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For Immediate Release:
Nov. 18, 2011

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New Design for Mechanical Heart Valves

Baltimore, Md. – The heart's valves, which guarantee the unidirectional flow of blood from one chamber to another, are asymmetrical. For example, the two flaps of the heart's mitral valve – which regulates blood flow between the left atrium and the left ventricle – vary in size by up to 70 percent. This arrangement, says fluid mechanicist Marija Vukicevic from the University of Trieste (now a researcher at Clemson University), naturally drives blood flow along the lateral wall of the ventricle; from there, blood takes a smooth turn creating a large vortex that redirects the blood toward the aorta (the main blood vessel of the heart), through which it exits out into the body.

Mechanical heart valves, however, are symmetric in design – with both flaps of a mitral valve replacement of identical size – and that, Vukicevic and colleagues have found, disrupts the flow of blood. "Blood flow in the left ventricle is characterized by a physiological vortex that disappears when a symmetric mechanical prosthesis is implanted," she says. With such prostheses, which are implanted into an estimated 60,000 patients each year in the United States, blood flows across the ventricular chamber then hits the opposite side instead of taking a turn, leading to a higher effort in the heart muscle and a disruption in its regulatory mechanism.

To see if a more naturally asymmetric design could improve blood flow, Vukicevic, along with Gianni Pedrizzetti of the University of Trieste and colleagues created aluminum models of asymmetric valves, similar in size to the valves of an adult human heart. The valves were tested in a mock ventricle, made of silicon, through which the researchers could visualize fluid flow. The pattern and rate of flow through the valves, the researchers found, closely matched that of a healthy heart. "We recommend that industries test asymmetric prototypes for mitral valve replacement," she says.

Vukicevic will discuss the findings in a talk at the *APS Division of Fluid Dynamics Meeting*, which will take place Nov. 20-22, 2011, at the Baltimore Convention Center in the historic waterfront district of Baltimore, Maryland.

The talk, "Experimental study of asymmetric heart valve prototype," is at 3:44 p.m. on Tuesday, Nov. 22, in Room 324-325.

Abstract: http://absimage.aps.org/image/MWS_DFD11-2011-000190.pdf

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MORE MEETING INFORMATION
The 64th Annual DFD Meeting is hosted by the Johns Hopkins University, the University of Maryland, the University of Delaware and the George Washington University. Howard University and the U.S. Naval Academy are also participating in the organization of the meeting. It will be held at the Baltimore Convention Center, located in downtown Baltimore, Md. All meeting information, including directions to the Convention Center, is at:
http://www.dfd2011.jhu.edu/index.html

USEFUL LINKS
Main Meeting Web Site: *http://www.dfd2011.jhu.edu/index.html*
Search Abstracts: *http://meeting.aps.org/Meeting/DFD11/Content/2194*
Directions and Maps: *http://www.dfd2011.jhu.edu/venuemaps.html*

PRESS REGISTRATION
Credentialed full-time journalists and professional freelance journalists working on assignment for major publications or media outlets are invited to attend the conference free of charge. If you are a reporter and would like to attend, please contact Charles Blue (cblue@aip.org, 301-209-3091).

SUPPORT DESK FOR REPORTERS
A media-support desk will be located in the exhibit area. Press announcements and other news will be available in the Virtual Press Room (see below).

VIRTUAL PRESS ROOM
The APS Division of Fluid Dynamics Virtual Press Room features news releases, graphics, videos, and other information to aid in covering the meeting on site and remotely. See:
http://www.aps.org/units/dfd/pressroom/index.cfm