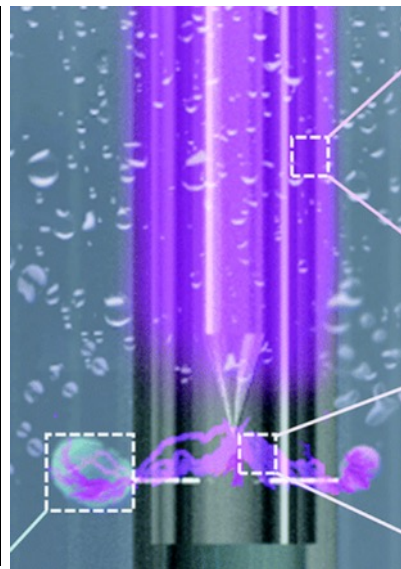


PI : I. Furno

Co-PI: A. C. Oates



SV Infrastructures



Develop a prototype device for **sterilization** and **decontamination** of solid surfaces and liquids based on a novel **plasma-based** technology

- ✓ energy efficient
- ✓ no storage of harmful chemicals
- ✓ no long-lived toxic residues
- ✓ low cost

Alternative to standard autoclaving

Reduce environmental footprint (energy/CO₂/water)

Open new fields of application

To be demonstrated by 2025 in the EPFL SV-IN facility

Sterilization/decontamination are essential in research laboratories and clinical facilities

Autoclaves are the workhorse (pressurized steam)

