

Arvydas Tamulis BIOGRAPHICAL SKETCH

Name: Arvydas TAMULIS

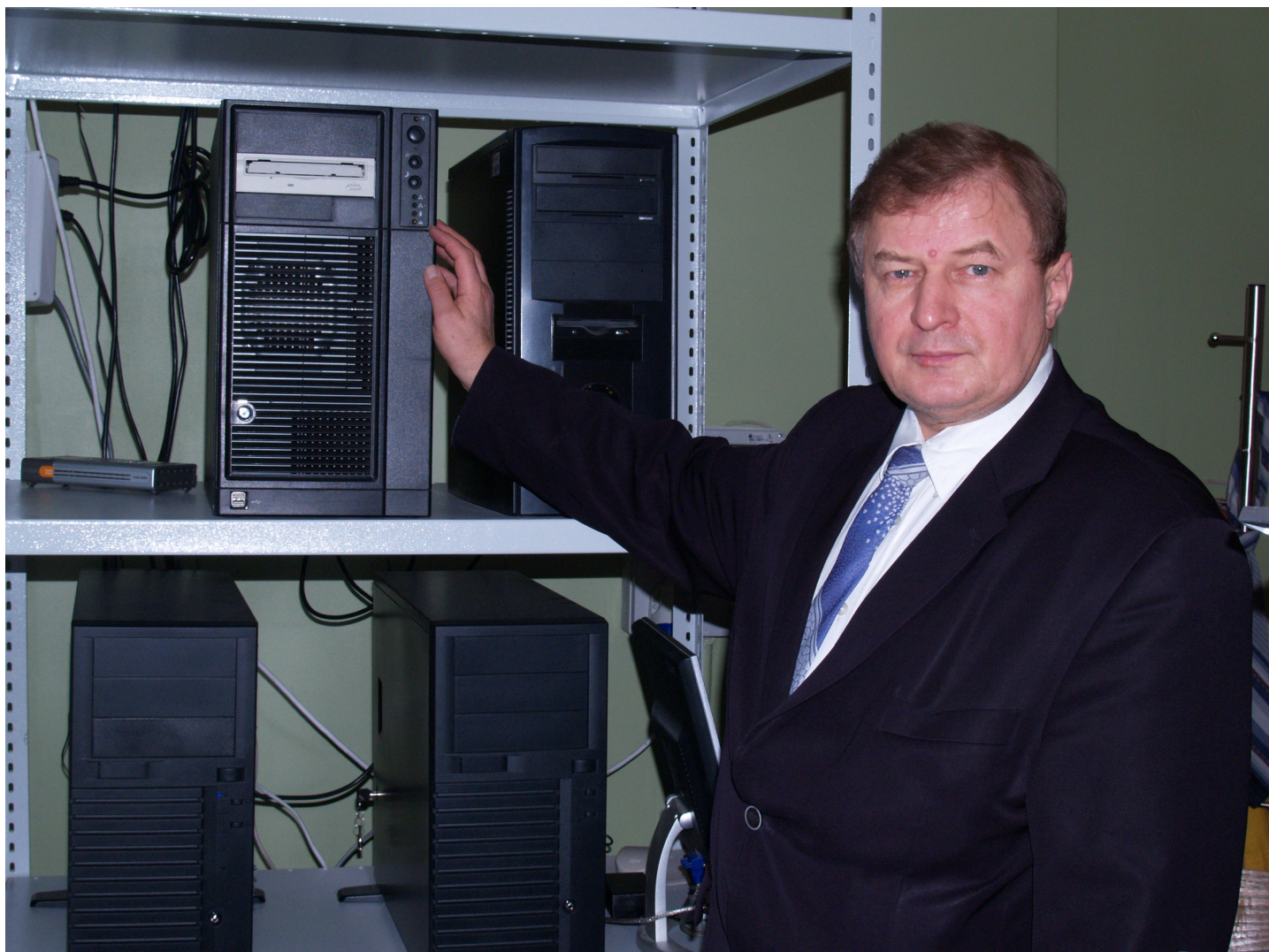
Citizenship: Lithuanian, citizen of the Republic of Lithuania, born in Taurage, Lithuania on 18th of March 1948

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Business: March 2013 – present, Independent expert for the European Commission, Brussels

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Summary of scientific publications of dr. A. Tamulis:

Total number of scientific publications 234 including: 5 chapters of books, 124 scientific articles in the referred issues (73 of them in the ISI Web of Science list, 50 of them in the journals possessing the impact factor).

Membership:

Founding Member of the International Society for Molecular Electronics and BioComputing (ISMEBC) from 1989.

Member of the European Optical Society (EOS) from 1992.

Member of the International Society for the Study of the Origin of Life (ISSOL) from 1994.

Member of SPIE-The International Society for Optical Engineering from 2000.

