

DISTINGUISHED LECTURER SERIES

*VCU
MECHANICAL ENGINEERING*

The Constructal Law of Design in Nature



*Professor Adrian Bejan
Duke University*

13 October 2008

Social Hour: 11:30-12:00 noon

Seminar: 12:00-1:00 pm

Room E2214

Engineering East Hall

ABSTRACT

Constructal theory is the view that the generation of “design” in nature is a phenomenon of all physics, which is covered by a deterministic principle (the constructal law): “For a finite-size flow system to persist in time (to live) it must evolve such that it provides greater and greater access to the currents that flow through it”. This principle is about direction in time: the tape of the animated movie of configurations runs such that existing configurations are replaced by globally easier flowing configurations.

The theory coin has two sides, both useful: the prediction of natural phenomena, and the strategic engineering of novel flow architectures that are derived from principle, in accordance with the constructal law, not by mimicking nature. The lecture will show that the emergence of scaling laws in inanimate (geophysical) flow systems is the same phenomenon as the emergence of allometric laws in animate (biological) flow systems, and that features of evolutionary “design” in nature can be predicted based on the constructal law. This theoretical unification of the phenomena of animate and inanimate flow design generation is illustrated with examples from biology (lung design, animal locomotion), the physics of fluid flow (river basins, turbulent flow structure, self-lubrication, climate) and engineering (technology evolution). The place of the constructal law in thermodynamics will be outlined. The constructal law covers several ad-hoc and often contradictory statements such as maximum entropy production, minimum entropy production, minimum resistance, maximum resistance, minimum time, minimum weight, uniform stresses, characteristic organ sizes, etc.

Bio

Adrian Bejan received all his degrees from M.I.T.: B.S. (1971, Honors Course), M.S. (1972) and Ph.D. (1975). He was a postdoctoral fellow at the University of California, Berkeley, at the Miller Institute of Basic Research in Science (1976–1978). He served on the faculty of the University of Colorado from 1978 to 1984. He was appointed as a full professor of mechanical engineering with tenure at Duke University in 1984, and J.A. Jones Distinguished Professor in 1989. Adrian Bejan pioneered numerous original methods in thermal sciences, such as entropy generation minimization, scale analysis of convection, heatlines and masslines, designed porous media, and the constructal law of design in nature. Adrian Bejan is ranked among the most-cited authors in all of engineering (all fields, all countries, living or deceased) by the Institute of Scientific Information (www.isihighlycited.com). He is the author of 23 books and 470 peer-refereed journal articles. Adrian was awarded 15 honorary doctorates by universities all over the world, for example, the Swiss Federal Institute of Technology (ETH, Zurich, 2003). He received numerous society awards, including the Max Jakob Memorial Award (ASME & AIChE, 1999), Ralph Coats Roe Award (ASEE, 2000), Luikov Medal (ICHMT, 2006), Donald Q. Kern Award (AIChE, 2008), Worcester Reed Warner Medal (ASME, 1996), and the James Harry Potter Gold Medal (ASME, 1990).



Contact:

*Mechanical Engineering
School of Engineering
Virginia Commonwealth
University*

*401 West Main St
Richmond, VA 23284-3015*

Office: 804-828-9117

Fax: 804-827-7030