At EPFL 30 autoclaves in SV-IN facility

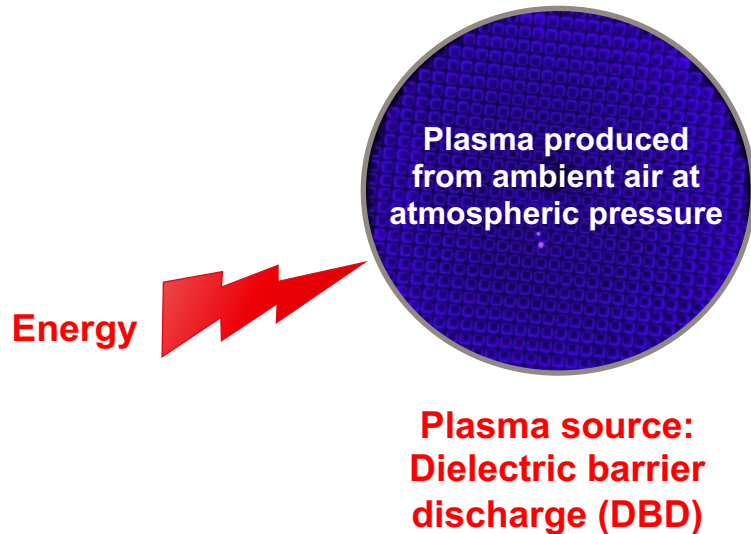


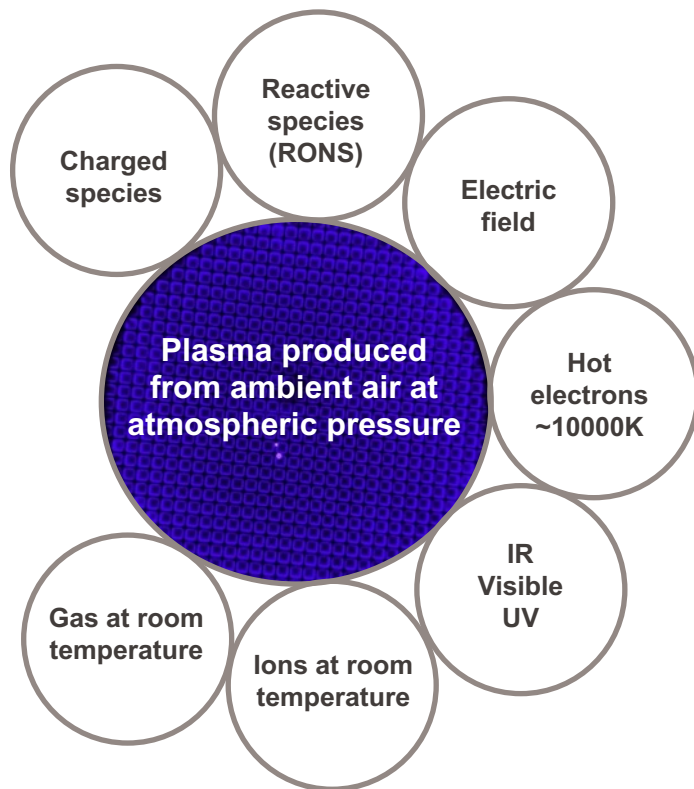
Pros

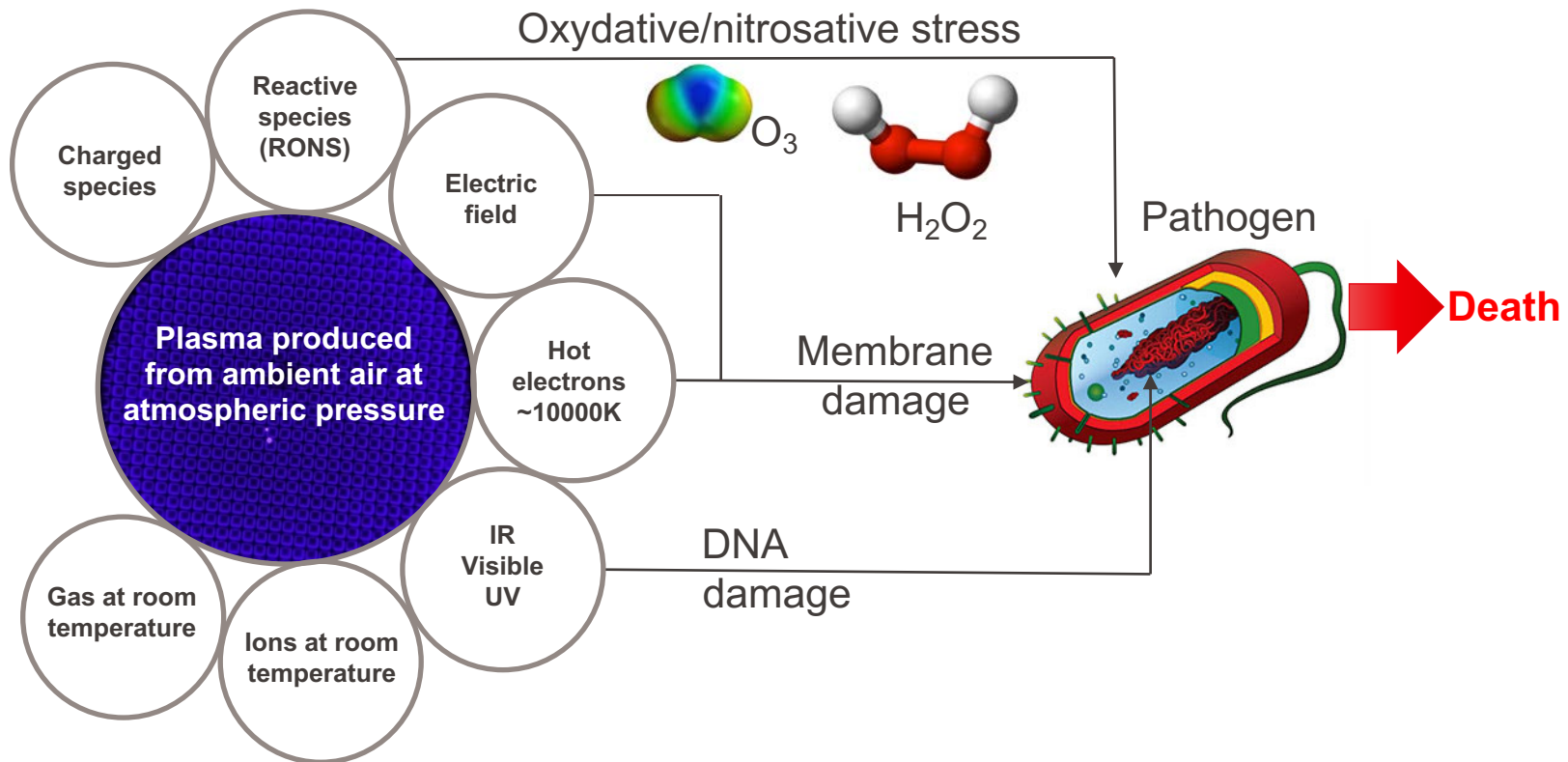
- ✓ Established industrial technology
- ✓ Fast sterilization (~1h for 6-Log reduction)