Member of Management Committees:

1. COST D27 “Prebiotic Chemistry and Early Evolution” action from 2002 year and
2. COST D35 “From Molecules to Molecular Devices: Control of Electronic, Photonic, Magnetic and Spintronic Behaviour” action from 2005 year.

Conferences, Lectures:

1. Poster presentations in more than 85 conferences and symposia in Lithuania, Russia, Poland, England, Wales, Scotland, Germany, Japan, Denmark, Norway, Sweden, Italy, Spain, France, Netherlands and USA.

2. Oral presentations at the NATO ARW on The Synergy Between Dynamics and Reactivity at Clusters and Surfaces (Drymen, near Glasgow, Scotland, 1994); International Workshop on Quantum Communications and Measurement (Nottingham, U. K., 1994); NATO ASI on Localized and Itinerant Molecular Magnetism. From Molecular Assemblies to the Devices (Tenerife, Spain, 1995); NATO ASI on Photoactive Organic Materials. Science and Applications (Avignon, France, 1995); NATO ARW on

Polymers and Composites for Special Applications (Poznan, Poland, 1999); NATO ARW on Multiphoton and Light Driven Multielectron Processes in Organics: Materials, Phenomena, Applications (Menton, France, 1999); Photonics West 2000 SPIE Conference on Organic Photonics Materials and Devices II (OE04) (San Jose, USA, 2000); Second International Symposium on Optical Power Limiting (Venice, Italy, 2000), Workshop on Life (Modena, Italy, 2000); NATO ARW on Molecular Low Dimensional and Nanostructured Materials for Advanced Applications (Poznan, Poland, 2001); NATO ARW on "Organic Nanophotonics", Aix-en-Provence, France, August 25-29, 2002; NATO ARW on Dynamic Interactions in Quantum Dot Systems, Puszczykowo, Poland, May 16-19, 2002; International Conference 'Self-Formation. Theory and Applications', 26-28 November, 2003, Vilnius, Lithuania; Third Annual Meeting COST Action P10 "Physics of Risk" & Workshop on "Complex System Science", Vilnius Lithuania, 13-16 May, 2006;

3. Invited Lectures:

A. Tamulis invited lecture, Arvydas Tamulis, Mantas Grigalavicius, Jonas Baltrusaitis, „Quantum Evolution of Fatty Acid World Life and Applications for Magnetically Controlled Artificial Minimal Cells“, book of abstracts of Chembiogenesis, p.p. 26-27, 2011, 27-30 October, Heraclion-Crete, Greece.

A. Tamulis, invited lecture in international workshop: “Multiscale Modelling and Simulation in Science”, AlbaNova University Campus, Stockholm, November 2 - 27, 2009, see <http://agenda.albanova.se/conferenceDisplay.py?confId=1122>

Arvydas Tamulis, Invited lecture: „Quantum Mechanical Self-assembling of Artificial Minimal Cells and Control by Molecular Electronics and Spintronics Logical Devices“, book of extended abstracts of International School „Advanced Methods in Biophysics“, 26-30 November, 2007, Hotel „Trasalis“, Trakai, Lithuania, 3 pages.

EU COST D27 conference, COST D27 Final Evaluation conference “Prebiotic Chemistry and Early Evolution”, Inter – University Center, Dubrovnik, Croatia, May 11 - 13, 2007.

EU COST D27 conference “Chembiogenesis 2006”, Barcelona, Spain, December 14 – 17, 2006;

„Basic Questions about the Origin of Life“, Question 9: Artificial life“, International School on Complexity – 4th Course, Italy, Erice, 2-5 October, 2006;

EU COST D27 conference “Chembiogenesis 2005”, Venice, Italy, September 28 – October 01, 2005;

EES-6/CNLS at the Los Alamos National Laboratory (LANL), USA (February, July 2005), host Professor Steen Rasmussen; CNLS/LANL December-January 2002-2003 (host professor G. Berman);

NATO ASI on Molecular Electronics: Bio-sensors and Bio-computers, Pisa, Italy, June 24 - July 4, 2002;

University of New Mexico, AHPCC, USA (host Prof. S. Karna, March 2001);

Institute of Physics and Astronomy, University of Aarhus, Denmark (host Prof. K. Langanke, April 1998);

Vilnius University, Department of Chemistry (5 times, host Prof. P. Adomenas, 1977-1990);

Vilnius University, Department of Chemistry (host Prof. G. Dienys, 1974);

Institute of Biochemistry, Lithuanian Academy of Sciences (3 times, host Prof. K. Konstantinavicius, 1973-1979).

Fully reimbursed participation in approximately 200 science conferences in the period of 1971-2014 years was good school of my education.



Experience, education:

March 2013 - present Independent expert for the European Commission, Brussels.



2009 - Participation and invited lecture in the workshop: "Multiscale Modelling and Simulation in Science", AlbaNova University Campus, Stockholm, November 2 - 27, 2009, see <http://agenda.albanova.se/conferenceDisplay.py?confId=1122> , host professor Hans Agren.

