

# **Biomedical Computing**

*Computational Challenges and Opportunities*

*BioComp PI Meeting Session*

*December 2002*

# HPCS Challenge Problems

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**Tom Knight**

**Protein Folding femto seconds, particle simulator 3-10,000 for 10s of milliseconds.**

**AI Technology for reading and understanding biology**

**Andrzej Prezkwas**

**Simulation of cloud dispersion to weapons of mass destruction.**

**Roger Brent**

**Stochastic Simulation (Gillespie), Yeast nucleus, 3 million proteins for the internal dynamics of the cell: better the tools the better the science.**

# HPCS Challenge Problems

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**Shakat HP**

**Grid Computing**

**Game technology will drive (Tflop/sec)**

**Aaron (Budgore)**

**I/O Technology limitations**

**Optical Computing O/O conversion??**

**Prezkwas (DTRA)**

**Predictive medicine**

**Cellular response to drugs**

# HPCS Challenges

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**Hybrid Computing with multiple sensors combining analog and digital computing ??**

**Biomaterials to do optical computing. Optical substrates using rhodopsin and other material. Searching large databases ??**

**Sensors and distributed computing ??**




**Data flow machines: processors in memory, super-scalar machines.**

**Algorithms: multi-dimensional simulation (octree meshes)**

**Data mining: algorithms and code.**

# HPCS Goals

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-  **Need changes in architecture for security, trustability. Legacy of PDP-11 leaves security holes.**
-  **Computer Systems are vulnerable.**
-  **Odors, chemical sensors, ...**

# HPCS Challenges

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**Roger Brent, MSI**

**Needs of Celera, be flexible, be able to scale up fast.**

**If Sysbio takes off, current algorithms will be flop hogs, move to tracking individual molecules will vastly increase the promise of Sysbio**





**Roychowdhury, UCLA**

**Designing biomolecular systems: molecular pump, intra-cellular pumps (need to be simulated at multiple scales)**

**Exploratory intracellular process modeling: branch and bound techniques**

# HPCS Challenges

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-  **Verification, Model Checking of Hybrid Systems. Constraint satisfaction routines with added memory usage (New SMP).**
-  **Distributed Databases: P2P database systems**
-  **Storage of Image Data in multi-modal formats**
-  **Architecture for dealing multi-modal sensory inputs**