

Integrated Databases in Physiology and Medicine

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Problems with Physiological and Medical Data



- Databases largely unavailable
- Incomplete data documentation
- Different and “closed” data formats
- No unified data pre-processing standards
- “Closed” software for data analysis

Consequences:

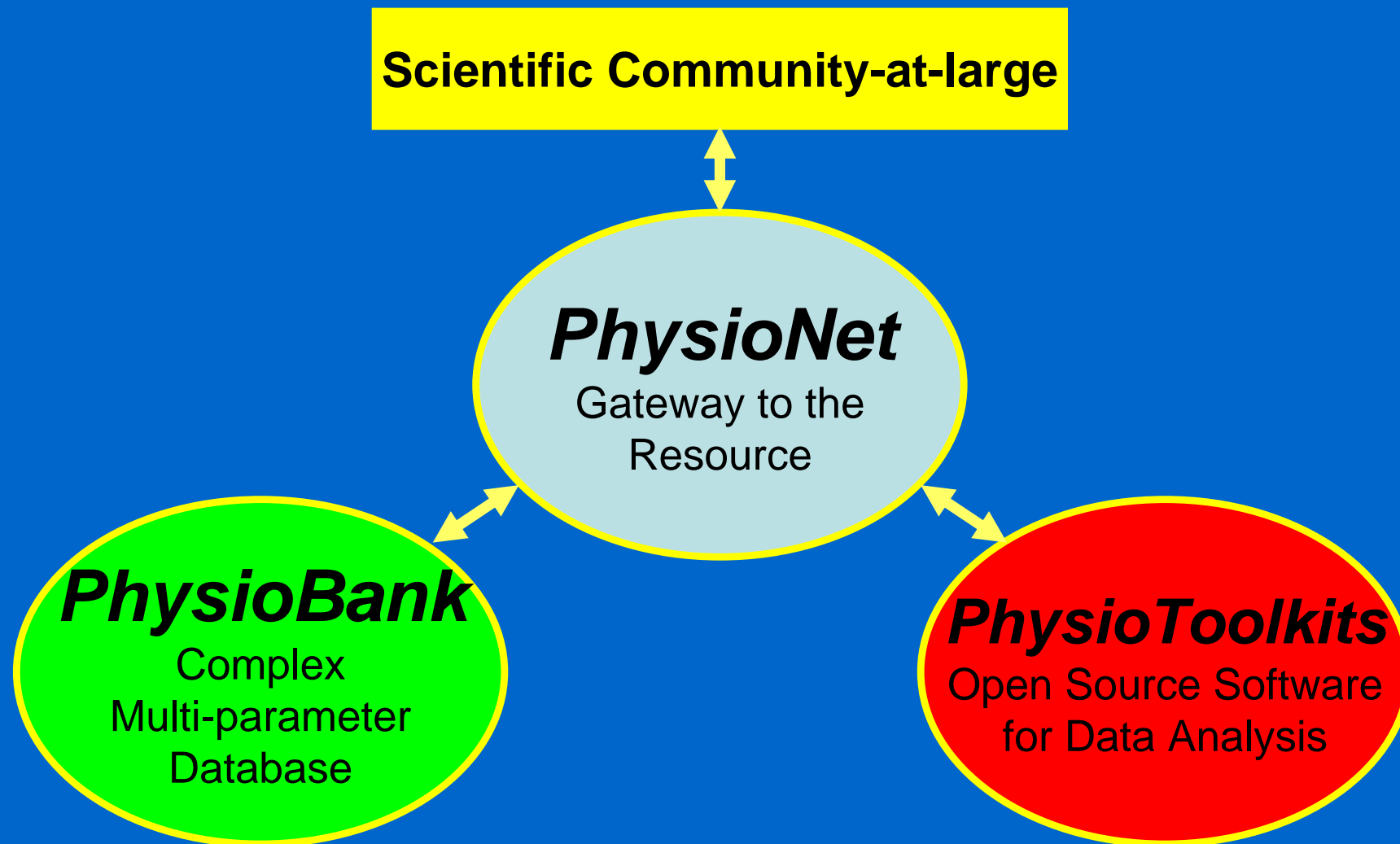
- Obstacles to validation of results
- Barriers to diffusion of ideas across fields
- Inefficient use of public funds
- Slow advancement of science and society

Parallel problems in humanities, social and economics sciences

Case Study: PhysioNet • start 1999



An Integrated Resource for Physiologic Data



A.L. Goldberger, L.A.N Amaral, L. Glass, J.M. Hausdorff, P.Ch. Ivanov, R.G. Mark, J.E. Mietus, G.B. Moody, C.-K. Peng, H.E. Stanley. *Circulation* 101(23):e215-e220

Integrated Approach: not just a data repository

PhysioNet

- Dissemination Portal
- Challenges/Competitions
Discussion Groups
- Tutorials

Build IT-community:

