

Creating a Current Awareness Web Page on Complexity Theory, Information Theory, Entropy, and the Life Sciences

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ACS Spring Meeting San Diego CA

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Division of
Chemical
Information

Proposal Accepted

To create a web page on the subject of information theory and the evolution of living systems. The project was to develop a page that would update itself through clever programming and be useful for current awareness. It was to include

- Current research papers and archive
- Background reading / Books
- Most heavily cited papers
- Research institutes and top researchers
- Key journals
- Databases
- Ask-a-librarian

A flood of information-containing free energy reaches the earth's biosphere in the form of sunlight. Passing through the metabolic pathways of living organisms, the information keeps the organisms far away from thermodynamic equilibrium. As the thermodynamic information flows through the biosphere, much of it is degraded into heat, but part is converted into cybernetic information and preserved in the intricate structures which are characteristic of life. The principle of natural selection ensures that this happens, the configurations of matter in living organisms constantly increase in complexity, refinement, and statistical improbability. This is the process we call evolution....

John Avery: *Information theory and evolution* (2004)



In a nutshell the argument is that free energy -- energy from which work can be derived, contains information and as such it can be seen as the source of order and complexity of living systems.

John Avery: *Information theory and evolution* (2004)



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evolution and entropy Search Advanced Search Preferences

The "AND" operator is unnecessary -- we include all search terms by default. [\[details\]](#)

Web

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[Evolution as Entropy: Toward a Unified Theory of Biology](#)

... **Evolution as Entropy: Toward a Unified Theory of Biology** by Daniel R. Brooks and EO Wiley. Chicago: Chicago University Press, 1968. ...
www.innovationwatch.com/books/bks_0226075745.htm - 20k - [Cached](#) - [Similar pages](#)

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Department of English Literature. lit399: Tutor(s): LIT399 **Evolution & Entropy**: Changing Representations of the Sciences in Nineteenth-Century Literature. ...
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... LIT399: **EVOLUTION AND ENTROPY: CHANGING REPRESENTATIONS OF THE SCIENCES IN NINETEENTH-CENTURY LITERATURE**. Primary Texts. Mary Shelley, Frankenstein. ...
www.shef.ac.uk/english/modules/lit399/reading.php - 8k - [Cached](#) - [Similar pages](#)
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[LIE](#)

... **evolutionary** mechanism yet suggested has ever been able to overcome. **Evolution** and **entropy** are opposing and mutually exclusive concepts. ...
www.creationism.ws/lie23.htm - 5k - [Cached](#) - [Similar pages](#)

[Lie](#)

... First of all is the insinuation that evolutionists may not know about the relationship between the processes of **evolution** and **entropy**. ...
www.creationism.ws/lie25.htm - 8k - [Cached](#) - [Similar pages](#)

[Green Apple Books: Evolution as Entropy \(Brooks, Daniel\)](#)

... Title: **Evolution as Entropy** Author: Brooks, Daniel Description: Hardcover with Dust Jacket Publisher: University of Chicago Press Year Published: 1966 Book ...
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[Amazon.com: Books: Evolution As Entropy: Toward a Unified Theory ...](#)

Amazon.com: Books: **Evolution As Entropy: Toward a Unified Theory of Biology (Science and Its Conceptual Foundation Series)** by Daniel R. Brooks,EO Wiley,DR ...
www.csicop.org/q/book/0226075737 - 54k - Mar 9, 2005 - [Cached](#) - [Similar pages](#)

[IIDB - need help with evolution and entropy arguement \(u guys seem ...](#)

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If you want to read more about this, a good place to start might be two classic books...

Some early attempts to get a grip on the role of entropy and information theory in biology include...[5 titles]

Be aware that many of the early papers in this field are based upon misconceptions of the fundamental concepts of information theory...in fact I'd go so far as to wonder aloud whether anyone is really qualified to work in this area, which probably explains why forty years after the first conference devoted to this field, it remains contentious.

.....

Please DO NOT email me at optimist.@u.washington.edu I post from this account to fool spambots.