Con

- ✓ **S** Energy: 3kWh/cycle (At EPFL, 60MWh/year)
- De-ion. water: ~20 l/cycle (developing countries?)
- No heat/pressure/moisture-sensitive materials



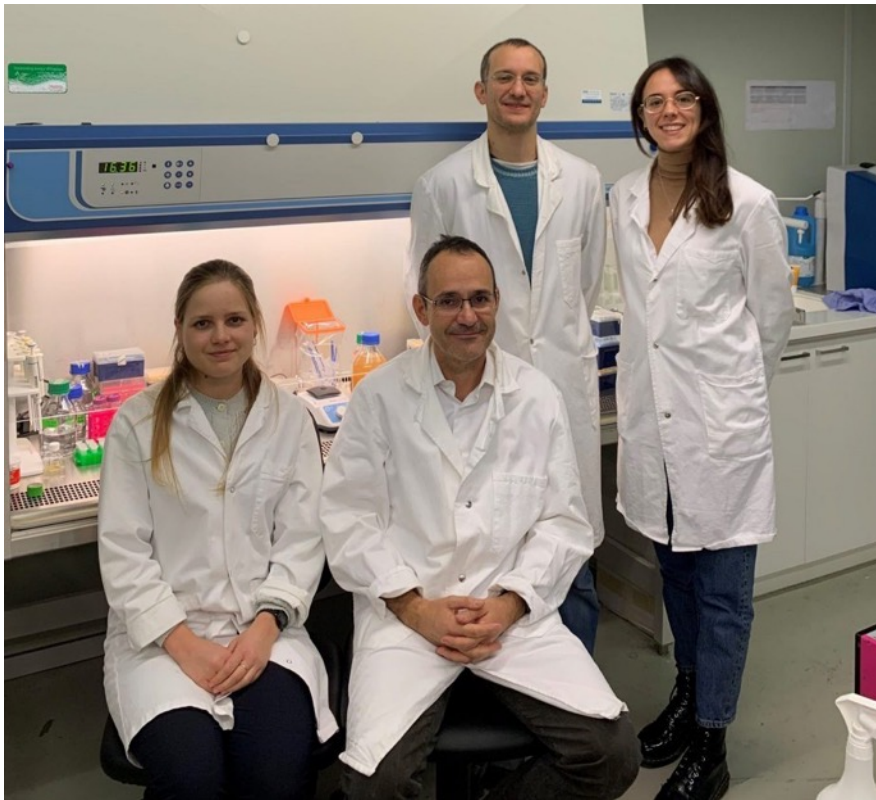




- ✓ atmospheric plasmas are a fast-sterilizing agent
- ✓ plasma produced from ambient air when needed
- ✓ energy efficient
- ✓ usable for heat/pressure/H₂O-sensitive materials
- ✓ no need for complex pumping system
- ✓ no need for harmful chemicals
- ✓ no long-lived toxic residues



... and one disadvantage: it needs development!



