

# WHAT IS LIFE ?

## DISCUSSION GROUP @ 2002 TELLURIDE WORKSHOP ON NEUROMORPHIC ENGINEERING

**Ille C. Gebeshuber**

Institut für Allgemeine Physik  
Vienna University of Technology,  
Wiedner Hauptstraße 8-10/134  
A-1040 Wien  
Austria

ille@iap.tuwien.ac.at

Nine people (Bert Shi, Constanze Hofstoetter, Dan Matthias, Francesco Tenore, Ille C. Gebeshuber, Jean-Christophe Zufferey, John Henry Wittig Jr, Laurent Perrinet and Paulina Varshavskaya) signed up for the discussion group "What is life?". Andreas Andreou was guest member.

We met twice, and discussed not only this question and some related literature (like Freeman Dyson's "The two origins of life" and Erwin Schrödinger's famous book "What Is Life?"), but of course – given the nature of this workshop – also briefly touched consciousness and artificial life.

---

### Discussion Group Description:

The traditional boundaries between scientific disciplines can no longer be upheld, if one is to understand nature. Today, physics has made further inroads into the organic domain, in its emphasis on nonlinear phenomena far from thermal equilibrium, on coherence and cooperativity which are some of the hallmarks of living systems [1].

I think that Alfred North Whitehead, the English philosopher who wrote Principia Mathematica with Bertrand Russel, was not too far off when he stated in 1925 that "physics has to be explained in terms of a general theory of the organism" [2] !

[1] Thinking about Biology: An Invitation to Current Theoretical Biology, Eds. W.D. Stein and F.J. Varela, Lecture Notes Vol. III, Santa Fe Institute, 1993

[2] Whitehead A.N. "Science and the Modern World", 1925, Mentor N.Y., 1960.

See also "What Is Life?" by Erwin Schrödinger.

# TOOLS IN THE NANOKOSMOS

**Ille C. Gebeshuber**  
Institut für Allgemeine Physik  
Vienna University of Technology,  
Wiedner Hauptstraße 8-10/134  
A-1040 Wien  
Austria

ille@iap.tuwien.ac.at

Scanning probe microscopes are versatile tools for imaging on the atomic scale. Furthermore, they allow for nanomanipulation of single atoms and nanostructuring. One can for example produce electric circuitry orders of magnitude smaller than commercially available ones.

Most recent developments are hybrid systems on the nanometer scale, combinations of biological molecules and electric circuitry. Scanning probe microscopy methods thereby open a new world to the field of Neuromorphic Engineering, since artificial neural systems can be built closer to the scale of the biological systems which provide the design and principle they are based on<sup>1</sup>.

- [1] Gebeshuber I.C. "Naturally nanostructured biomaterials", Invited lecture, Bionanotechnology Meeting @ Oxford University, UK, April 11-13, 2002.