MAX-PLANCK-GESELLSCHAFT

TECHNISCHE UNIVERSITÄT DRESDEN

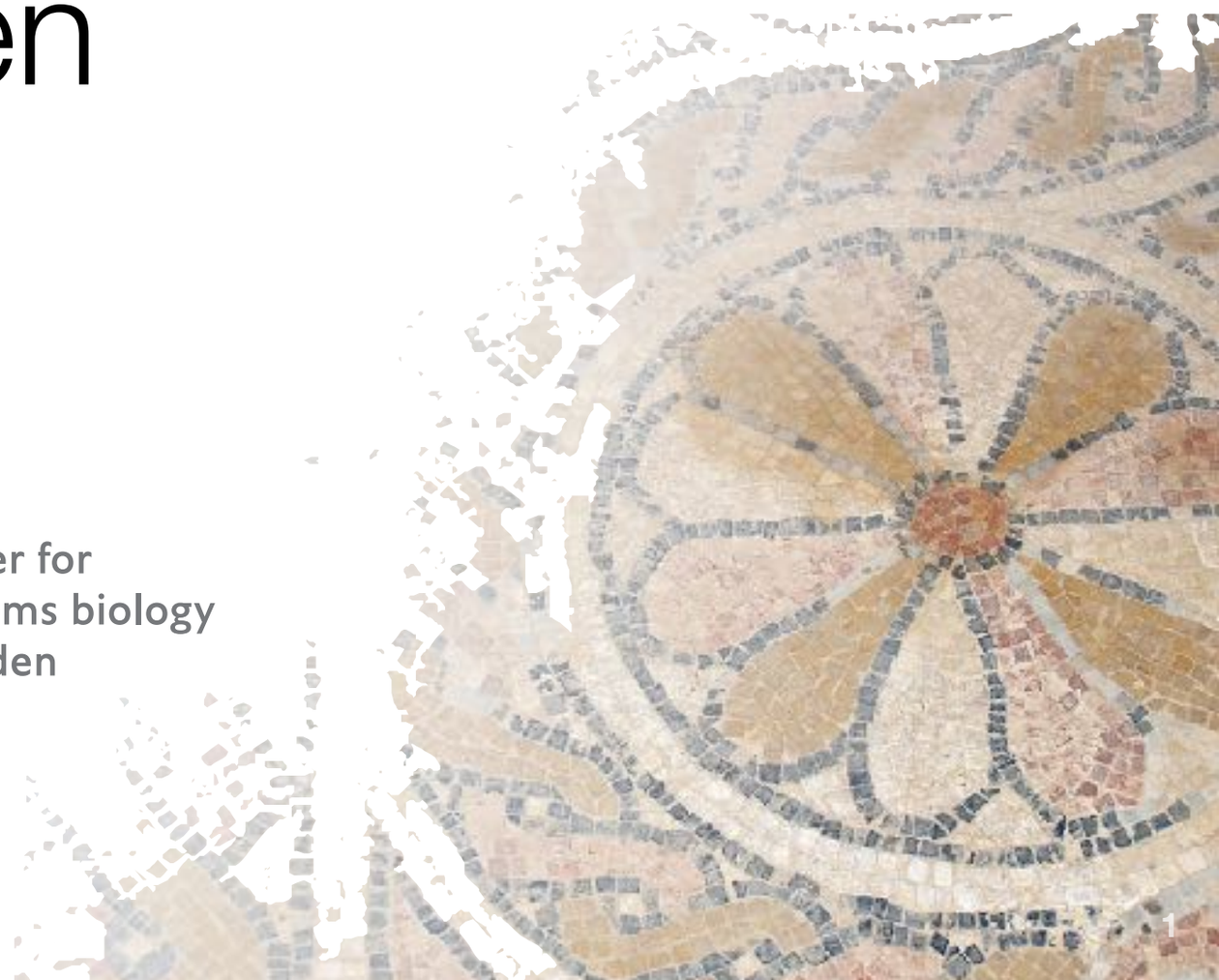
# Nebenfach Biowissenschaften


Ivo F. Sbalzarini

MOSAIC Group, CSBD

TUD & MPI-CBG

center for systems biology dresden

# mosaic.mpi-cbg.de

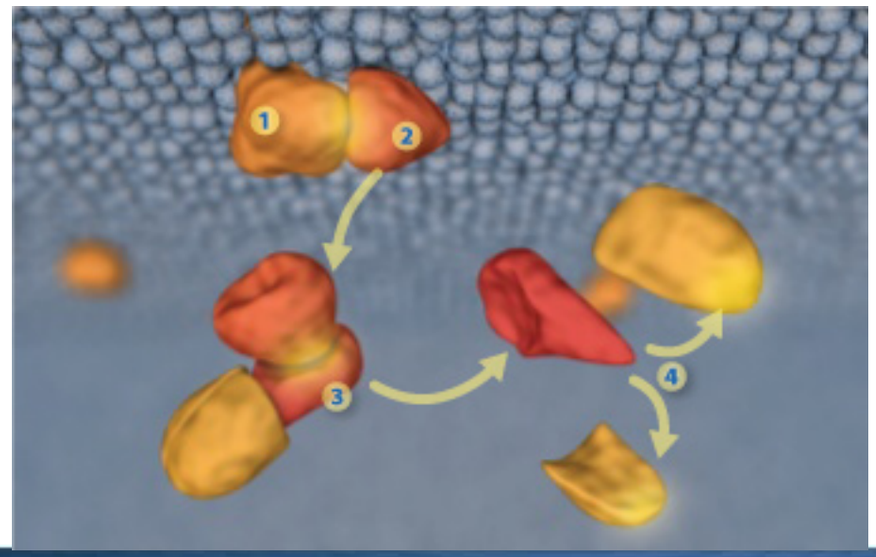
center for
systems biology
dresden

# Biology Computes

Cells execute **programs**:

- Genetic programs
- Communication programs
- Decision making
- Signaling networks
- Endosomal sorting

- . . .




## Trafficking Computes

**Ivo F. Sbalzarini**
Center of Systems Biology Dresden, Max Planck Institute of Molecular Cell Biology and Genetics

The functioning of cells is intimately linked to uptake, processing, and release of a multitude of signals. Cellular trafficking is key to this information processing, involving localized biochemistry in multiple dynamic compartments with still-elusive molecular and biophysical details. Concerted trafficking of chemical signals between compartments allows the cell to "compute," i.e., to exchange information and take decisions. But this type of computation is fundamentally different from that in human-made computers.

Cellular trafficking has thus inspired the theoretical concept of membrane computing, also named "P-Systems" after G. Păun. A membrane-computing system, like the trafficking system in cells, processes a multitude of signals in parallel and in a distributed manner. It consists of many membrane-bound compartments, within which signals are processed, and which are able to move, fuse, and split, hence communicating. This concurrent, stochastic processing is

# Systems Biology

It's not about **using** computers to process biological data or to simulate biophysical models,

**but**

to understand the biological system itself as a **computing process**, reverse-engineer its "algorithms" and its "grammar",
**and be able to reprogram (re-engineer) it.**

biological processes are inherently *algorithms* that nature has designed to solve computational problems.

