

Pulsatile Flow Module

Use of BioFlux system for variable shear flow

Introduction

Shear stress plays a major role in cell differentiation, metabolism, and many other cellular processes. Within the circulatory system, blood flow is pulsatile and impacts endothelial cell alignment and vascular permeability. The amount of shear stress that is applied to the vasculature is dependent upon cardiovascular dynamics, the vessel type, vessel health, and the measurement location within the vessel. Abnormal or dysregulated blood flow can contribute to inflammation, atherosclerotic plaque formation, and exercise intolerance.

It is difficult, expensive, and time-consuming to investigate the impact of pulsatile shear stress on cellular mechanisms *in vivo*. BioFlux shear flow systems are equipped with a precise and programmable Pulsatile Flow Module, which enables rapid and high-throughput *in vitro* simulation of *in vivo* vasculature, without costly animal models and surgeries.

The Pulsatile Flow Module works with the BioFlux Control Software to enable user-defined, sinusoidal pulsatile shear flow (Figure 1). Within the main BioFlux control panel, the option for pulsatile flow can be selected and shear stress amplitude and frequency can be defined. This module is fully compatible with all other BioFlux control options. In addition, shear flow on a BioFlux plate can be simultaneously split between pulsatile and laminar flow.

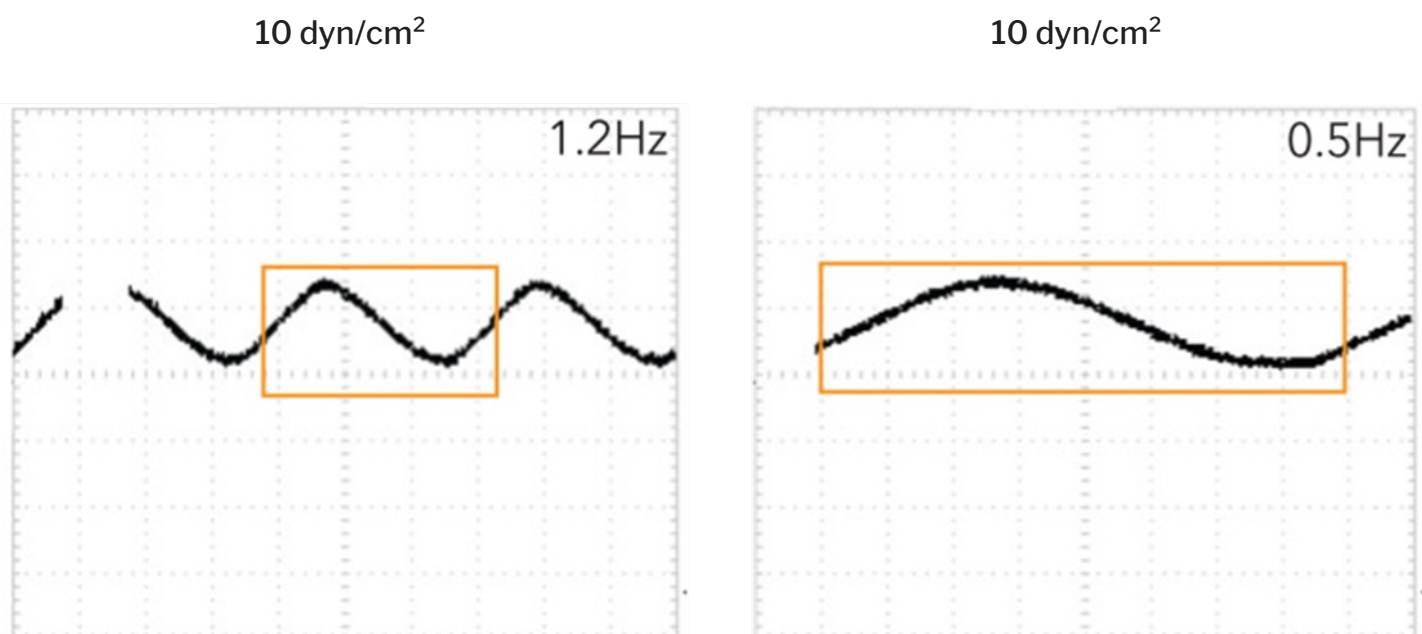


Figure 1. Pulsatile waveforms. Sample waveforms at an amplitude of 10 dyn/cm². A single pulse cycle is shown within the boxed regions.

