Bionanotechnology and Iran

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The paper will explore the international security connections of Iran's bionanotechnology research and development programs, infrastructure, and capabilities emphasizing the biomedical engineering applications. The work seeks to develop models of strategic interaction to assess the prospective implications of the nanotechnology revolution for international conflict and cooperation. Pathways and indicators of bio-nanotechnology research and development, which focuses on the distribution of opportunities and potential to pursue (intent) offensive versus defensive applications will be investigated. This research will integrate traditional social science comparative case study and scenario methodologies with semi-quantitative network analysis and technical security studies analysis. Technically robust scenarios will be used to illustrate the potential malfeasant cooption of nanotechnology. Models to identify and delineate technical and non-technical factors (e.g., structural conditions, norms, institutional capabilities) related to bio-nanotechnology will be explored. How bio-nanotechnology, as a representative emerging technology, reconciles with or challenges the predominant theories explaining the role of technology in defense strategy and current models of state-based WMD proliferation, e.g., balance of power/balance of threat, offense-defense, strategic security, deterrence, and constructivist theories, will also be examined. Inter-disciplinary research and analysis will provide novel systematic insight into the dimensions and significance of nanotechnology for changing the character of conflict and strategic stability in the global system.

Among the highest priorities for the United States is preventing the acquisition and use of advanced chemical and biological agents by hostile states, sub-state actors, or terrorists. At the onset of the 21st Century, this has emerged as a national and international priority for today and also important for a wider range of future challenges.[3] Understanding and anticipating the types of threats that may emerge as science and technology advance; the potential consequences of those threats; and the motivation for enemies to seek, to intentionally pursue proliferation, and to obtain unconventional weapons is necessary for preparing for the future security of the nation and allies.

While in the second half of the 20th Century, biology was a leading driver of technology, nanotechnology is emerging as the major science and technology focus of the 21st Century. Proponents assert that nanotechnology will revolutionize life as we know it; others have argued that nanotechnology will yield doomsday scenarios and military applications of nanotechnology have even greater potential than nuclear weapons to radically change the balance of power.[4]

Today, all developed nations are vigorously pursuing nanotechnology developments with well-funded programs in the United States, China, Russia, Brazil, Iran, Israel, Taiwan, India, Japan, and all of Europe. The global nature of this research means that much of the nanotechnology advancement recently achieved, and that projected for the future, will likely be available to friends and foes.

Given the advances in and the ubiquitous nature of nanotechnology and biotechnology, understanding potential proliferation challenges and threats that states, sub-state actors, or non-state actors may wield through application of these and emerging analogous technologies is critical. Understanding analytically the social, political, economic, institutional, and motivational factors that contribute to pursuit of benevolent versus malevolent use of new technology is a national security concern and may aid in countermeasure development for emerging threats.

This project will contribute to the development of a theoretical framework to assess motivation to pursue offensive versus defensive (or civilian) applications of bionanotechnology. Technically robust scenarios may illustrate the potential malfeasant cooption of nanotechnology. Scenario analysis is useful for defense planning and resource allocation,[5] with the goal to enable assessment of motivation, early detection, and possible interdiction before threats become imminent, to defeat threats at a distance, and to mitigate consequences of such an attack. Presenting scenarios in any area with risks for application to weapons must be approached with great sensitivity and consideration. Foremost, scenarios must be grounded in observed scientific results. It is also important to maintain an appropriate level in discussions of scenarios by excluding details needed to turn a concept into an operation.

A critical component of this is an effort to discriminate among those research and development pathways that are purely benign or defensive and those that are offensive, as well as considering those pathways that are ambiguous, e.g., encapsulation of physiologically active materials at the nanoscale. A method to provide measure (confidence level/error) of the ambiguity of pathways will be included. This project builds directly upon unique prior nanotechnology countermeasures development, threat assessments, and laboratory experience of the Principal Investigator.[6]

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[3] The US National Security Strategy *(*http://www.whitehouse.gov/nsc/nss.html*), the National Strategy to Combat Weapons of Mass Destruction*, (http://www.whitehouse.gov/nsc/nss5.html), and the *Quadrennial Defense Review (QDR) Report*, February 2006.

[4] DE Jeremiah, "Nanotechnology and Global Security," (Palo Alto, CA; Fourth Foresight Conference on Molecular Nanotechnology), 9 November 1995.

[5] Peter Schwartz, The Art of the Long View: Planning for the Future in an Uncertain World 1996, (Currency Press); Herman Kahn, *On Thermonuclear War* (1960) RAND; and *Global Trends 2015: A Dialogue About the Future With Nongovernment Experts*, December 2000 (Government Printing Office 041-015-00211-2).

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