2004-2008 - science conferences at the European Center for Living Technologies in Venice, see website:

http://www.ecltech.org/ecltech_j/index.php/organization.html

2005 visiting scientist with the EES-6 group at the Los Alamos National Laboratory, USA (February, July), host Professor Steen Rasmussen.

2002-2003 - visiting scientist at the Centre for Nonlinear Studies at the Los Alamos National Laboratory, USA (from November 2002 to March 2003), host Professor G. Berman.

2000 - visiting scientist at University of California, Davis, USA (from 28 January to 28 February), host Professor A.L. Balch.



1998 and 1999 - visiting scientist at Groupe Composants Organiques, DTA-LETI-DEIN, Service de Physique Electronique, CEA Saclay, Gif sur Yvette, France (from 08 September to 07 November 1998 and from 04 October to 03 December 1999), host Professor J.-M. Nunzi.

1997 - visiting scientist and Max-Planck-Institute of Colloids and Interfaces (Max-Planck- Institut für Kolloid- und Grenzflächenforschung), Berlin, Germany (host Prof. D. Vollhardt, May 1997).

1996-2013 - September Senior Research Fellow at the Institute of Theoretical Physics and Astronomy, Vilnius University, Lithuania.

1996 - Visiting Scientist at the ISSECC-CNR, Florence, Italy (from 08 January 1996 to 08 May 1996), host Professor C. Mealli.

1991-1996 - Research Fellow at the state Institute of Theoretical Physics and Astronomy, Vilnius, Lithuania.

1993 - Legalized as Doctor of Natural Sciences in Lithuania.

1992 - Visiting scientist in Chalmers University of Technology, Department of Physical Chemistry, Gothenburg, Sweden (from 01 August 1992 to 15 December 1992). Host Professor S. Larsson.

1985-1990 - Research Fellow at the Institute of Physics of the Lithuanian Academy of Sciences.

1985 - Ph.D. degree of the Theoretical and Mathematical Physics in Vilnius University. Thesis entitled "Quantum Mechanical Investigation of Electronic Structure and Orbitals of Molecular Fragments and Selection Rules for Fragment Joining to Molecules".

1975-1985 - Junior Research Fellow at the Institute of Physics of the Lithuanian Academy of Sciences.

1971-1975 - Junior Research Fellow at the Institute of Physics and Mathematics of the Lithuanian Academy of Sciences.

1971 - Master of Theoretical Physics, Graduation from Vilnius University.

Successfully accomplished international scientific projects by dr. Arvydas Tamulis research group

Foundation	Project	Duration	Finances
25) Agency for International Science and Technology Development Programmes (Lithuania)	COST Action D35 "From Molecules to Molecular Devices: Control of Electronic, Photonic, Magnetic and Spintronic Behavior"	2009	13,000.0 Lt 1 EUR = 3.428 Lithuanian currency Litas (Lt)
24) Agency for International Science and Technology Development Programmes (Lithuania)	"Quantum mechanical modeling of programmable artificial living cells and nanobiorobots based on organometallic photosensitizers"	2008	13,000.0 Lt
23) Agency for International Science and Technology Development Programmes	"Quantum mechanical modeling of programmable artificial living cells and	2007	15,000.0 Lt