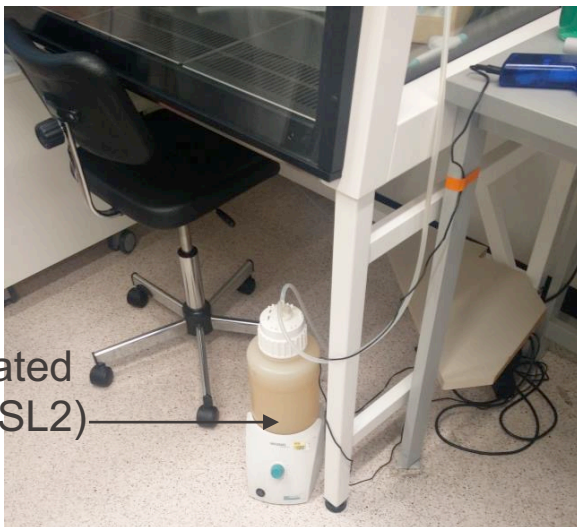
Swiss Plasma Center

Aleksandra LAVRIKOVA,
Rita AGUS, Fabio AVINO,
Ivo FURNO

Segmentation Timing and Dynamics Laboratory

Vivianne PADRUN,
Laurence WINKEL,
Andrew C. OATES

Contaminated
Liquids (BSL2)



Gram positive bacteria

Bacillus thuringiensis: UPLEM; *Micrococcus luteus*

Gram negative bacteria

E. coli: 90% de labo SV, *Pseudomonas putida*

Fungi

Neurospora crassa: milieu Agar 1,5-2% (solid)

Yeast

Saccharomyces cerevisiae: milieu YPD

Virus + cell lines to test plasma treatment efficacy

Viral vector AAV with reporter gene like *GFP* : PBS Buffer.

Cell line 293T: milieu DMEM + 10% Foetal Bovine Serum.

~~Contaminated
liquids~~



~~BSSL2~~



~~Autoclave~~



~~Inactivated
waste~~



~~Off-site
destruction~~





Gram positive bacteria

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**Collected
liquid waste**



**In-situ treatment
(no transportation)**



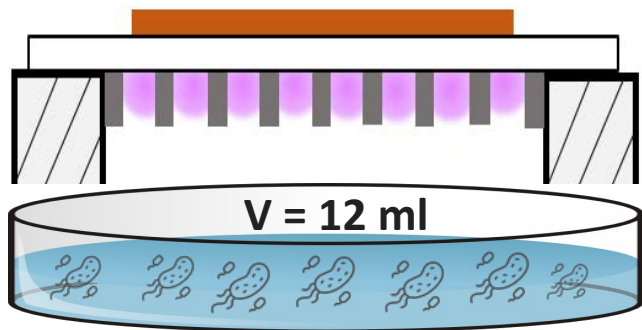
Inactivated waste



**Off-site
destruction**



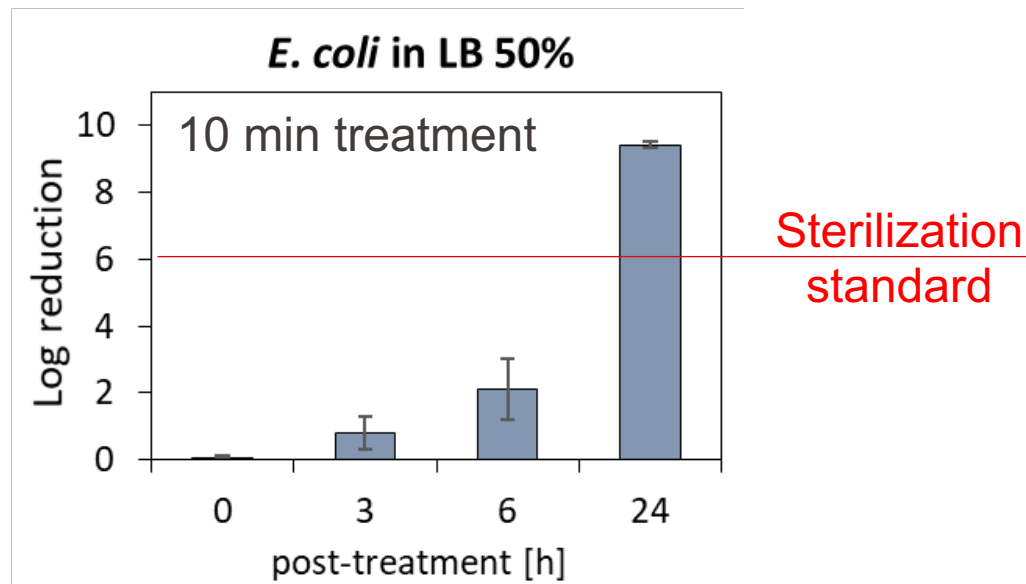
Surface Dielectric Barrier Discharge (SDBD)



