# PIN-TO-HOLE SPARK DISCHARGE (PHD) PLASMA FOR BIOLOGICAL AND MEDICAL APPLICATIONS

Danil Dobrynin, Gregory Fridman, Gary Friedman and Alexander Fridman
*A.J. Drexel Plasma Institute, Drexel University*
*Philadelphia, PA 19104 USA*

The number of potential applications of atmospheric pressure discharges in biology and medicine has grown significantly in recent years, causing formation of a new field of plasma physics and plasma chemistry, "Plasma Medicine". Recent studies (see, for example, [1, 2]) show that specific applications, e.g. sterilization of various surfaces including tissue sterilization, wound and burns healing, cancer treatment, etc., require careful choice of the plasma system in order to achieve desired effect. One of the advantages of thermal plasma systems is that a controllable production of *nitric oxide* (NO), a biologically important molecule which is responsible for anti-inflammatory and other effects, is possible. However, thermal nature of these types of plasmas prevents direct application to living tissues in order to avoid burns and other undesired effects. In the presented work, a special electrode configuration is used to deliver active species to the treated substrate (e.g. neutral reactive oxygen species (ROS) and reactive nitrogen species (RNS), charged particles and UV radiation).

Here we focus on the study of biologically and medically relevant effects of application of spark discharge plasma with pin-hole electrode configuration: a) sterilization of surfaces and b) liquids and c) treatment of gastroenterological disorders. The presented results of discharge characterization in terms of plasma-produced active species in the treated liquid medium provide better understanding of the observed effects.

1. G. Fridman et al., "Applied Plasma Medicine", 2008 Plasma Processes and Polymers, 5 (6), pp. 503-533.
2. D. Dobrynin et al., "Physical and biological mechanisms of direct plasma interaction with living tissue", 2009 New J. Phys. 11 115020 (26pp)

This work is supported in part by the Telemedicine and Advanced Technology Research Center (TATRC) and Drexel University Major Research Initiative (MRI) funds.