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## ***PRINCIPAL RESEARCH INTERESTS***

*Probabilistic and statistical aspects in genome organization – Non-randomness at several length scales – Genomic Evolution*

- Deviations from randomness at the level of nucleotide n-tuplets. Patterns related to the functionality of genomic regions and to the global genome structure.
- Deviations from randomness at the “middle” length scale (tenths of nucleotides), expressed as clustering of similar nucleotides. Use of such approaches for the distinction of coding and non-coding regions, heuristic measures of clustering, modified “chaos-game-representation” methods etc.
- Long-range correlations and Zipf laws in the genome structure. Power-laws in the distribution of repeats, coding segments and of other functional genomic localizations.
- DNA sequences seen as genomic text – Linguistic features in the genome: redundancy, multiple coding, asymmetries etc.
- “Conservation laws” at the genome structure. The case of “Chargaff’s 2<sup>nd</sup> parity rule”. The use of deviations from this law in the study of genomic dynamics and evolution.
- Evolution at the genomic level. Formulation of minimal evolutionary scenarios compatible with the observed probabilistic features of genomes. Interpretation of the above mentioned probabilistic features either by selectionist or mutationist reasoning.

*Pattern formation in biological systems – Self-organization and evolution.*

- Early development – Left-right asymmetries – Limb development.
- Reaction-diffusion systems – Spontaneous symmetry breakings.
- Prebiotic and early evolution as a complex self-organization procedure.

***LIST OF PUBLICATIONS IN REVIEWED JOURNALS***

32.-D.Sellis & Y.Almirantis. Power-laws in the genomic distribution of coding segments in several organisms: an evolutionary trace of segmental duplications, possible paleopolyploidy and gene loss. *Gene* (2009) 447, 18-28.

31.-D.Sellis, A.Provata & Y.Almirantis. Alu and LINE1 distributions in the human chromosomes. Evidence of a global genomic organization expressed in the form of power laws. *Molecular Biology and Evolution* (2007) 24, 2385-2399.

30.-C.Nikolaou & Y.Almirantis. Deviations from Chargaff's second parity rule in organellar DNA - Insights into the evolution of organellar genomes. *Gene* (2006) 381, 34-41.

29.-P.Katsaloulis, T.Theoharis, W.M.Zheng, B.L.Hao, A.Bountis, Y.Almirantis, A.Provata. Long-range coorelations of RNA polymerase II promoter sequence across organisms. *Physica A Physica A* (2006) 366, 308-322.

28.-Y.Almirantis. The Paradox of the Planetary Metals. *Journal of Scientific Exploration* (2005) 19, no.1, 31-42.

27.-C.Nikolaou & Y.Almirantis. A study on the correlation of nucleotide skews and the positioning of the origin of replication: different modes of replication in bacterial species. *Nucleic Acids Research* (2005) 33, 6816-6822.

26.-C.Nikolaou & Y.Almirantis. "Word" preference in the genomic text and genome evolution. Different modes of n-tuplet usage in coding and noncoding sequences" *Journal of Molecular Evolution* (2005) 61, 23-35.

- 25.-Y.Almirantis & C.Nikolaou. Multi-criterial coding sequence prediction. Combination of GeneMark with two novel, coding-character specific quantities. *Computers in Biology and Medicine*. Accepted, 2004.
- 24.-C.Nikolaou & Y.Almirantis. Measuring the Coding Potential of Genomic Sequences through a Combination of Triplet Occurrence Patterns and RNY Preference. *Journal of Molecular evolution*. Accepted, 2004.
- 23.-C.Nikolaou & Y.Almirantis. Mutually symmetric and complementary triplets: Differences in their use distinguish systematically between coding and non-coding genomic sequences. *Journal of Theoretical Biology* (2003), 223, 477-487.
- 22.-C.Nikolaou & Y.Almirantis. A Study of the Middle-scale Nucleotide Clustering in DNA Sequences of Various Origin and Functionality, by means of a Method based on a Modified Standard Deviation. *Journal of Theoretical Biology* (2002), 217, 479-492.
- 21.-A.Provata & Y.Almirantis. Statistical dynamics of clustering in the genome structure. *Journal of Statistical Physics* (2002), 106, 23-56.
- 20.-Y.Almirantis & A.Provata. An evolutionary model for the origin of non-randomness, long-range order and fractality in the genome. *BioEssays*, (2001) 23, 647-656.
- 19.-A.Provata & Y.Almirantis. Fractal Cantor patterns in the sequence structure of DNA. *Fractals* (2000) 8, 15-27.
- 18.-Y.Almirantis. Pattern formation in a Turings' type model with minimal reactional complexity. *Computers and Chemistry* (2000) 24, 159-170.
- 17.-Y.Almirantis & A.Provata. Long- and short-range correlations in genome organisation. *Journal of Statistical Physics* (1999) 97, 233-262.
- 16.-Y.Almirantis & S.Papageorgiou. Modes of morphogen cooperation for limb formation in vertebrates and insects. *Journal of Theoretical Biology* (1999) 199, 235-242.
- 15.-Y.Almirantis. A standard deviation based quantification differentiates coding from non-coding DNA sequences and gives insight to their evolutionary history. *Journal of Theoretical Biology* (1999) 196, 297-308.

14.-A.Provata & Y.Almirantis. Scaling properties of coding and non-coding DNA sequences. *Physica A*. (1997) 247, 482-496.

