

Science and Technology for A Sustainable Human Development

Claudio Nicolini^{1-4*} and Eugenia Pechkova^{5,6}

¹Foreign Member of the Russian Academy of Sciences, Moscow and Lomonosov Moscow State University, Russian Federation

²President Fondazione ELBA Nicolini, Pradalunga, Bergamo, Italy

³President and CEO, NanoWorld High Tech LLC, AZ, USA

⁴Tempe and Molecular Biosciences Professor, Arizona State University, Tempe, AZ, USA

⁵Assistant Professor Biochemistry, Head Laboratory Biophysics and Nanobiotechnology, DIMES, University of Genova, Italy

⁶Fondazione ELBA Nicolini, Pradalunga, Bergamo, Italy

*Correspondence to:

Prof. Claudio Nicolini
President Fondazione ELBA Nicolini,
Pradalunga, Bergamo, Italy
E-mail: clannicolini@gmail.com

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Abstract

At the end of the NanoWorld Conference in San Francisco 25 April 2018 it was decided to formalize the move of the NanoWorld Journal Headquarter from Texas (USA) at United Scientific Group to Bergamo (Europe) at Fondazione ELBA Nicolini, moving also to Paris the Nano World Conferences from March 4-6 2019, previously in San Francisco and Boston.

Keywords

Langmuir-Blodgett, Grazing incident small angle X-ray scattering (GISAXS), CryoEM, Atomic Force Microscopy, Penniciline G Acylase

Proteins Multilayered Langmuir-Blodgett and Nanobiotechnology

Invited by the President Segeev of the Russian Academy Sciences, in official partnership with the Russian Peace Foundation and UNESCO in Moscow for the 10th Anniversary International Forum on “Science for a sustainable human development” held on 26 and 27, November 2018 at the Ritz-Carlton Hotel. With the new generation of Synchrotrons Diffraction of Multilayered Langmuir-Blodgett Penniciline G Acylase film after Heating and Cooling, based on Langmuir Blodgett technology, in combination to laser microfragmentation, of *In situ* MicroGISAXS along with CryoEM and Atomic Force Microscopy, all shown in figures 1-6 [1-11].

As a results of the above experimentations at the nanobioscale (Figures 1-6) previously reported [1-11], we achieved a great progress in the area of X-ray protein crystallography for Cancer Research. The Langmuir-Blodgett (LB) nanotemplate method, which became applicable in recent times to any protein, including membrane proteins as large protein as Penniciline G Acylase [11], allows highly ordered 2D LB thin protein films formation on the air-water interface and their deposition on the any solid supports, including nano-patterned chip surfaces. These templates can be applied as a 2D template for triggering of 3D protein crystals, including direct “on chip” protein crystals preparation. The specific properties of LB protein thin films were quite significant (long range order, thermal stability, ability of trigger protein crystallization including those non-crystallizable by classical methods).

The structural information about the reorganization in the LB film during

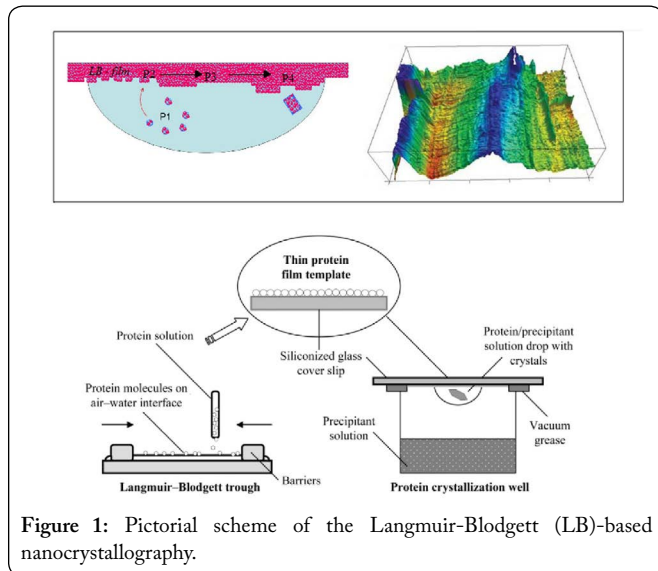


Figure 1: Pictorial scheme of the Langmuir-Blodgett (LB)-based nanocrystallography.

