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SWISS PLASMA
CENTER



Objectives

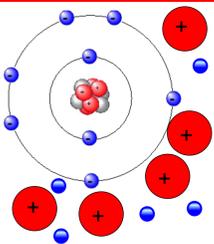
- Plasma exposure is a proven efficient means of sterilization
- Industrial application requires large area and large volume sources
- Conventional plasma sources have to be adapted for higher pressures
- Intermediate pressures (100 – 200 mbar) are advantageous for:
 - i) Higher volume than for atmospheric plasma sources
 - ii) Higher fluid dynamic forces than for low pressure (mbar) plasma



Example of a large area plasma reactor 1 m x 1 m

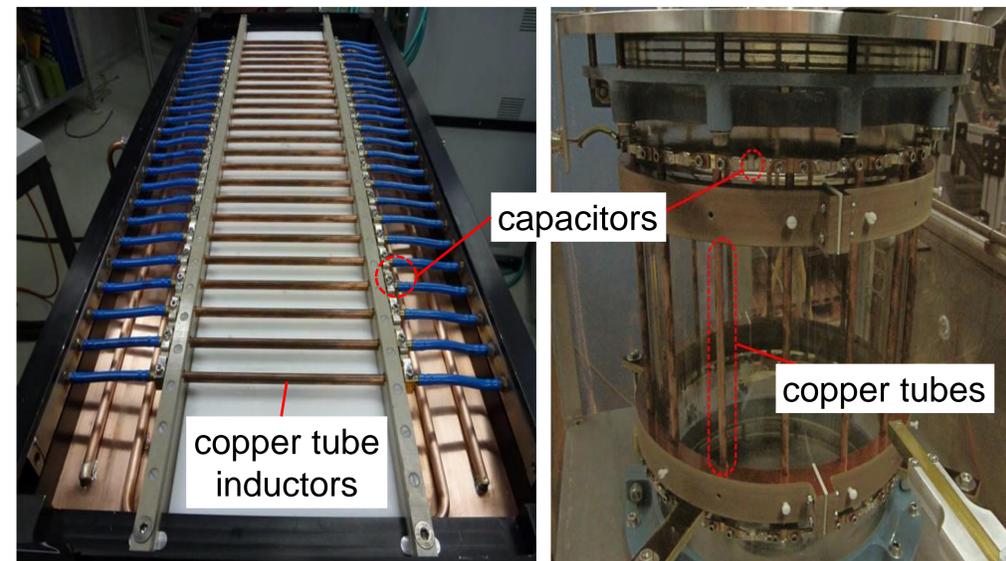
Plasma is a neutral medium

- consists of ions, electrons, neutral species (atoms, molecules)
- exhibits collective effects (waves, ...)
- interacts with electric and magnetic fields



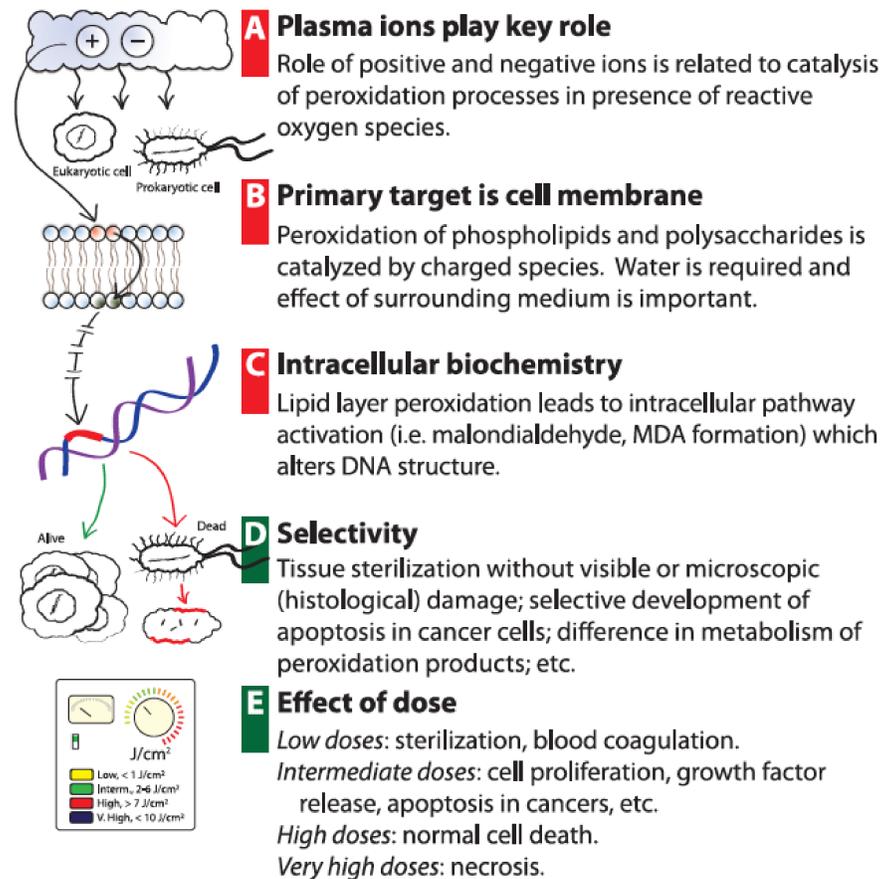
Possible effects on organisms

- reactive oxygen and nitrogen species (RONS)
- UV photons
- electric fields
- charged particles (ions, electrons)
- synergy of all four phenomena.



The planar antenna is for large area surface treatment; the cylindrical antenna is for volumetric plasma sources. The parallel legs of each antenna are made of copper tubes which act as inductances. High Q capacitors link the legs together. High currents circulate in the resonant structure which is an efficient inductively-coupled plasma source.

Plasma interaction with biological organisms



D. Dobrynin et al, New Journal of Physics **11**, 115020 (2009)

Planar RF antenna resonant networks

Prototypes of Helyssen antennas operating at 13.56 MHz have been tested up to 15 kW rf power and are currently under industrial pilot tests for barrier layer coatings in packaging, silicon thin film deposition for photovoltaic solar cells, and plasma sources for neutral beam heating. Conventional plasma sources operate at low pressures (< 10 mbar) which require long exposure times (20 minutes) for spore inactivation.

Conclusions

These results show the proof of principle of a novel generic type of plasma source. The next step is to develop the source towards higher operating pressures for rapid inactivation of spores, and integration into fluidized bed reactors for food powder manipulation and treatment.

Acknowledgments

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References

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