Healthcare Smart Systems

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- Smart Systems are able to sense and diagnose complex situations. They are “predictive”, they have the capability to decide and help to decide as well as to interact with the environment. They may also be energy autonomous and networked.
Medical Technologies

• Smart systems are critical in driving innovations in the field of medical technology, as they provide the basis for information-based care and cure.

• The integration of microsensors and micro-actuators in products will provide the healthcare professional to better treat and take care of patients in the hospital and at home.

• The seamless linking of microsystems to a telemetric and telediagnostic infrastructure will significantly reduce response time, and simultaneously contribute to containing public healthcare costs.

• Roadmap
  – In-vivo and ex-vivo health monitoring devices
  – Integrated healthcare solutions
  – Portable diagnostics systems
EPoSS’ Enabling Technology Roadmaps

**Portable Diagnostic Systems**
- **APPLICATION**: Biosensors, Lab on a chip, Neural measurement and stimulation
- **ENABLING TECHNOLOGY**: Multiplex sensing agents, reliable sample-taking, spectroscopy, Microfluidics, Bio-compatible surfaces and materials, packaging

**In- and ex-vivo technologies**
- **APPLICATION**: Diagnostic & imaging devices, Therapeutic and drug delivery systems
- **ENABLING TECHNOLOGY**: Highly miniaturized low-power wireless devices, optical molecular imaging (probes and instrumentation), Multimodal molecular imaging (e.g., optical + ultrasounds), Micro machined devices for high resolution imaging, Automated drug delivery pump, Electronic textile or foil technology for robustness/comfort, In-vivo drug delivery (“electronic pill”), Bio-compatible packaging, Devices for cell therapy & transfection (personalized medicine), In-vitro, neurostimulator, etc.

**Integrated Healthcare Solutions**
- **APPLICATION**: Autonomous networked devices, Care robots, In-hospital patient telemetry, Out-of-hospital doctor/patient data transmission, Digital Hospital & personalized care based on expert systems for analysis and decision support
- **ENABLING TECHNOLOGY**: Wireless power technologies, Energy scavenging, Low power communication (radio, etc.), Robotics and safe & reliable systems, Standardization of communication technology, Cognitive radio (white spaces), Data security (privacy), Remote patient monitoring, Data integration from various analytic sources, Digital patient data networking, Smart data reduction methods for medical data analysis software (algorithm)

**TIMELINE**
Convergent Solutions are enabled by MedTec

*Smart systems enable new care delivery models*

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**Life Sciences**

- Nanobiotechnology
- Molecular and proteomic biomarker discovery and validation: ‘omics’
- Biomolecular models & disease pathways
- Chemical biology
- Targeted agents for imaging and therapy
- siRNA, RNAi
- Stem cells, regenerative medicine

**Smart Systems**

- Nanotechnology
- Microsystems technology
- Microfluidics-based miniaturized diagnostics platforms
- Implantable devices
- Drug delivery technologies
- Embedded systems
- Mechatronics

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**Convergent Solutions**

- Personalized Medicine
- Targeted, Image-Guided Intervention
- Local Drug Delivery Devices
- Ubiquitous Disease Mgt
- ‘Targeted’ Diagnostics
- Life Science Tools
Clinical Validation is Key!

- Advantages of new treatment paradigms (enabled by integrated smart device technology) are often hypothetical and need clinical validation.
- Specific requirements for medical devices are known only after first (pre-)studies have taken place.
- Large chance that first technology solutions do not fit clinical needs.

→ Close, iterative collaboration needed: Development of device solutions together with clinical insights and joint validation!
Concluding Remarks

• Smart System developments are driving innovations in healthcare, enabled by microsystems- and nanotechnology, addressing today’s challenges

• Successful new products require joint technological development, and clinical development & validation (and business model innovation)

• Multidisciplinary collaboration across industries and with multiple academic partners (including those with access to clinical applications) is key