Subject: Evolution and thermodynamics

Newsgroups: sci.phys, bionet.info-theory

Author: Chris Hillman

Date: Sunday 23 August 1998

Cached by Google. Retrieved from Search terms: Hubert P.Yockey

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thermodynamics creation

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Tip: Save time by hitting the return key instead of clicking on "search"

[Entropy Thermodynamics - Creation and Evolution FAQ and Resources](#)

Click Here Entropy **Thermodynamics - Creation** and Evolution FAQ and Resources. What does entropy and the second law of **thermodynamics** say about evolution? ...

www.icr.org/faqs/Creation_and_Creation_Science/Entropy_Thermodynamics/ - 18k - [Cached](#) - [Similar pages](#)

[Entropy and the second law of thermodynamics. Creation Science.](#)

The 2nd Law of **Thermodynamics**, Evolution, and Probability The second law of **thermodynamics** definition and further links Biblical **Creation** Science - Introduction ...

www.awitness.org/bible_commentary/genesis/entropy_second_law_thermodynamics.html - 10k - [Cached](#) - [Similar pages](#)

[Second Law of Thermodynamics - ChristianAnswers.Net](#)

pp. 91-110. Harold L. Armstrong, "Evolutionistic Defense Against **Thermodynamics** Disproved," **Creation** Research Society Quarterly, Vol. 16, No. 4 (March 1980), pp. ...

www.christiananswers.net/q-eden/edn-thermodynamics.html - 33k - [Cached](#) - [Similar pages](#)

[Thermodynamics and Order Q&A](#)

Can natural laws prevent Evolution? (Christian Answers Network); Evolution, **Creation** **Thermodynamics**; Can Water Flow Uphill? The Mystery of ...

www.answersingenesis.org/home/area/faq/thermodynamics.asp - 15k - Mar 15, 2005 - [Cached](#) - [Similar pages](#)

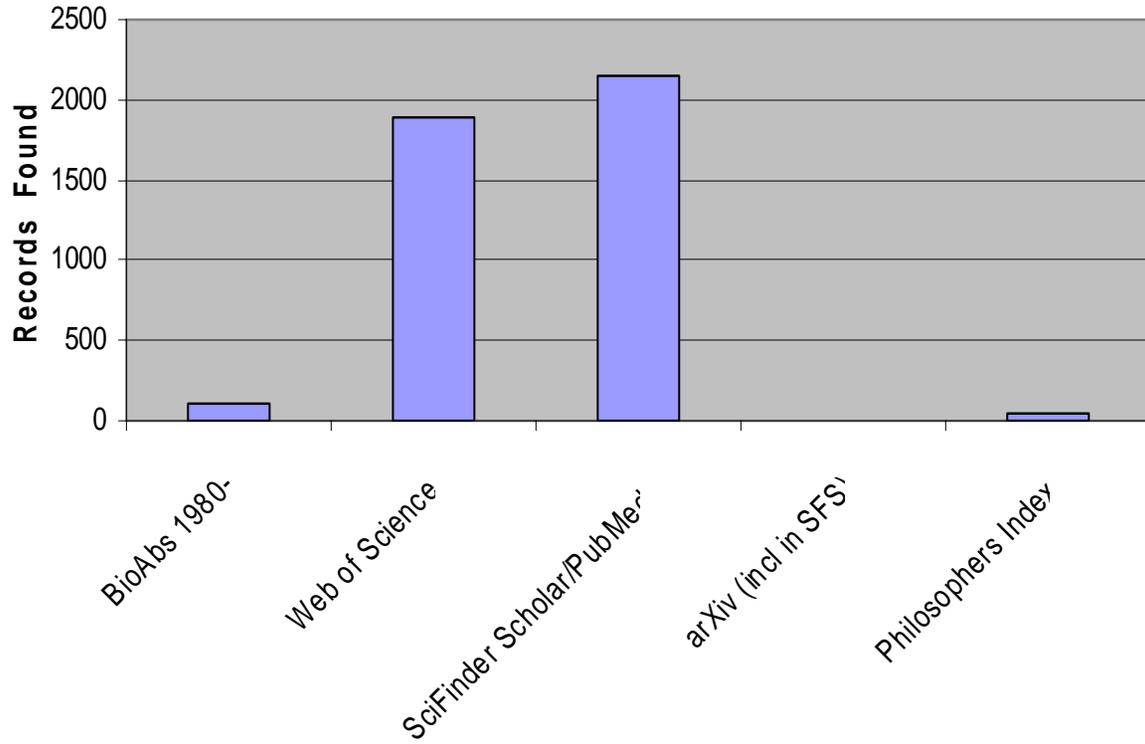
[Evolution, Creation, and Thermodynamics](#)