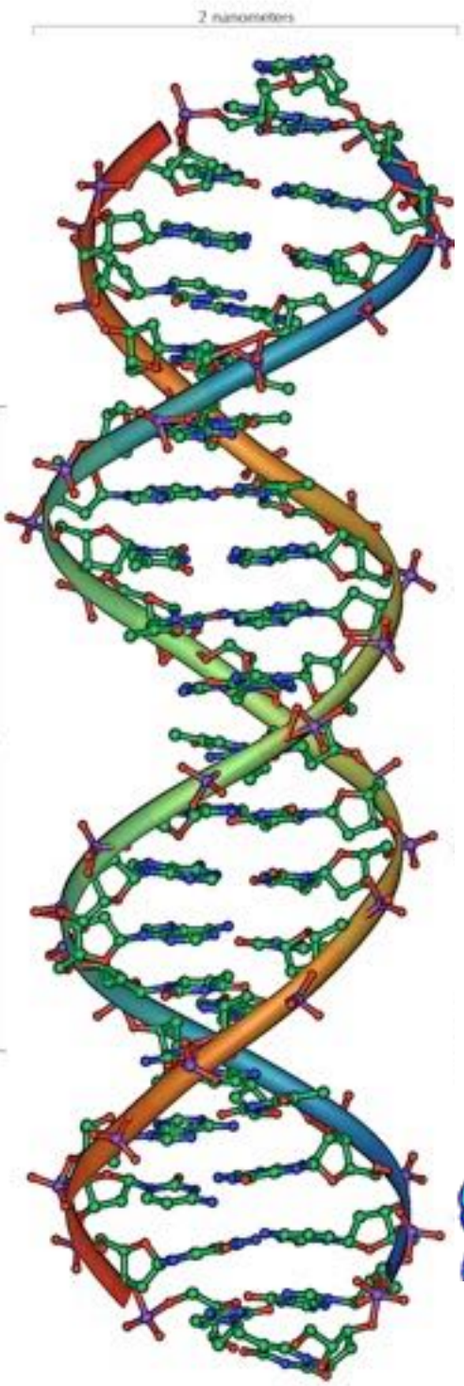
algorithmsinnature.org

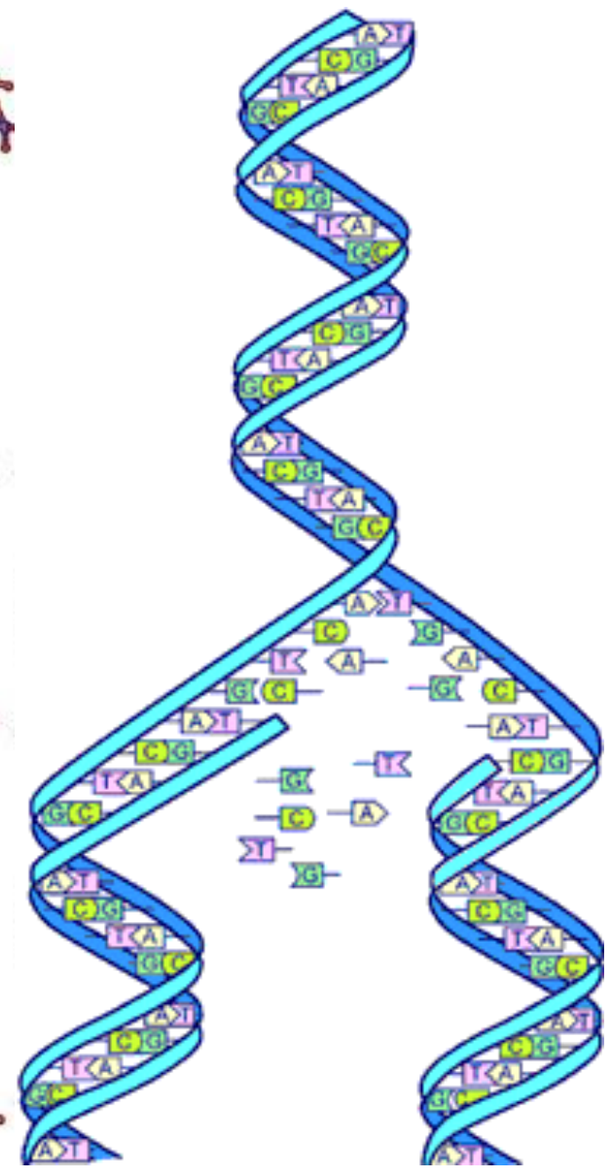
## Computing in Biology

> Computer science will be for 2020 biology what mathematics is for today's physics.

Microsoft Report "2020 Science"

# Source Code —> Algorithms



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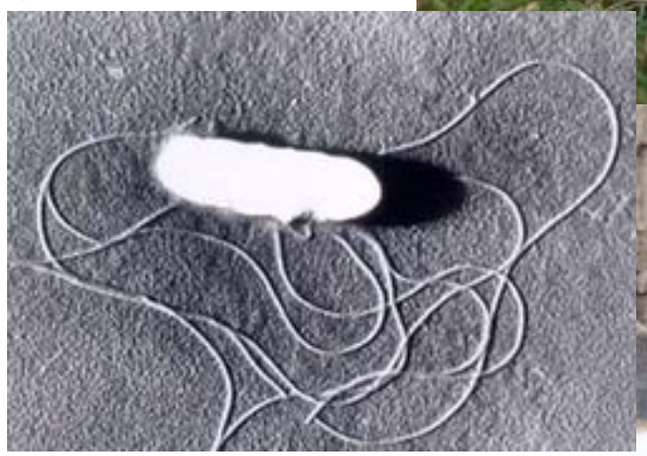
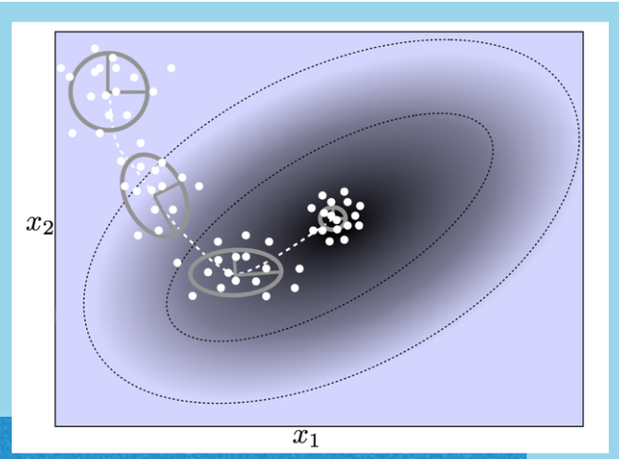