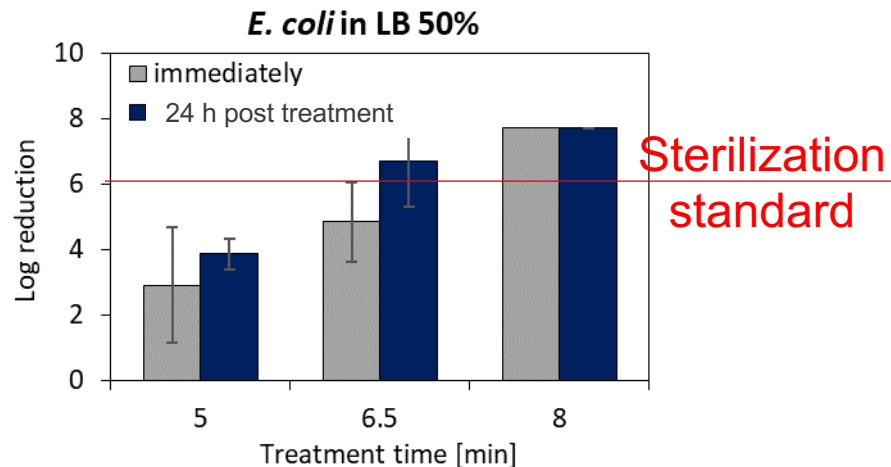
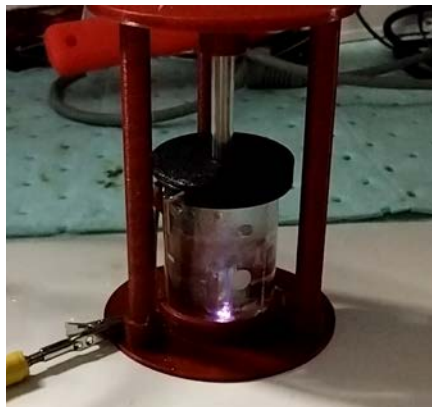
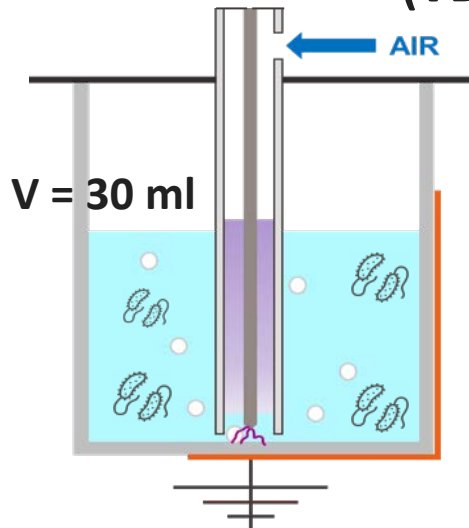
Energy consumption

Autoclave	SDBD
0.58 kWh/l	1.11 kWh/l

+ 92%



Volume Dielectric Barrier Discharge (VDBD)













Energy consumption

Autoclave	VDBD
0.58 kWh/l	0.29 kWh/l

- 50%



	SPC
	SV-IN
	Milestone

	First year				Second year			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP1		 						
		 						

Development of **different configurations**
(volume and surface DBDs)

Identification of most **effective configurations** for sterilization and decontamination

Can we develop “greener” sterilization methods?

YES!

A prototype device for sterilization and decontamination based on a novel plasma technology to be demonstrated by 2025 at EPFL

Broad impact at EPFL and outside (labs, hospitals, clinical centers,...) covering a global multi-Bn market

Attract private funding to industrialize the technology