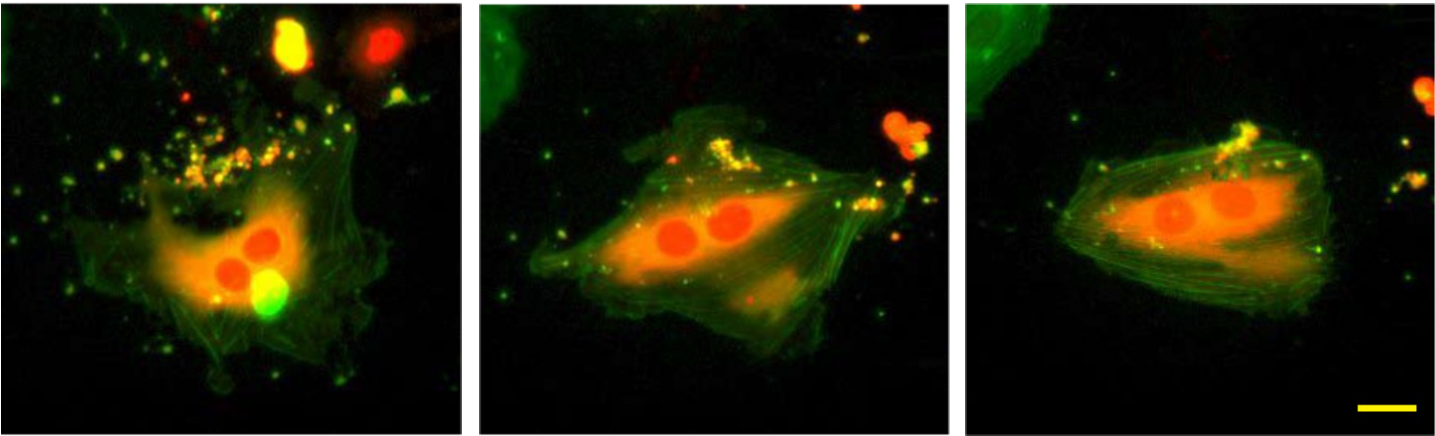


Figure 2. Endothelial cells under pulsatile flow A BioFlux was used to apply a pulsatile shear flow amplitude of 5 dyn/cm², (frequency 1.2 Hz) to endothelial cells transiently expressing actin-GFP (green) and nucleus-NLS-RFP (red). Micrographs were captured every 30 minutes during the application of shear flow. Timepoints (left to tight) 0, 8.5, and 19 hours. Scale bar is 25 μm.

Shear Control

K factor 1.000000

Columns 1-4

Fluid	Flow Mode	Max Shear (dyn/cm ²)	Frequency (Hz)	Max Shear Rate (1/s)	Max Flow (uL/hour)	Min Run Time (hrs/full well)	Pressure (psi)
Whole Blood	Pulsatile	20.00	1.20	500.00	466	2.15	6.71

Columns 5-8

Fluid	Flow Mode	Max Shear (dyn/cm ²)	Frequency (Hz)	Max Shear Rate (1/s)	Max Flow (uL/hour)	Min Run Time (hrs/full well)	Pressure (psi)
Whole Blood	Pulsatile	20.00	0.60	500.00	466	2.15	0.17

Figure 3. BioFlux Pulsatile Flow Module control panel. Select pulsatile flow mode and enter a shear amplitude and frequency. The Pulsatile Flow Module is fully compatible with existing flow protocols and methods.



Specifications

Pulsatile Flow Module	
Waveform:	Sinusoidal
BioFlux Plate Compatibility:	24-well plate (8 channels) 48-well low-shear plate (24 channels) 48-well high-shear plate (24 channels)
Shear Stress Amplitude Range:	0.1-20 dyn/cm ² (24-well plate & 48-well low-shear plate) 0.1-200 dyn/cm ² (48-well high-shear plate)
Frequency Range:	0-1.2 Hz (0-72 bpm)
System Requirements	
Operating System:	Windows XP, Windows Vista, Windows 7
Hardware:	BioFlux 200 or BioFlux 1000z
BioFlux Software Version:	Pulsatile Flow Module is embedded in BioFlux software version 2.4.0.0 and higher.
Ordering Information	
Part Number:	940-0020
Email:	sales@cellmicrosystems.com

For more information on BioFlux Technology,
visit cellmicrosystems.com/bioflux

