CONVERSATIONS WITH SCIENTISTS

Alexander L. Yarin: Investigating Fluid Mechanics

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University of Illinois Chicago (UIC)

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Alexander L. Yarin is a distinguished professor in the Department of Mechanical and Industrial Engineering at the University of Illinois Chicago (UCI). Born in 1953 in the former Soviet Union, Yarin earned a master's degree in mechanical engineering from the Polytechnic Institute of Leningrad in 1977. He completed a Ph.D. in physico-mathematical sciences at the USSR Academy of Sciences' Institute for Problems in Mechanics in Moscow in 1980, followed by a habilitation in physico-mathematical sciences from the same institution nine years later. During his time in Moscow, he also worked as a research associate and lecturer at the academy. Relocating to Israel in 1990, Yarin joined the faculty of mechanical engineering at Technion in Haifa, assuming the Eduard Pestel Chair in 1999. In 2006, after 25 years at Technion, Yarin moved to the U.S., accepting a faculty post at UIC.

Yarin is the recipient of numerous awards and honors, including the 2005 Hershel Rich Prize. In 2016, he was elected to the American Physical Society. A prolific writer, Yarin has published more than 400 peer reviewed journal articles and conference papers, authored 5 books and a dozen book chapters, and holds 11 patents. He has participated in hundreds of invited talks, international congresses, and professional reports and has served as a reviewer and referee for research publications, private foundations, and government associated institutions. Over his four-decade career, Yarin has supervised more than 60 graduate and post-graduate students and garnered several million dollars in research grants.

Yarin's research interests span a broad range of topics in fluid mechanics, focusing on areas in hydrodynamics, rheology, aerodynamics, optoelectronics, and micro-and nanofluidics.

Below are Alexander Yarin's June 9, 2021 responses to questions posed to him by Today's Science. *Some of the questions deal with how he became interested in science and began his career in fluid mechanics while others address particular issues raised by the research discussed in Point Blank: The Impact of Guns on Blood Spatter.*

Q. When did you realize you wanted to become a scientist?

A. When I've been 12 years old

Q. How did you choose your field?

A. In many cases I felt intuitively how fluids flow. Thus, fluid mechanics became my main field.

Q. Are there particular scientists, whether you know them in person or not, that you find inspiring?

A. Of those I knew in person, Ya. B. Zel'dovich was the most impressive (and famous). That was a great honor and luck for me to have contact with him (from time to time) or just to see/hear him at seminars. Princeton University published 2 volumes of his Collected Works. You can find details on him there, or online.

Q. What do you think is the biggest misconception about your profession?

A. Some people see it as a part of applied mathematics, but in reality, it's a part of applied physics; also engineering which stems from it is fascinating. That also describes my personal trajectory.

Q. Your research indicates that, in analyzing blood spatter evidence, the propellant gases from a firearm need to be taken into account. Are there any other physical phenomena that could affect this blood spatter evidence that you think may not have been sufficiently recognized in traditional approaches?

A. The confinement effect, e.g., the effect of the skull on waves of blood and brain spatter.

Q. What prompted you to investigate the issue of propellant gases and bloodsplatter evidence?

A. It was triggered by the made-for-TV film about the murder trial of music producer Phil Spector. The film showed a hydrodynamic puzzle in a very artistic way (moreover, the stars—Al Pacino and Helen Mirren—were great!).

Q. Do different guns vary substantially in how the propellant gases emerge? Is this a complication for trying to determine how the gases affect the evidence?

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Propellant gases emerge from a handgun as it is fired. Determining how these gases affect the evidence is "a reason for further, systematic research."

A. Most probably. It's not a complication, but a reason for further, systematic research.

Q. Are there any TV (or other media) shows with forensic scientists that you feel do a particularly good (or for that matter, really bad) job of showing what forensic science is like?

A. The film I mentioned above showed (among many other things) what forensic science can do and what also puzzled me.

Q. Where do you spend most of your workday? Who are the people you work with?

A. At the University of Illinois at Chicago: several hours in my office working on theory, writing proposals, etc., and several hours in my lab, discussing experiments with my Ph.D. students. I also teach and advise students.

Q. What do you find most rewarding about your job? What do you find most challenging about your job?

A. It's good to understand how things work and make something of that. Things are basically logical, ordered and 'simple' but the challenge is to understand that logics, order and simplicity.

Q. What has been the most exciting development in your field in the last 20 years? What do you think will be the most exciting development in your field in the next 20 years?

A. I'd extend to my professional life (20*2=40): strange attractors, fractals growing from fluid mechanics, non-Newtonian fluid mechanics. Regarding the next 20 years – I am not a prophet. Extrapolations typically fail. However, I hope that computers won't swallow the essence of fluid mechanics, and analytical results and ideas of great importance will still lead.

Q. How does the research in your field affect your daily life?

A. I spent most of my time on that research. I also work at home and during weekends. That's put pressure on my family members, for which I am sorry.

Q. For young people interested in pursuing a career in science, what are some helpful things to do in school? What are some helpful things to do outside of school?

A. Math, physics and chemistry are fundamental for any science, but definitely young people have many other important and funny things to do. They always know better.