... Evolution, **Creation**, and **Thermodynamics**. Carl Wieland. First published in **Creation** Ex Nihilo 3(2):9-11, May 1980. Introduction: The ...

www.answersingenesis.org/docs/3810.asp - 20k - [Cached](#) - [Similar pages](#)

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Entropy and Evolution Search



Library of Congress Subject Headings

Biological systems
Cognitive neuroscience
Brain and evolution
Consciousness
Intellect
Developmental neurobiology
Physiological anthropology
Neurobiology – Philosophy
Biology
Philosophy
Evolution
Human evolution
Molecular evolution
Life—Origin
etc

LC Classifications

BD 450
BF 311
BF 431
BD 450
QH 325
QH 331
QH 366
QH 371
QH 501-506
QP 501
QP 360
QP 376
QP 398
etc

Biological Abstracts Classifications

Scope Note for: "01500"

NOTE: Philosophical, theoretical and experimental studies of the origins of life, natural selection, phylogeny, speciation and divergence.

Scope Note for: "10515"

NOTE: Studies of the mathematical relationships of the functional elements of living systems and studies that quantitatively evaluate biological processes or systems.

Introduced in 1972

Scope Note for: "10064"

NOTE: Chemical studies of proteins, peptides, and amino acids.

Web of Science KEYWORDS

Cybernetics
Entropy
Complexity Theory
Evolution
Biology
Information Theory
Thermodynamics
Life Origin
DNA
Shannon
Systems Theory
arXiv searched concurrently on WoS

SciFinder Scholar INDEX TERMS

Evolution, Molecular
Entropy
Free energy
Order
Conformation (DNA, information theory and creation of order and application to origin of biological structures)
Thermodynamics (DNA, information theory and creation of order and application to origin of biological structures)
Evolution (DNA, information theory and creation of order and application to origin of biological structures)
Simulation and Modeling
Proteins
Genetics
Models, Biological
Information Theory

PubMed searched concurrently with SciFinder Scholar

- **BIOLOGICAL ABSTRACTS**

- **Scope Note**

- *Computational Biology*

- **NOTE:** Studies of the tools and infrastructure necessary to support biological research or cross-disciplinary research centered around biological databases, and software systems.
- For studies emphasizing information processing or analysis, see Information Studies. For studies dealing with the general application of computers in the life sciences, see Computer Applications.

- **Related:**

- Information Studies
- Computer Applications
- Mathematical Biology
- Models and Simulations

- *Mathematical Biology*

- **NOTE:** Studies of the application of mathematics and statistics to biological phenomena.
- For studies of pure mathematics without a biological application, see Mathematics.

