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BIOGRAPHY

Christopher L. Barrett has developed successful, wide-ranging interdisciplinary scientific programs in simulation science of complex systems over a research career that spans the military, national labs, and universities.

In the 1980s, he was on the frontier of developing what is known today as *transdisciplinary team science*, a novel scientific approach to solving complex problems that Barrett thought about while studying at Cal Tech, and began to think about in earnest as a freshly minted Ph.D. and Aviation Systems Research Scientist in the U.S. Navy. His pioneer thinking was predicated in the belief that to address complex problems one must approach these challenges with teams, and the teams needed to have a broad range of skills and represent a crosscut of disciplines. Barrett tested this unexplored concept early in his career, and was successful in creating sustained and committed teams to push significant and urgent research forward.

A theme ever present throughout the decades is Barrett's emphasis on high-performance computing (HPC) and intelligent systems as a way to augment the human work being done, allowing work to get done faster and with greater accuracy. The combination of HPC and team science permitted researchers to broaden their focus, be more agile, and arrive at solutions more quickly. These abilities seeded the future for innovative discoveries such as creating a foundation for simulation science rooted in pure mathematics, called sequential dynamical systems.

To realize his scientific vision, Barrett blended both conventional and unconventional ideas, to create interdisciplinary research teams, groups, laboratories, institutes and programs that have grown from eight people in 1987 to hundreds during the last decade. These unique research organizations have been built successfully inside traditional institutions. The purpose is to create an organization capable of achieving academic, yet practical contributions, to very large-scale science. These are solutions for which the traditional institutional structures might interfere in their usual form; however, Barrett's research organization model is capable of leveraging mutual benefits.

The historical succession of novel organizations that Barrett founded and built has had lasting impact. It is not surprising that there have been extensive teaming and collaboration arrangements over the years with funded program lines representing significant investment from a wide range of sponsors, of which many have continued for over a decade.

In the mid 1970s, Barrett served as an officer in the U.S. Navy Submarine Force where he developed a deep appreciation for the extension of human intelligence with advanced, task integrated, computation. Returning to graduate school to pursue these ideas, he received a Master of Science and Ph.D. from Caltech in an early interdisciplinary program that brought together multiple fields. These included information science, physics of computation-system biology, and bioinformation systems. He specialized in a wide-ranging computational theory of the mind program that combines neural, visual, and immune systems with other adaptive and nonlinear phenomena.

After graduation, he again served in the U.S. Navy for a short, but transformative period. The conceptual origins of the current Institute were derived from his graduate work at Caltech and in research with the U.S. Navy that brought together his computational and information science view of neural systems applied to an AI and human aircrew integration project to manage crew workload. This *Knowledgeable Observation Analysis-Linked Advisory System* provided automated reasoning and sensor-coupled multi-sensor data fusion. That work at the Naval Air Development Center provided design concepts for automated autonomy in air combat platforms.

Moving to the Los Alamos National Laboratory Analysis Division, Barrett established a Simulation Science Group which embarked on a large, decade-long national scale multi-modal transportation and environment modeling science and technology research program, called *TRANSIMS.* Subsequently, the team moved to the Computing and Computational Science Division to conduct research in mobile packet communication systems and projects. These projects were informed by problems in computational social epidemiology for national security sponsors. Building on this work, in 2002, Barrett's team undertook research for the NIH, and began the NIH/MIDAS EpiSims program.

A critical output of the cumulation of this sponsor-driven applied research was the establishment and formal mathematical theory program in dynamical networks. To advance this research, in late 2004, Barrett made a strategic decision to move the laboratory to academia, and established the Network Dynamic Simulation Lab at the Virginia Bioinformatics Institute of Virginia Tech. He would later be named the Scientific Director, and then Director, after which time the institute was renamed the Biocomplexity Institute.

In 2018, the University of Virginia invited Barrett and his team to establish the Biocomplexity Institute and Initiative at the University of Virginia. Barrett was named Executive Director.

From his time at Virgina Tech to present day, Barrett has led and driven cutting-edge research and routinely delivered functional applied demonstrations of advanced analytics to the Department of Defense/Defense Threat Reduction Agency. One such program is the Scalable Analytics for Decision Support (SADS), formerly called Comprehensive National Incident Management System (CNIMS). In 2020, under Barrett's strategic guidance and leadership, the Institute pivoted it's efforts from SADS to focus on intensive epidemiological analysis for decision makers to support and prioritize the DTRA Technical Reachback (COVID19) Surge Support project.

In his leadership role at the UVA Biocomplexity Institute, Barrett continues to be an innovator, an unconventional thinker, and a thought leader and mentor to fellow scientists at all career levels.

RESEARCH INTERESTS

- Large multi-scale, high-performance modeling and simulation systems grounded in computational and information sciences spanning mathematical, biological, psychological and social sciences
- Dynamical Networks called Sequential/Graphical systems grounded in topics ranging from RNA to social dynamics and policy
- Theoretical and applied research in intelligent systems
- Translational research-to-application analytics and machine intelligence