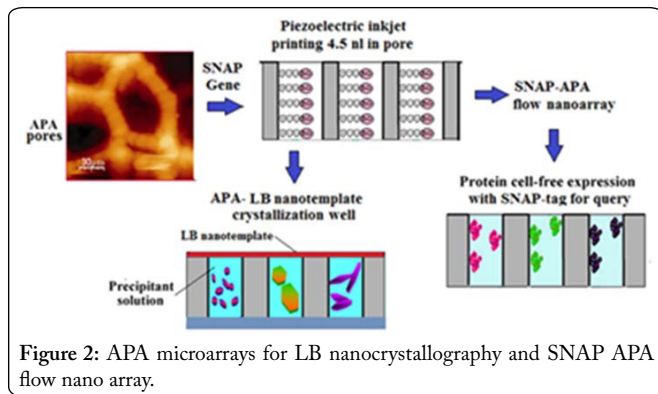


Figure 2: APA microarrays for LB nanocrystallography and SNAP APA flow nano array.

crystallization process on the nano level can be obtained by *in situ* sub-micron Grazing Incident Small Angle X-ray Scattering (GISAXS) measured directly on the interface of the LB films and protein solution in real time. Multilayer and on-chip 3D structure determination approach is needed in order to avoid any screening procedure. With the new generation of synchrotrons and microfocussed beam lines a great progress is achieved in the area of X-ray protein crystallography, even if the production of the protein crystals as well as their quality remain open problems. Novel methods of macromolecule organization into the diffracting arrays (Langmuir Blodgett, 2D crystals, etc.) come to the forefront. The LB nanotemplate method, applicable to any protein (including membrane proteins) allows highly ordered 2D LB thin protein films formation on the air-water interface and their deposition on the any solid supports, including nano-patterned chip surfaces. These templates can be applied as a 2D template for triggering of 3D protein crystals, including direct “on chip” protein crystals preparation, the specific properties of LB protein thin films (long range order, thermal stability, ability of trigger protein crystallization including those non-crystallizable by classical methods). The structural information about the reorganization in the LB film during crystallization process on the nanolevel can be obtained by *in situ* sub-micron GISAXS measured directly on the interface of the LB films and protein solution in real time multilayer

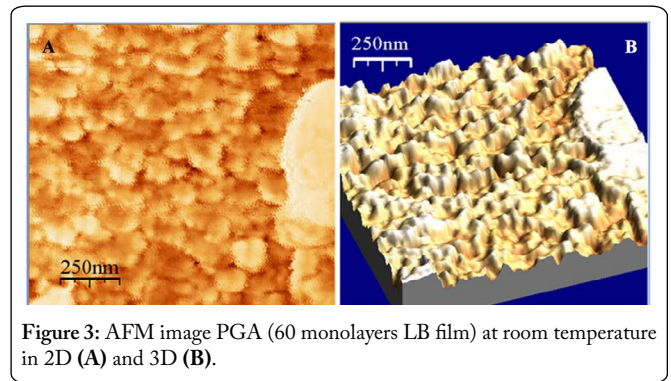


Figure 3: AFM image PGA (60 monolayers LB film) at room temperature in 2D (A) and 3D (B).

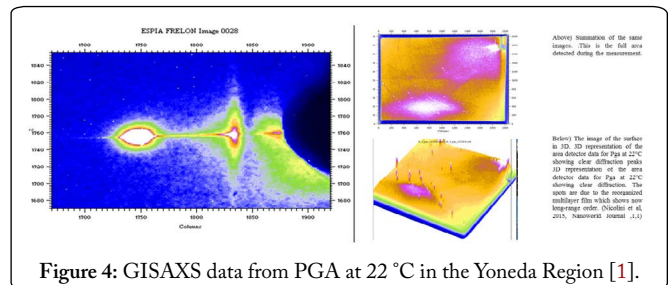


Figure 4: GISAXS data from PGA at 22 °C in the Yoneda Region [1].

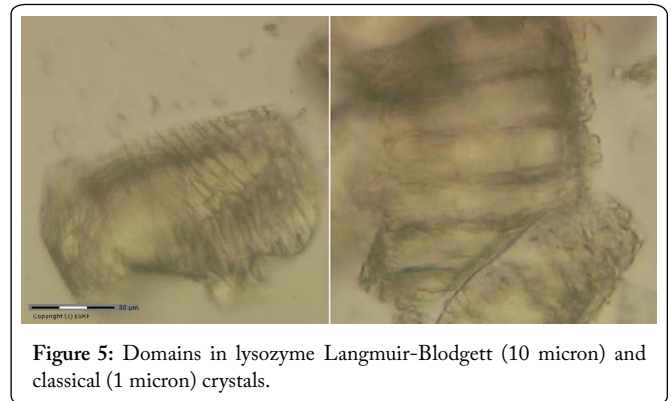


Figure 5: Domains in lysozyme Langmuir-Blodgett (10 micron) and classical (1 micron) crystals.