Foundation	Project	Duration	Finances
(Lithuania)	nanobiorobots consisting up to 500 atoms"		
22) Lithuanian State Science and Studies Foundation (LVMSF)	"Prebiotic chemistry and early evolution"	2006	14,000.0 Lt
21) Lithuanian State Science and Studies Foundation	"Prebiotic chemistry and early evolution"	2005	15,000.0 Lt
20) Lithuanian Republic Ministry of Education and Science	"Programmable Artificial Cell Evolution"	2004	74,000 Lt
19) LVMSF	"Prebiotic chemistry and early evolution"	04/2004-12/2004	15,600.0 Lt
18) NorFA	"Quantum Modeling of Molecular Materials" http://www.ifm.liu.se/~panor/QMMM/	2004- 2006	111,000.0 NOK
17) European Union FP6	"Programmable Artificial Cell Evolution" http://www.istpace.org/index.html	2004-2008	169,389.0 EUR
16) LVMSF	"Prebiotic chemistry and early evolution"	04/2003-12/2003	14,600.0 Lt
15) European Union COST D27	"Prebiotic chemistry and early evolution"	2002-2006	10,000.0 EUR
14) Los Alamos National Laboratory, USA	"Quantum Computation Using Self-Assembled Molecular Spin Arrays"	11/2002-03/2003	\$9,000.00
13) LVMSF	"Investigations of electronic structure of biliverdin and related compounds"	04/2001-12/2001	5,000.0 Lt
12) LVMSF	" <i>Ab Initio</i> Quantum Chemical Design of Single Supermolecule Photoactive Machines and Molecular Logical Devices"	03/2001-12/2001	14,500.0 Lt
11) USA Air Force Department EOARD contract F61775-00-WE050	" <i>Ab Initio</i> Quantum Chemical Design of Single Supermolecule Photoactive Machines and Molecular Logical Devices"	07/2000-07/2001	\$25,000.00
10) USA NRC Twinning program	"Studies of the Electronic Structure of Biliverdin and Related Compounds"	01/2000-12/2001	\$6,500.00
9) Atomic Energetic Centre, Groupe Composants Organiques, DTA-LETI-DEIN, Service de Physique Electronique, CEA Saclay, Gif sur Yvette, France.	"Modeling of photoactive molecular, devices from photoactive azo-dyes"	10/1999-11/1999	\$2,000.00
8) LVMSF	"New "Chlorine Free" Technology of Organophosphorus Compounds based on Catalytic Reactions of Elemental Phosphorus"	03/1999-12/1999	12,800.0 Lt
7) Atomic Energetic Centre, Groupe Composants Organiques, DTA-LETI-DEIN, Service de Physique Electronique, CEA Saclay, Gif sur Yvette, France.	"Modeling of photoactive molecular devices from photoactive azo-dyes"	09/1998-10/1998	\$2,500.00
6) European Union INCO-COPERNICUS contract ERBIC15CT960746	"New "Chlorine Free" Technology of Organophosphorus Compounds based on Catalytic Reactions of Elemental Phosphorus"	02/1997-02/2000	\$39,000.00
5) NORDITA	"Electronic Structure of Fullerene Complexes"	09/1997-11/1997	\$4,000.00

Foundation	Project	Duration	Finances
4) Max-Planck-Institute of Colloids and Interfaces, Berlin, Germany	"Quantum Chemical Investigations, of Intermolecular Bonds in Organic Molecules"	May 1997	\$2,000.00
3) NATO-CNR Italy Joint Foundation	"Stability of Small Fullerene Molecules and Design of Molecular Devices"	01/1996-05/1996	\$7,000.00
2) International Science Foundation Long-Term Research Grants Program	"Quantum Mechanical Investigation of Stability Factors of Small Empty and Endohedral Fullerene Molecules and Disc-like Photoactive Supramolecules"	01/1994-12/1995	\$18,000.00
1) Swedish Institute foundation	"Quantum Mechanical Investigations of Spectra of Fullerene Clusters"	08/1992-12/1992	\$6,000.00

Summary of Arvydas Tamulis research during 2009-2014 years

Use of quantum mechanical density functional theory nonlocal gradient electron correlation interactions methods for investigations of various self-assembled photoactive fatty acid micelles. The micelle systems studied are based on a photoactive squaraine sensitizer, an 8-oxo-guanine electron donor, cytosine, fatty acid and their precursor (pFA) molecules. The systems include a water environment and consist of some 717 atoms and are up to about 6.0 nm in diameter. The quantum mechanical based electron correlation interactions are the source of the weak hydrogen and Van der Waals chemical bonds that are critical to the behaviour of these systems. Polar solvent molecules such as water increase the strength of these bonds and thus play a central role in the self-assembly and functioning of the systems studied. The distances between the separated sensitizer, precursor of fatty acid, and water molecules are comparable to Van der Waals and hydrogen bonding radii. As a result, these nonlinear quantum interactions compress the overall molecular system resulting in a smaller gap between the HOMO and LUMO electron energy levels allowing enhanced tunnelling of photoexcited electrons from the sensitizer to pFA. The most intense excited states of the photoactive fatty acid micelles are partially composed of LUMO+n states located on the fatty acid precursors when the bis(4-diphenylamine-2-phenyl)-squaraine molecule is covalently attached to the 8-oxo-guanine. This coupling also promotes electron hopping (tunnelling) to the pFA molecules during the most intense absorption excited state. The photoexcited electron tunnels to the waste end of the pFA molecules where it causes these molecules to split due to intense rotation and vibration of the weak chemical bond that joins the waste piece to the fatty acid section of the pFA molecule. The most intense absorption lines of the squaraine-8-oxo-guanine supermolecule were found to be shifted to the red when these molecules were associated with fatty acid micelles. In addition, the 8-oxoguanine:: cytosine-squaraine supramolecule was observed to have an absorption region that covered more of the visible spectrum than a lone squaraine-8-oxo-guanine supermolecule. The redward shift of the intense absorption lines would allow a self-reproducing micelle to absorb the light in the longer wavelength region, which may have been important in the environment that life might have developed, in addition to extending the photoactive period into the earlier morning and later evening hours. That could have provided a competitive advantage for such photoactive micelles of Fatty Acids World life in the acquisition and use of food molecules. Furthermore, one notes that the nucleotide caused wavelength shift and broadening of the absorption pattern potentially gives the nucleotides an additional valuable role, other than just a purely genetic one in the early stages of the development of life. The main quantum mechanical research result of our research group is that life on Earth or elsewhere in the Space could have emerged in the form of self-reproducing photoactive fatty acid micelles, which step by step evolved to nucleotide containing micelles due to an ability to co-associate and an enhanced ability to absorb visible light. The nucleotide molecules and their sequences, which in the first period of evolution of fatty acid molecules were useful just for better absorbency of the light in the longer wavelength region, later in the peptide nucleic acid (PNA) or RNA World living organisms took on the role of genetic information storage. From the information theory point of view, the nucleotide molecules sequences in the Fatty Acids World micelles carry positional information selected for the ability to provide better relaxation electron transport along the nucleotide-sensitizer chain, in addition to providing complimentary copies of that information to the next generation. The result of self-assembly of molecules in minimal cells depends on the electromagnetic forces between electrons and in general is predicted by the universal physical constants. Molecules are built from atoms which themselves are the result of thermonuclear reactions and which in turn are made possible by the other three fundamental forces: strong and weak nuclear interactions and gravitation (for the self-formation of stars). Universal constants of physical interactions have not changed in the Universe during last 13.73 billion years, therefore the emergence of life was possible following the origin of the Universe.

