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CONFERENCE REPORT: NATO PROGRAMME SECURITY THROUGH SCIENCE ADVANCED RESEARCH WORKSHOP

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NATO PROGRAMME SECURITY THROUGH SCIENCE ADVANCED RESEARCH WORKSHOP. Environmental and Biological Risks of Nanobiotechnology, Nanobionics and Hybrid Organic-Silicon Nanodevices (Silicon vs Carbon); June, 18 - 20 2008, Saint-Petersburg, Russia (The workshop was organized and supported by the NATO Diplomacy Division Collaborative Programmes Section; the workshop was also supported by the Office of Naval Research Global and the Office of Naval Research, USA).

NATO ARW in St. Petersburg was a unique opportunity for intellectual interaction for the representatives of different fields of study, which unfortunately is not common in contemporary highly-specialized scientific milieu. While it is well-known that many of technological problems that humanity is currently facing can be addressed only by multifaceted approaches, such study groups are created ad hoc and rarely exist on the permanent basis. Thus, the meeting in question was a welcome exception to the rule.

The main task for the participants of NATO ARW in St. Petersburg was to consider the fundamental multi-disciplinary problems of Nanotechnologies in their totality. In the near future these technologies are likely to become a mainstay of industrial and subsequent economic progress. Nanotechnologies are principally defined by the scale of the phenomena and associated processes. The whole history of industrial development can be viewed as non-stop miniaturization. The processes of smaller and yet smaller scale were originally dissected in the research laboratories and then gradually became a part of contemporary industry. Currently, the time has come to understand the nanoscale processes and to make them a technological and industrial routine.

At the same time, whenever an industrial revolution is pending (Nanotechnologies indeed have a very good chance to be the conduit of such a revolution), it is important to try to analyze its consequences, i.e. at least to try to foresee both likely benefits and risks for the society. It will be wrong to dissociate the possible social impact of nano-technological revolution from "purely" technical issues and factors. Moreover, it would be outright dangerous to separate the biological, medical and likewise "natural" risks that un-thoughtful applications of Nanotechnologies potentially entail from their social consequences, even if the affected population group is relatively small.

As it was already mentioned, in accordance with the multidisciplinary manner in which the goals were posed at the meeting, the experts that took part in ARW represented different disciplines and fields of study. Quantum chemists, material scientists and solid state physicists shared podium with social scientists studying the impact of technological revolutions on civilizations, ecologists and biologists. This has permitted an extremely fluid and engaging discussion of many nanotechnology-related subjects.

Another aspect of discussions at ARW, at the same time technical and philosophical, was the comparison of industry based on inorganic solid state materials and silicon in the first place, e.g., electronic schemes, processors, etc., with the possible future industrial shift to application of organic carbon based materials. It seems that this is where the Nanotechnologies lead us. Industry created by humans utilizes silicon for many applications, but in vivo many of similar applications are based on the utilization of carbon-based polymers. Thus, the physics used by nature is very different. Should we then envision in the near future the strategic transition from silicon-based electronics, the mainstay of current high-tech industry, to the carbon based principles and devices? Several scientists addressed this issue at the meeting, but at the moment it would be premature to try to come with definitive answers. Still, the question has been posed.

Finally, the third fundamental issue discussed at ARW was the role that Nanotechnologies may play in the nearest future to enable the transition to an environmentally friendly, at the same time an intensive industrial society (notably, some of talks addressed the inherent risks of societies that has "chosen" an extensive development). It seems rather obvious that such a transition eventually must take place in order to avoid the looming ecological disasters. Natural regulatory mechanisms function on molecular (i.e., on nano-scale) level implemented through enzymatic processes, which are so effective that they utilize virtually every molecule. Conversely, man-made industrial technologies are rather wholesome, global, macroscopic, with no or little microscopic control and regulation. Although, it may not sound like a fair comparison, there is a manifest difference in the efficiency between combustion engine or muscle cells. Therefore, should we at least think about transition to a new generation of technologies with regulatory controls on a nano-molecular level? If such controls are indeed technologically possible, will this present us with a general approach to reduce risks? All of these fundamental issues were discussed and analyzed by the participants at ARW.

Additionally, over 20 observers (ranked from graduate students to professors and department chairs) had the opportunity to demonstrate their results and discuss the topics of the ARW agenda during the poster sessions, one-on-one conversations, group discussions and round tables. At least several of these St. Petersburg-based

researchers in different areas of nanotechnologies have established international professional contacts with ARW speakers and participants and are currently involved in the creation of working groups within the scope of the workshop agenda.

Presentations were focused, among others, on the environmental friendly nanotechnologies, the approaches to creation of the general theory of nano-processes and their risk assessment, nano-processes, their prospects and risks, nano-media - the next generation of television and computer displays, utilization of synthetic and virus-like particles for vaccine delivery, polymer-based gene delivery for gene therapy and novel vaccine development and substantiation of International Nano-materials Security Group (NMSG) creation. Each session was followed by the round table and the breadth of their topics did not even once compromise the quality of discussion.

One has to desire that ARW workshop on Nanotechnology-related problems will not be an isolated event and that, moreover, collaborations incepted at this meeting will bear fruit, both scientific and societal.