- **Related:**

- Mathematics
- Methods and Techniques
- Computational Biology

- **Classification:**

- *"10515"*

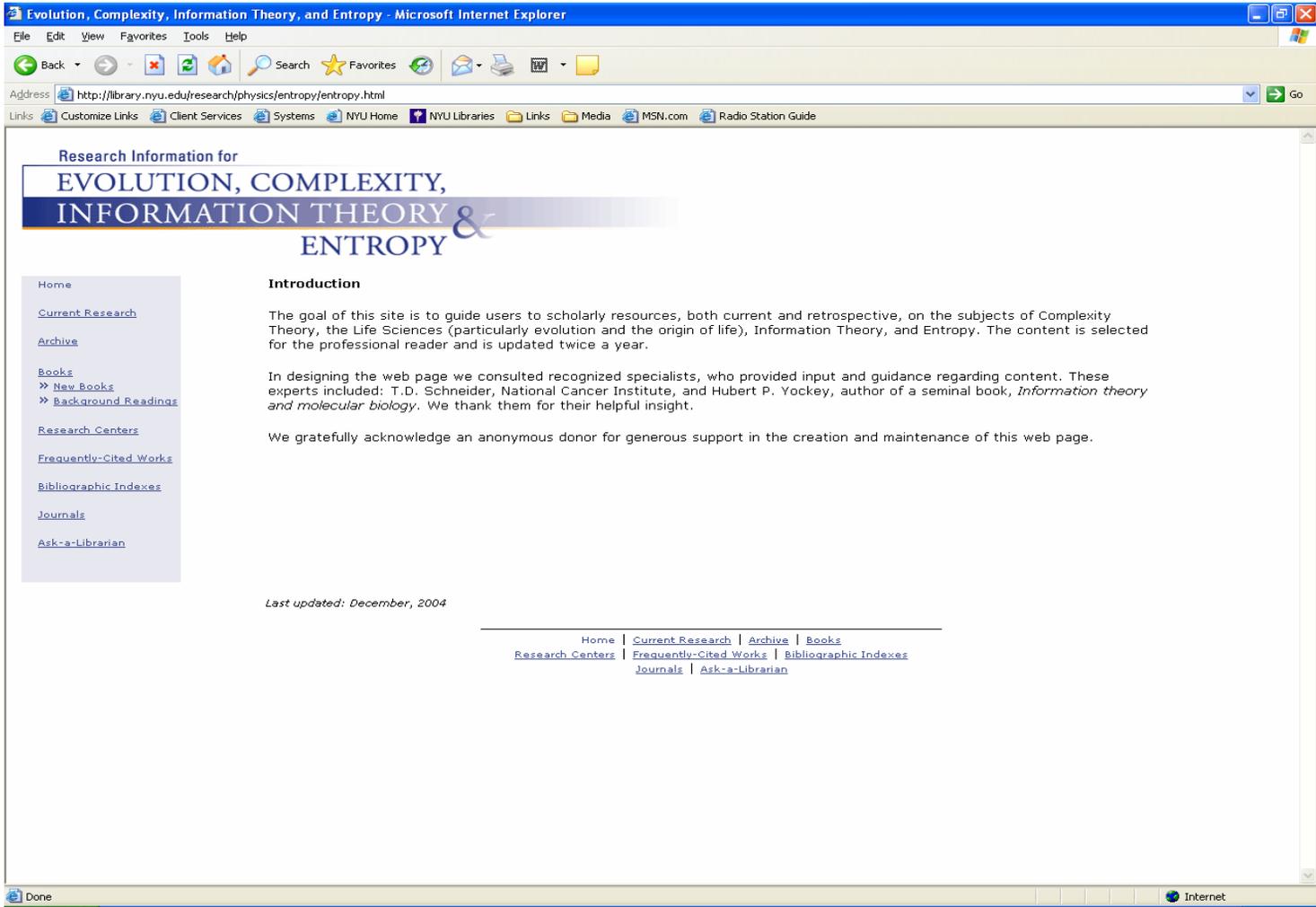
- **NOTE:** Studies of the mathematical relationships of the functional elements of living systems and studies that quantitatively evaluate biological processes or systems.
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- **Scope Note for: "10064"**

- **NOTE:** Chemical studies of proteins, peptides, and amino acids.
-

- **Scope Note for: "01500"**

- **NOTE:** Philosophical, theoretical and experimental studies of the origins of life, natural selection, phylogeny, speciation and divergence.



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Introduction

The goal of this site is to guide users to scholarly resources, both current and retrospective, on the subjects of Complexity Theory, the Life Sciences (particularly evolution and the origin of life), Information Theory, and Entropy. The content is selected for the professional reader and is updated twice a year.