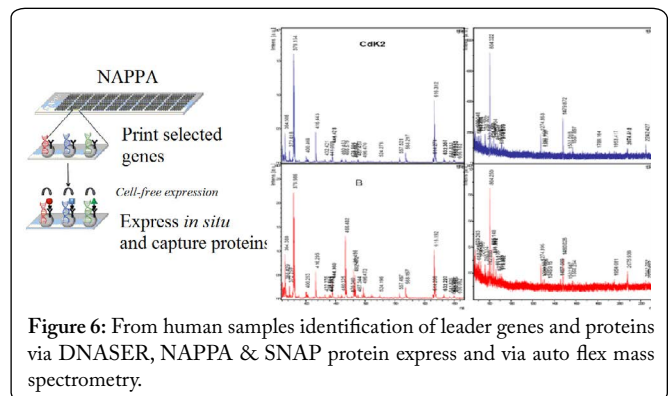


Figure 6: From human samples identification of leader genes and proteins via DNASER, NAPPA & SNAP protein express and via auto flex mass spectrometry.

and on-chip 3D structure determination approach is needed in order to avoid any screening procedure. X-FEL, Synchrotron Diffraction and Cryo-EM of Protein Multilayered Langmuir Blodgett after heating and cooling will provide the future methods for development bypassing the bottleneck of protein crystallization leaving still unsolved large part of important proteins providing the needed significant progress also in the area of Nanobiotechnology for Energy, Environment and Electronics [12].

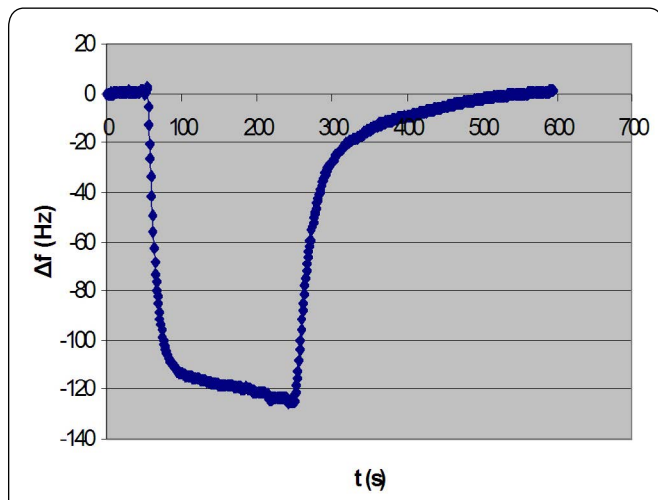


Figure 7: Determination of environmental CO₂ accumulation takes advantages of the properties of CaO to be carbonated by this gas according to the following equation: $\text{CaO} + \text{CO}_2 \leftrightarrow \text{CaCO}_3$. The variation of mass connected to the carbonation process assess the quantity of gas absorbed by a fixed and known amount of composite in relation to the concentration of environmental CO₂. Determination of environmental CO₂ accumulation: while long-term based on calcium oxide with plastic cells showed a linear absorption coherently with the human activity of the sampling period, short-term is based on variation of frequency in relation to the quantity of CO₂ absorbed by the nanocomposites.



Figure 8: Hubble telescope in orbit.

From Nuclear and Strategic Disarmament to Joint Worldwide Research and Development for Humanity Survival

In the second part of this manuscript the concern being

growing for energy, electronics, space and environment (Figures 7-13) [12-16]. Molecular bioelectronics in the 19 years of progress [14] gave a significant contribution to energy and industrial development as Nanocomposites (Figure 7).



Claudio Nicolini illustrate to Nobel Prize Roberts Rich the Asteroids threat during a coffee break at the Science Technology Society Forum in Kyoto on October 4 2015 where they were invited by past Science and Finance Minister

Figure 9: Forum at Kyoto on October 4, 2016.