The quantum mechanical self-assembly of two separate photoactive supramolecular systems with different open electronic shell photosynthetic centres was investigated by means of density functional theory methods. These photoactive prebiotic kernel systems are based on two different photoactive neutral radical sensitizer molecules: (5-(4-(1-hydroxyethyl)phenyl)pentanoic acid and 5-(2,8-dimethyl-1,3-dioxo-2,3-dihydro-1H-phenalen-5-yl)pentanoic acid, the precursor of a fatty acid (pFA) molecule attached via Van der Waals forces, all surrounded by water molecules. [Comment: What about the nucleotide that is mentioned later in this paragraph??] The subsystems include a real water molecule environment consisting of some 155 or 306 atoms and are up to about 2.3 or 2.6 nm in diameter. The electron correlation interactions responsible for the weak hydrogen and Van der Waals chemical bonds increased due to the addition of polar water solvent molecules. The distances between the separated sensitizer, nucleotide, pFA, and water molecules are comparable to Van der Waals and hydrogen bonding radii. As a result, the overall system becomes compressed, resulting in photo-excited electron spin density tunnelling from the sensitizers to the pFA molecules. Absorption spectra as well as electron spin density transfer trajectories associated with the different excited states

were calculated using time dependent density functional theory methods. The results allow separation of the quantum entangled photosynthetic transitions with the neighbouring prebiotic kernel. The metabolism involves magnetically controlled photoexcitation of an electron in these neutral radical supramolecules which possess stable α or β oriented spins.

The main quantum mechanical research result of this paper is that the non-conventional systems which were proposed include the use of quantum entangled molecular spintronics logic gates to control growth and division of artificial living cells. A two variable, quantum entangled AND logic gate was proposed, consisting of two input photoactive sensitizer molecules and one output (both pFA molecules). The excited electron is used to cleave a waste organic molecule resulting in the formation of the desired product. In the future, this process might be applied for the destruction of the tumour cancer cells or to yield building blocks in artificial cells.

The dynamics of quantum mechanical self-assembly of two separate supramolecular systems (*i.e.* two minimal cells each containing a different photosynthetic centre) were investigated by means of semiempirical and density functional theory methods (DFT) using the electron correlation approach. These two bicellular systems consist of 717 atoms or 696 atoms.

Absorption spectra, as well as quantum entangled electron density transfer trajectories associated with the different excited states were calculated using time dependent density functional theory methods (TD-DFT). The calculation methods allow the separation of quantum entangled photosynthetic transitions within the same minimal cells. Presence of photosynthesis in nature and in our quantum mechanical investigations of artificial cells suggest that photosynthetic process may have played an important role in the development of life, perhaps as early as 3.7-3.85 billion years ago as may be indicated in the Isua Greenstone Belt in Greenland. We address the idea that quantum entanglement could have played an important role in the first stages of origins of life and evolution of biospheres because it enhances photosynthesis, leading to faster growth and self-replication of minimal living cells. The quantum mechanically modelled possibility of synthesizing artificial self-reproducing quantum entangled prebiotic minimal cells also impacts the possibility of the most probable path of emergence of protocells on Earth or elsewhere.