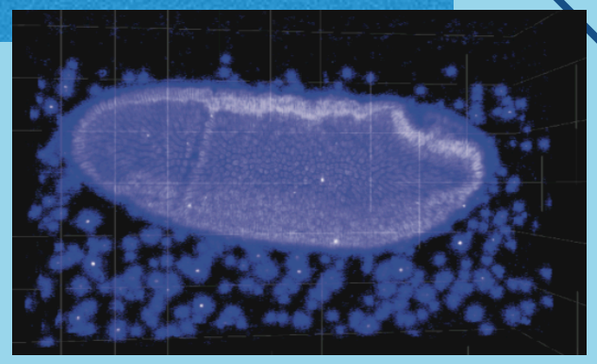
Bilder: Wikipedia

# Computer Science Topics

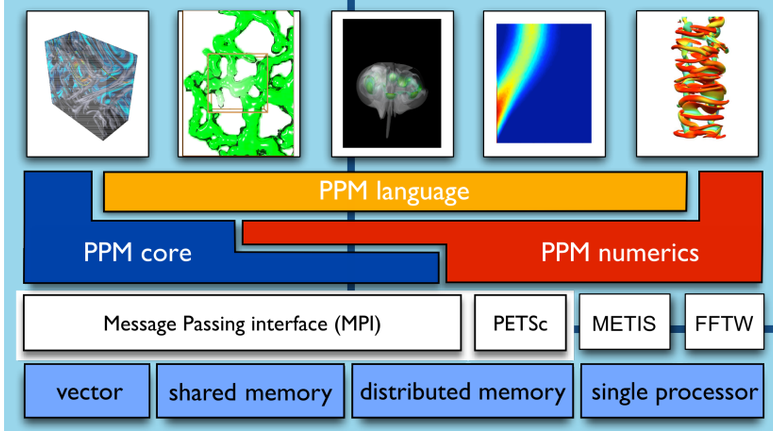



Machine Learning

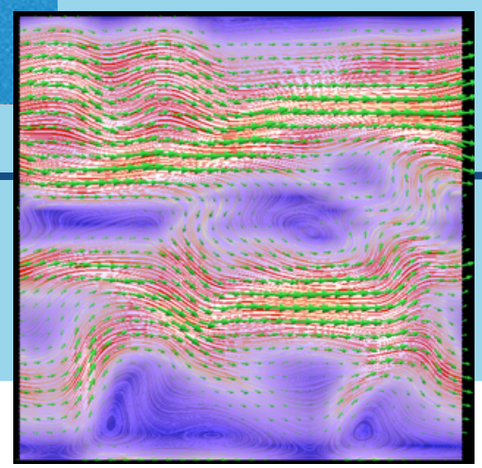
Computer Vision



Computer Graphics/ UI




*Scientific Computing*



High-Performance Computing / SE

# Nebenfach-Struktur

**INF-D-510: Grundlagen des Nebenfachs (Beginn 3. FS, 7 LP)**

Winter: Allgemeine Genetik I (2/0/0, Pflicht)
Sommer: Allgemeine Genetik II (2/0/0, Pflicht)

**INF-D-920: Vertiefung im Nebenfach (Beginn 5. FS, 15 LP)**

Winter: Physiologie der Tiere (2/0/0, Pflicht)
Physiologie der Mikroorganismen (4/0/0, Pflicht)
Sommer: Entwicklungs- und Zellbiologie (2/0/0, Pflicht)
Applied Bioinformatics (2/0/0, Pflicht)