- bottom-up
- self-organized
- E-mediated
- interdisciplinary

PhysioBank

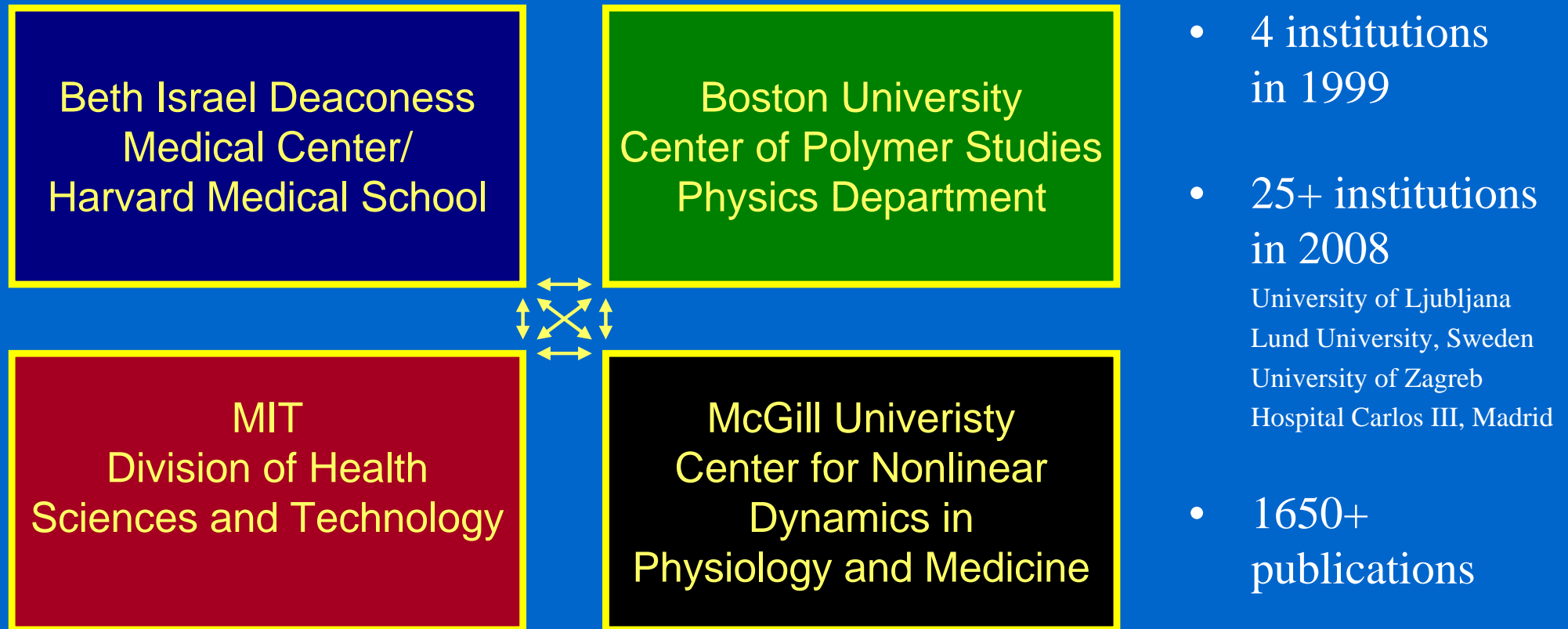
- Multi-parameters databases
ECG, EEG, Neurological, MRI
Polysomnographic, Synthetic
- 40 different databases
- 220 Gigabytes

PhysioToolkits

- Open source software
- Data analysis packages
- Software from publications
- Physiologic models

PhysioNet: Impact

Integration across **institutions**



Integration across **disciplines & cross-fertilization**

- New paradigms/concepts from physics, applied mathematics, engineering
- New methods for characterization and modeling of physiologic data
- New diagnostic and prognostic approaches & new technologies

American Physical Society **new sub-field classification**: Physics in Physiology

PhysioNet: Impact

- **Challenging problems**
- **New Discoveries**
- **New Technologies**

Case Example: Bottom-up approach

Challenge 2000 – detection of sleep apnea from EKG

- **Background**

- Obstructive sleep apnea: serious & common disorder
- Detection and follow-up costly
- Detection from EKG monitor could improve screening/costs, but unvalidated



- **The Contest** (*Computers in Cardiology & PhysioNet*)

- PhysioNet posted training and test datasets
- Entries from 15 teams, 9 countries
- Attracted non-biomedical experts, e.g. Physics, Engineering, Applied Math

- **Results**

- Sleep apnea reliably detected from EKG
- Conceptually different methods developed; fusing ideas from different fields
- Clinical/Commercial applications under development



Future EU Information Infrastructure - Metadata

Hierarchy of Integration

- within fields
- across natural sciences
- natural & social/economics sciences