Investigations of a prebiotic kernel which contains the precursor of fatty acid (pFA) molecules, provitamin D, and a photosensitizer (1,4-bis(N,N-dimethylamino)naphthalene) which is covalently attached to an oxo-guanine nucleotide were also carried out. Analysis of the absorption spectrum as calculated by TD-DFT and the associated images of electron transfer trajectories for the different excited states allow one to separate quantum photosynthetic transitions and quantum entangled states. The results show that the provitamin D enhances the photosynthetic process in the near UV region and converts into vitamin D. A two variable, quantum entangled AND logic gate was discovered in these photosynthetic prebiotic kernel systems containing provitamin D, which consist of two input photoactive sensitizer derivatives containing two different variable inputs and one output. [Comment: The previous sentence is unclear. All of the above but the last sentence speaks of only one photosensitizer molecule, not two. Where does the second one come from??? Is it a second copy of the 1,4-bis(N,N-dimethylamino)naphthalene, or is it the provitamin D which can of course undergo photocleavage, or is it something else. This needs to be said and the preceding sentence needs clarification.]

Other quantum logic devices can also be built. For instance, quantum mechanical investigations of supramolecular systems containing the light emitting molecule 3,6-di(9-carbazolyl)-9-(2-ethylhexyl)carbazole (TCz) show that one can create a five variable logical identity function device, as well as a quantum entangled two variable OR light emitting logic photon-electron-photon converter, *i.e.* a quantum logic device. These quantum logical devices might be applied for the construction of molecular processors of quantum optical computers or can be regulators of natural and artificial cells.

The new alternative forms of life based on molecular quantum information processing and logically controlling are proposed in our research in early 1998 year (see, for example <http://www.fondazione-delbianco.org/accademici/tamulis.htm>) which we are still developing.

A. Tamulis research group dissemination knowledge during 2014, 2013, 2012, 2011, 2010 and 2009 years

- [34] Tamulis A, Grigalavicius M, Serbenta J, Plausinaitis K, Quantum Entangled Single BioOrganic Supramolecules as Light Absorbing and Light Emitting Logical Devices. *J Comput Theor Nanos*. Vol. 12, 2015.
- [33] Tamulis A, Berteska L, Grigalavicius M, Baltrusaitis J, Quantum Dynamics of Self-Assembly of Minimal Photosynthetic Cells. *J Comput Theor Nanos*, vol. 4, 2015.
- [32]. Tamulis A, Grigalavicius M (2014) Quantum Entanglement in Photoactive Prebiotic Systems. *Systems and Synthetic Biology*, 8:117-140.
- [31] Tamulis A, Grigalavicius M, Krisciukaitis S (2014) Quantum Entanglement in a System Composed of Two Prebiotic Kernels with Molecular Spintronics Logic Devices for Control of Photosynthesis. *J Comput Theor Nanos*, 11:1597-1608.
- [30]. Arvydas Tamulis and Mantas Grigalavicius (2014) "Quantum Mechanical Origin of Fatty Acid Life and Correlations with Anthropic Principle and Old Testament", *Quantum Matter*, 3:460-468.
- [29] Tamulis A, Grigalavicius M, Baltrusaitis J (2013) Phenomenon of quantum entanglement in a system composed of two minimal protocells. *Orig Life Evol Biosph* 43:49-66.
- [28] Arvydas Tamulis, Mantas Grigalavicius and Jonas Baltrusaitis, (2013) „Phenomenon of Quantum Entanglement in a System Composed of Two Minimal Protocells“, *Origins of Life and Evolution of Biospheres*, 43:49–66, DOI 10.1007/s11084-012-9323-0, available in electronic version at <http://link.springer.com/article/10.1007%2Fs11084%C2%AD012%C2%AD9323%C2%AD0>,
- [27] Arvydas Tamulis and Mantas Grigalavicius, "Molecular Spintronics Control of Photosynthesis in Artificial Cell", *Journal of Computational and Theoretical Nanoscience*, vol. 10, No 4, p.p. 989-995, 2013.
- [26] A. Tamulis, M. Grigalavicius, S. Krisciukaitis, G. Medzevicius, "Quantum Processes in 8-Oxo-Guanine-Ru(bipyridine)₃²⁺ Photosynthetic Systems of Artificial Minimal Cells", *Central European Journal of Physics*, vol. 9(3), (2012), p.p. 775-791. DOI: 10.2478/s11534-010-0092-y, electronic version since June 24, 2010, available at: <http://www.springerlink.com/content/dn06077114p41327/>
- [25] Arvydas Tamulis, Mantas Grigalavicius, Jonas Baltrusaitis, „Quantum Evolution of Fatty Acid World Life and Applications for Magnetically Controlled Artificial Minimal Cells“, book of abstracts of Chembiogenesis, p.p. 26-27, 2011, 27-30 October, Heraclion-Crete, Greece.
- [24] Arvydas Tamulis, Mantas Grigalavicius, Jonas Baltrusaitis, „Quantum Evolution of Fatty Acid World Life and Applications for Magnetically Controlled Artificial Minimal Cells“, book of abstracts of 39th Lithuanian National Physics conference, p. 150,

2011, October 06-08, Vilnius University, Lithuania.