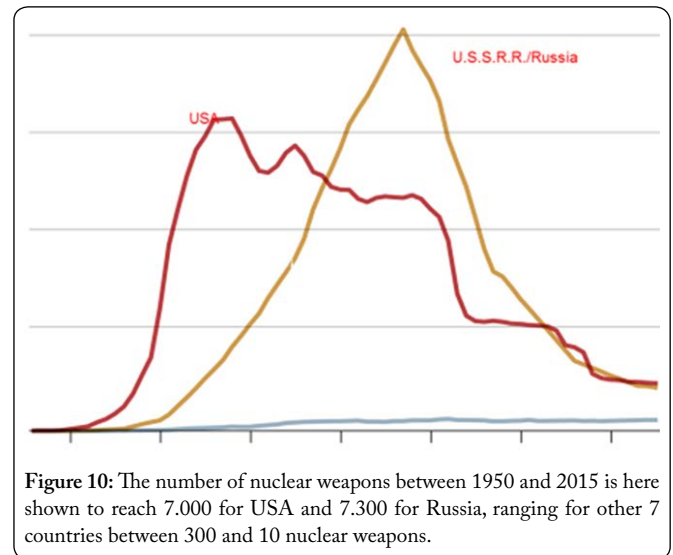


Figure 10: The number of nuclear weapons between 1950 and 2015 is here shown to reach 7.000 for USA and 7.300 for Russia, ranging for other 7 countries between 300 and 10 nuclear weapons.

However, the production of most protein crystals as well as their quality remain open problems. Novel methods of macromolecule organization into the diffracting arrays (nano crystals, 2D crystals, etc.) come to the forefront with related implications derived from nuclear energy development and acquisition in all aspects of human relationship starting from the last world war dramatic events using Uranium and Thorium. The significant Thorium advantages over Uranium were recently stressed by myself [15], like fuel cycle thorium 232 transformed in Uranium 233 (fission fuel), great abundances, superior physical and nuclear fuel properties, reduced nuclear waste production, self-sustained fuel with reutilized byproduct, lack of weapons production with meltdown impossible.

One of the most practical outfacing for thorium is that cannot be transformed in bombs, and this for Thorium based nuclear reactors was utilized as an excuse to close the initiative in 1973 very near to success after the assassinations years

before of open supporters as President JFK Kennedy in 1963 and of his brother Bob few years later close to be also elected USA President as well. Interest indeed was reborn only from 2013 with new startup companies and conferences aiming to thorium independent safe nuclear energy. Endorsement for Thorium based nuclear reactor was emerging also in Russia and Europe among emerging liberal leaders (Figure 12) during joint meetings in Moscow late June 2012.



Figure 11: Belfer Center for Science and International Affairs at Harvard Kennedy School, USA and Russian Research Center at “Kurchatov Institute” Russian Federation, both promoting safe, secure, and peaceful growth of nuclear energy, met in April 2010 with Obama & Medvedev at the presence of Nazarbayev of Kazakhstan.



Figure 12: Images of a meeting in Moscow of the European socialist party with Russian liberal and socialists parties to which attended also Claudio Nicolini (second at the left above) and Boris Nemtsov (while speaking at the right below) in late June 2012.



Figure 13: Eugene Garfield.

Oil fuels the modern world, but oil is a finite resource. The critical question is however now “When is or was the date of the maximum daily amount of world oil production—the peak?” After that oil is going to become an irreversibly declining resource facing an increasing demand which will not be met. The world passed its peak of rate of oil discoveries in the 1960s, and it seems that the peak of world oil production will then be reached by 2020, and possibly within the next decade with dramatic consequences for humanity standard of leaving.

In the figure above is shown the American businessman founder of bibliometrics and scientometrics who helped to create Current Contents, Science Citation Index (SCI), Journal Citation Reports, and Index Chemicus, among others, and founded the magazine *The Scientist*. Claudio Nicolini knew about him since covering in the same Philadelphia town from 1975 the Temple University Medical School Chair of Biophysics at Philadelphia in USA until 1985 when returned from USA to Italy where was called as eminent scientist to Genova University Medical School. Recently academician Claudio Nicolini was called in 2008 at the Russian Academy of Sciences as Foreign Member with an unanimous vote, in 2010 Honoris Causa to the Chair of Biophysics and Nanobiotechnology of Lomonosov Moscow State University, while on November 26, 2018 to the International Forum for Science and Piece in Moscow organized by UNESCO and the Russian Academy of Science upon the invitation of the new President of Russian Academy of Science Professor Sergeev attached below to this paper (APS). It is indeed our opinion [16] that scientists competing for career progression and grant awards should be ranked by the number and impact factor of their SCI publications falling into the 10 out of 10 deciles.

Acknowledgement

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