13.-Y.Almirantis & A.Provata. The "clustered structure" of the purines/pyrimidines distribution in DNA distinguishes systematically between coding and non-coding sequences. *Bulletin of Mathematical Biology* (1997) 59, 975-992.

12-S.Papageorgiou & Y.Almirantis. Gradient model describes the spatial-temporal expression pattern of *Hoxa* genes in the developing vertebrate limb. *Developmental Dynamics* (1996) 207, 461-469.

11-D.Venieratos, Y.Almirantis & S.Papageorgiou. Small angle dislocations of the newt limb axes can test the validity of several models. *Growth, Development and Aging* (1995) 59, 45-54.

10-Y.Almirantis. Left-right asymmetry in vertebrates. *BioEssays*, (1995) 17, 79-83.

9-Y.Almirantis & M.Kaufman. Chiral selection of rotating waves in a reaction-diffusion system: The effect of a circularly polarized electromagnetic field. *International Journal of Bifurcation and Chaos* (1995) 5, 507-518.

8-S.Papageorgiou & Y.Almirantis. Autocatalytic action of retinoic acid cannot explain pattern duplications in the chick wing bud. *Progress in Clinical and Biological Research* (1993) 383, 725-733.

7-S.Papageorgiou & Y.Almirantis. Diffusion or autocatalysis of retinoic acid cannot explain pattern formation in the chick wing bud. *Developmental Dynamics*, (1992) 194, 282-288.

6-Y.Almirantis. Pattern formation in far-from-equilibrium systems due to cross-diffusion. *Journal of the Mechanical Behavior of Materials*, (1992) 4, 1-11.

5-Y.Almirantis & M.Kaufman. Numerical study of travelling waves in a reaction-diffusion system: response to a spatio-temporal forcing. *International Journal of Bifurcation and Chaos* (1992) 2, 51-60.

4-Y.Almirantis & G.Nicolis. Chiral pattern selection induced by a Fokker-Planck diffusion law. *Dynamics and Stability of Systems* (1992) 7, 199-206.

3-Y.Almirantis & S.Papageorgiou. Cross-Diffusion effects on chemical and biological pattern formation. *Journal of Theoretical Biology* (1991) 151, 289-311.

2-Y.Almirantis & G.Nicolis. Morphogenesis in an asymmetric medium. *Bulletin of Mathematical Biology* (1987) 49, 519-30.

1-J.Salaun & Y.Almirantis. Cyclopentenones from 1,2,-disiloxycyclobutene via silylated 1-vinylcyclo-propanols. Application to the synthesis of the dihydrojasmone and cis-jasmone. *Tetrahedron* (1983) 39, 2421-8.

## *CURRICULUM VITAE*

DATE OF BIRTH: June 5, 1958  
PLACE OF BIRTH: Piraeus, Greece  
NATIONALITY: Greek

### EDUCATION

1970-1976 Ionnidios, Pilot high-school.

1976-1981 Aristotle University of Thessaloniki, Department of Chemistry  
Diploma in Chemistry.

1981-1982 University of Paris XI at Orsay, France Department of Organic Chemistry,  
D.E.A. in Organic Chemistry.  
Thesis project: "Cyclopentenones from 1,2-Disiloxy cyclobutene via silylated 1-vinylcyclopropanols. Application to the synthesis of dihydrojasmone."

1982-1988 Free University of Brussels, Belgium Ph.D. in Theoretical- Physical  
Chemistry and Biology. Ph.D. dissertation: "Chiral symmetry  
breaking and pattern selection in chemical and biological systems".

### LANGUAGES

Fluency in: Greek (mother tongue)  
French  
English

## GRANTS/EMPLOYMENT

1982-1983 &

1984-1987 Research for the "Instituts Internationaux de Physique et de Chimie, E.Solvay"  
Ave F.Roosevelt 50, Brussels 1050, Belgium.

1983-1984 Research grant from the General Department of International Relations of the  
French Community of Belgium.

1989-1992 Research associate. Institute of Biology, NCSR "Demokritos", Greece.

1992-1993 Secondary school teacher of chemistry.

1993-1994 IB (International Baccalaureate) teacher of chemistry.

1995-1998 Researcher, Inst. of Biology, NCSR "Demokritos".

1999-2004 Senior researcher, Inst. of Biology, NCSR "Demokritos".

2004- ... Research director, Inst. of Biology, NCSR "Demokritos".

Head of the *Theoretical Biology and Computational Genomics Group*

## POST-GRADUATE TEACHING ACTIVITIES

-Teaching of the course of "Developmental Biology - Theoretical Models in Morphogenesis",  
in the post-graduate program of the NRC "Demokritos" (1991).

-Teaching of the course "Selected chapters of chemistry" in the post-graduate program of the  
Technical Education Institution of Athens, Food Department (1993, 1994).

-Teaching of the course "Mathematical models and DNA, an introduction" in the Summer  
School organized by the NRC "Demokritos" (1998, 1999).

-Teaching of the course "Introductory Chapters of Computational Genomics" in the post-  
graduate program of the NRC "Demokritos" (2000-...).

-Teaching of the course "An Introduction to Theoretical and Computational Genomics"  
Bioinformatics Postgraduate Programme, Faculty of Biology, National and Kapodistrian  
University of Athens. (2005-...)