[23] Arvydas Tamulis, „Quantum Evolution of Fatty Acid World Life and Applications for Magnetically Controlled Artificial Minimal Cells“, Fifth International NanoSchool, 2011, November 15 – 17, Faculty of Chemistry, Vilnius University, Naugarduko st. 24, Vilnius, Lithuania.

[22] A. Tamulis worked as European Commission expert of FP7 projects in Brussels during 2008 July - 2011 July.

[21] Arvydas Tamulis, „Quantum Mechanical Investigations of Photosynthetic Systems of Artificial Minimal Cells Based on 8-Oxo-Guanine-Ru(bipyridine)₃²⁺“, *Journal of Computational and Theoretical Nanoscience*, Volume 8, Number 4, April 2011, pp. 624-636.

[20] Arvydas Tamulis appointed as one of the Editorial Board members of Open Journal of Inorganic Chemistry (OJIC, website: <http://www.scirp.org/journal/ojic>).

[19] A. Tamulis science presentation „Quantum Entangled OR Logic Gates Controlling Photosynthesis and Melodies in Minimal Artificial Cells“, on 2011 January 27, 11 hours, at Vilnius University Institute of Theoretical Physics and Astronomy, Library hall, A Goštauto str. 12

[18] A. Tamulis was accepted for research in COST Action CM0805 “The Chemical Cosmos: Understanding Chemistry in Astronomical Environments”, in working group WG3: Chemistry of planetary atmospheres (Models and observations).

Participated with science presentation in WG3 workshop on “Carbon in the Solar system”, Brussels December 6 to 8 2010.

Abstract of our presentation available at: http://ulisse.busoc.be/cost/abstracts_uploads/AbstractEmergenceLife.txt

Title of our presentation: “The Emergence of Life was Predicted”, authors: Arvydas Tamulis and Mantas Grigalavicius

[17] A. Tamulis presented three invited lectures in the Fourth International NanoSchool, Faculty of Chemistry, Vilnius University, November 30 – December 3, 2010, Vilnius.

[16] A. Tamulis, M. Grigalavicius, S. Krisciukaitis, G. Medzevicius, “Quantum Processes in 8-Oxo-Guanine-Ru(bipyridine)₃²⁺ Photosynthetic Systems of Artificial Minimal Cells”, *Central European Journal of Physics*, vol. 9(3), (2011), p.p. 775-791. DOI: 10.2478/s11534-010-0092-y, electronic version since June 24, 2010, available at:

<http://www.springerlink.com/content/dn06077114p41327/>.

[15] Arvydas Tamulis, Mantas Grigalavicius, „Magnetically controlled artificial minimal living cells“, book of abstracts of conference ICAMDATA 7, 21–24 September 2010, Vilnius, p. 69.

[14] Arvydas Tamulis and Mantas Grigalavicius, “Quantum Mechanical Origin of Genetic Material in Minimal Cells”, *J. Comput. Theor. Nanosci.* 7, 1831-1841 (2010)

[13] Arvydas Tamulis, “The Emergence of Life was Predicted”, The scientific seminar in headquarter of Lithuanian Scout Organization on May 31, 19-22 hours, Vilnius, Pylimo street 11-1.

[12] Arvydas Tamulis, Mantas Grigalavicius, „The Emergence and Evolution of Life in a “Fatty Acid World” Based on Quantum Mechanics”, *Origins of Life and Evolution of Biospheres*, 2011) vol. 41, pages 51-71. Electronic version of this article available since May 05, 2010 at <http://www.springerlink.com/content/7122n16869843314/fulltext.html>

[11] The reportage about our current research is placed in the website where you can see moving self-assembled micelles due to quantum mechanical interactions and some pictures from Los Alamos "Protocell Assembly" project:

<http://tv.delfi.lt/video/gkUbPraW/>

[10] Article in Lithuanian language Arvydas Tamulis “Quantum Mechanical Interactions Between Molecules Initiated Origin of Life and Genetic Material”, see more in website:

<http://mokslofestivalis.eu/lt/news/337/40/Kvantines-mechanines-saveikos-tarp-molekuliu-salygojo-pirmines-gyvybes-ir-genetines-medziagos-atsiradima>

[9] Arvydas Tamulis, “Quantum Mechanical Interactions Between Molecules are the Origin of Emergence of Protolife and Genetic Material”, lecture in the Seminar of Intracellular Signalization at the Institute of Cardiology, Kaunas University of Medicine, Sukileliu Ave.17, Kaunas, Lithuania, February 05, 2010, 11 hours. See http://www.kmu.lt/cellculture/rengin_1.htm [www.kmu.lt]

[8] Prof. Arunas Ramanavicius and Dr. Arvydas Tamulis, Joint experimental and theoretical meeting “Synthesis and Quantum Level Investigations of Elements of Nanobiorobots and Molecular Quantum Computers”, Vilnius University, Faculty of Chemistry, at centre NANOTECHNAS, Naugarduko str. 24, February 02, 2010, 12 hours.

