stanford University

Daniel Lee, University of Pennsylvania

Garrick Louis, University of Virginia

Christina Smolke, California Institute of Technology

Shinobu Suzuki, Nihon Schering K.K.,

Shoji Takeuchi, The University of Tokyo

Ron Weiss, Princeton University

Brian Witten, Symantec Corporation

Discussion Topic:

When should we not engineer novel biological life forms?

Technical advances such as automated DNA synthesis are making it much easier to create living organisms from scratch (e.g., reconstruction of the 1918 influenza). The technologies needed to perform such work are relatively cheap and widely distributed. Are there novel biological life forms that we should *not* create? If there are, can we organize the world so that others do not misapply current and future biological technologies?

Message to Society:

■We agreed that this is a difficult question that needs more attention. There are many potentially useful applications of biological technology, and each needs to be explored and developed responsibly.

Group 3:

Moderators; Naohiko Irie, Hitachi, Ltd. and Ghassan Jabbour, Arizona State University
Chihaya Adachi, Kyushu University
Michael Chabinyc, Palo Alto Research Center
Anil Duggal, GE Global Research
Mizunori Ezaki, Toshiba Corporation
Glenn Fredrickson, University of California, Santa Barbara
Koji Inoue, Kyushu University
Shigeyuki Kimura, Society Non-Traditional Technology
Garrick Louis, University of Virginia
Seth Marder, Georgia Institute of Technology
Fumiyuki Nihey, NEC Corporation
Masayuki Shigematsu, Innovation Core SEI, Inc.
Makoto Takamiya, The University of Tokyo

Discussion Topic:
The Societal Impacts of Flexible Electronics
Most of the ideas based on silicon technology, e.g., mainframes, microprocessors, DRAM, fiber optics, etc., were proposed in the 1970s, and they have radically changed society. The emerging technology of flexible electronics has the potential to change society over the next 30 years. In this breakout session, we would like to discuss how flexible electronics may affect society in the future.

Messages to Society:

■Flexible electronics will be harmoniously integrated into our environment.

■Care must be taken to balance the privacy, health, and environmental impacts due to the omnipresent nature of this technology.

Group 4:

Moderators; Hiroaki Kikuchi, Tokai University and Cliff Wang, U.S. Army Research Office

Venkat Allada, University of Missouri

David Balenson, SPARTA, Inc.

Paul Barford, University of Wisconsin, Madison

Kazukuni Kobara, National Institute of Advanced Industrial Science and Technology

Garrick Louis, University of Virginia

Tatsuyuki Matsushita

Kanta Matsuura, The University of Tokyo

Yuko Nakayama, Fujitsu Laboratories Ltd.

Jonathan Owen, General Motors Research and Development Center

Hideyuki Suzuki, The University of Tokyo

Keisuke Takemori, KDDI R&D Laboratories Inc.

Discussion Topic:

RFID (Radio-Frequency Identification) is a new technology that allows rapid inventory query and management. Similar to barcodes, we can tag almost everything we would like to track. Unlike a barcode, an RFID reader can query tags in its vicinity (up to a few meters away) via radio signal. This brings both technology advances as well as privacy concerns. On one hand, RFID allows instant tracking of multiple tagged items at once. On the other side, tagged items with private information (such as prescription drugs, passports, etc) needs to be protected from illegitimate scanning. So the question is whether we need to allow the ubiquitous deployment of RFIDs or we should limit the use of this technology.

Messages to Society:

■RFID technology needs to bring perceivable benefits to our society before it can be accepted widely.

■We need to identify business-only applications and applications involving private information.

■Society needs to be assured that privacy is preserved and trust is maintained.

Group 5:

Moderator; Noriko Osumi, Tohoku University School of Medicine
Richard Han, University of Colorado at Boulder
Yasuharu Koike, Tokyo Institute of Technology
Suguru Kudoh, National Institute of Advanced Industrial Science and Technology
Garrick Louis, University of Virginia
Michael Occhionero, Idaho National Laboratory
Masahiko Onosato, Hokkaido University
Akiyoshi Shimada, Nippon Teleghaph and Telephone Corporation
Makoto Taiji, RIKEN
Yong Wang, Pacific Northwest National Laboratory

Discussion Topic:

Humanoid robots: are they human?

A new world has come where we cooperate with humanoid robots in daily life. Do you think that humanoid robots that are so similar to humans could be considered human?

Possible responses:

1) Human beings and androids cannot be distinguished
2) Human beings and androids cannot be distinguished by appearance
3) Human beings differ from androids in terms of the mind and consciousness
4) It is impossible to scientifically discuss about human beings

This group will discuss the ethical issues of robotics technology.

Messages to Society:

■Androids: look like humans
- **■Some people do not think they are necessary**
- **■Could be friends of human beings, but could not be partners or kids**
- **■What personality should androids have if it can be replaced or reinstalled?**
- **■Possibility to be confusing to society**

■Humanoids: intelligent but do not look like humans
- **■The public must discuss how intelligent they should be**
- **■There may be problems if they are more intelligent than human beings**

■Cyborgs: hybrids of humans and robots
- **■Can be helpful for injured people**
- **■Should not be used by normal/healthy people who want be more powerful than normal human beings**