In designing the web page we consulted recognized specialists, who provided input and guidance regarding content. These experts included: T.D. Schneider, National Cancer Institute, and Hubert P. Yockey, author of a seminal book, *Information theory and molecular biology*. We thank them for their helpful insight.

We gratefully acknowledge an anonymous donor for generous support in the creation and maintenance of this web page.

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CURRENT RESEARCH

Research from 2003 to the present [see [Archive](#) for pre-2003 research]

[What is a DOI?](#)

Adami, Christoph and Wilke, Claus O. (2004) doi:10.1162/106454604773563540 Experiments in digital evolution (editors' introduction to the special issue). ARTIFICIAL LIFE vol 10 no. 2 pp 117-122 [link](#)

Amzallag, G. N. (2004) doi:10.1016/j.thbio.2004.03.003 Critical periods as fundamental events in life. THEORY IN BIOSCIENCES vol 123 no. 1 pp 17-32 [link](#)

Aristizabal, F. and Glavinovic, M. I. (2004) doi:10.1007/s00422-003-0432-8 Simulation and parameter estimation of dynamics of synaptic depression. BIOLOGICAL CYBERNETICS vol 90 no. 1 pp 3-18 [link](#)

Arrhenius, G. O. (2003) doi:10.1002/hlca.200390135 Crystals and life. HELVETICA CHIMICA ACTA vol 86 no. 5 pp 1569 [link](#)

Bar-Yam, Y. (2004) doi:10.1142/S0219525904000068 Multiscale complexity/entropy. ADVANCES IN COMPLEX SYSTEMS vol 7 no. 1 pp 47-63 [link](#)

Blanchard, J. L. (2004) doi:10.1016/j.fcr.2004.07.015 Bioinformatics and Systems Biology, rapidly evolving tools for interpreting plant response to global change. FIELD CROPS RESEARCH vol 90 no. 1 pp 117-131 [link](#); [link](#)

Bojarski, A. J. ; Nowak, M. and Testa, B. (2003) doi:10.1007/s00018-003-3280-8 Conformational constraints on side chains in protein residues increase their information content. CELLULAR AND MOLECULAR LIFE SCIENCES vol 60 no. 11 pp 2526-2531 [link](#); [link](#)

Bork, Per ; Jensen, Lars J. ; von Mering, Christian ; Ramani, Arun K. ; Lee, Insuk and Marcotte, Edward M. (2004) doi:10.1016/j.sbi.2004.05.003 Protein interaction networks from yeast to human. CURRENT OPINION IN STRUCTURAL BIOLOGY vol 14 no. 3 pp 292-299 [link](#); [link](#)

Chao, A. and Shen, T. J. (2003) doi:10.1016/j.sbi.2004.05.003 Nonparametric estimation of Shannon's index of diversity when there are unseen species in sample. ENVIRONMENTAL AND ECOLOGICAL STATISTICS vol 10 no. 4 pp 292-299 [link](#); [link](#)

Cordelli, A. and Galleni, L. (2003) Towards a theory of meaning in biology: A proposal for an operative definition. RIVISTA DI BIOLOGIA-BIOLOGY FORUM vol 96 no. 1 pp 145-158 [link](#)

Corning, P. A. (2004) doi:10.1016/j.techfore.2004.01.001 On the emergence of life and meaning.(book review).

Internet

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JOURNALS

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- [Acta Biotheoretica](#)
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Internet

Problems

- Cannot personalize it; it's not a database
- “Idiosyncratic” document selection
- Takes too much time to update
- Data capture and transfer are cumbersome
- Researchers do not use it

Some Resolutions

- Turn it into a “Pathfinder”
- Add information about Alerting Services
- And RSS feeds like <http://barf.jcowboy.org/>
- And IRCNet channel #bioinformatics
- And Newsgroups like bionet.info-theory
- And CiteSeer/Research Index – when it’s ready for prime time <http://citeseer.ist.psu.edu/cs>
- And Google Scholar – when it’s ready for prime time

library.nyu.edu/research/physics/entropy/entropy.html

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