[7] Arvydas Tamulis, “Quantum Mechanical Interactions Between Molecules are the Origin of Emergence of Protolife and Genetic Material”, lecture in Vilnius University Institute of Theoretical Physics and Astronomy, at library hall, January 14, 2010, 11 hours.

[6] Arvydas Tamulis, “Quantum Mechanical Design of Molecular Computing Devices Controlling Photosynthesis in NanoMedicine BioRobots”, *Multiscale Modelling and Simulation in Science*, AlbaNova University Campus, Stockholm, November 23 - 27, 2009, see: <http://agenda.albanova.se/internalPage.py?pageId=257&confId=1122>

[5] A. Tamulis, M. Grigalavicius, “The origin of genetic material in minimal cells is based on quantum mechanics”, *Multiscale Modelling and Simulation in Science*, AlbaNova University Campus, Stockholm, November 2 - 13, 2009, see <http://agenda.albanova.se/conferenceDisplay.py?confId=1122>

[4] A. Tamulis, M. Grigalavicius, “Quantum mechanical origin of genetic material in minimal cells”, book of abstracts of conference Chemistry 2009, October 16, Institute of Chemistry, A, Goštauto str. 9, Vilnius, page 115.

[3] Mantas Grigalavicius, “Quantum Mechanical Investigations of Photosynthetic Enters of Artificial Cells”, Workshop on NanoBioTechnologies at Molecular and Quantum Level, Vilnius University, Faculty of Chemistry, Naugarduko str. 24, October 01, 2009.

[2] Arvydas Tamulis, “Artificial Cells – New Trend in Quantum Molecular Nano BioTechnologies”, Workshop on NanoBioTechnologies at Molecular and Quantum Level, Vilnius University, Faculty of Chemistry, Naugarduko str. 24, October 01, 2009.

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A. Tamulis student Mantas Grigalavicius completed his Magister thesis, June 2011.

We have organized Joint COST actions Workshop on NanoBioTechnologies at Molecular and Quantum Level, Vilnius University, Faculty of Chemistry, Naugarduko str. 24, October 01, 2009.

Agency for International Science and Technology Development Programmes (Lithuania) on June 04, 2009 approved A. Tamulis project for the participation in the COST CM0703 action „Systems Chemistry“, see: http://w3.cost.esf.org/index.php?id=188&action_number=CM0703

A. Tamulis student Vidmantas Feiza completed his Bachelor thesis “Quantum mechanical design of artificial cells controlled by molecular electronic's logical devices“, supervisor Arvydas Tamulis. Faculty of Natural Sciences commission evaluated these thesis by mark: ten (10), June 2009.

A. Tamulis student Mantas Grigalavicius completed his Bachelor thesis “QUANTUM MECHANICAL ARTIFICIAL CELLS FOTOSYNTHETIC CENTRES RESEARCH“, supervisor A. Tamulis. Faculty of Physics commission evaluated these thesis by mark: nine (9), June 2009.

A. Tamulis student Martynas Misevicius completed his Bachelor thesis “QUANTUM MECHANICAL INVESTIGATION OF GUANINE-CYTOSINE INTERACTIONS IN WATER ENVIROMENT“, supervisor A. Tamulis. Faculty of Natural Sciences commission evaluated these thesis by mark: eight (8), June 2009.

Publications:

List of scientific publications of Dr. A. Tamulis : 234 scientific works. The most important papers were published in journals: Lithuanian Journal of Physics, Journal of Structural Chemistry (in Russian language), Die Makromolekulare Chemie, Progress in Colloid and Polymer Science, Fullerene Science and Technology, Viva Origino (1998, 2007, 2008, 2010), Mol. Cryst. Liq. Cryst., Synthetic Metals, Inorganica Chimica Acta, Nonlinear Optics, Biotech News International, Journal of Non-linear Optics & Quantum Optics, Solid State Phenomena; in SPIE Proceedings in 1998, 2000 and 2001; in NATO ARW and ASI book series 1996 and 1999/2000/2001/2002/2003 issues; 11th chapter in Handbook of Photochemistry and Photobiology", Vol. 3 "Supramolecular Photochemistry, 2003; Proceedings of the XIIth Rencontres de Blois "Frontiers of Life" (2003), Structural Chemistry (2003, 2004), J. of Nonlinear Optics (2003), Solid State Phenomena (2004), Nonlinear Analysis: Modelling and Control (2004), Fullerenes, Nanotubes and Carbon Nanostructures (2005), Journal of Nanoscience and Nanotechnology, vol. 6, 965-973 (2006), Origins of Life and Evolution of Biospheres (2007, 2011, 2013), Journal of Computational and Theoretical Nanoscience (2008, 2010, 2011, 2012, 2013, 2014), Chemical Physics Letters (2007), NeuroQuantology (2008), Central European Journal of Physics (2011).

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