

## PLASMA MEDICINE: PREVENTIVE CARE AND PERSONALIZED MEDICAL TREATMENT

Artificially generated physical plasmas, so-called cold atmospheric pressure plasmas, have come into focus for use in medicine in recent years, with three basic plasma effects being the focus of research and application interest:

- (I) killing a broad spectrum of microorganisms including multi-resistant bacteria and viruses;
- (II) stimulating tissue regeneration by stimulating cell growth, cell migration and the formation of new blood vessels;
- (III) inducing processes of regulated cell death especially in cancer cells.

Plasma efficacy, based on its antimicrobial and cell-stimulating effects, has now developed into an effective therapeutic option, especially for the treatment of chronic wounds. Plasma application in cancer therapy is the subject of intensive research.

### BENEFITS

- Non-invasive, painless, physical procedure without anaesthesia
- Various physical-technical possibilities of designing plasma devices adapted to the respective application requirements
- Up to now, hardly any side effects and no formation of resistance
- No increased genotoxic and mutagenic potential
- Further R&D towards comprehensive plasma therapy systems with integrated monitoring



### COMPETENCE AREA: PLASMA MEDICINE

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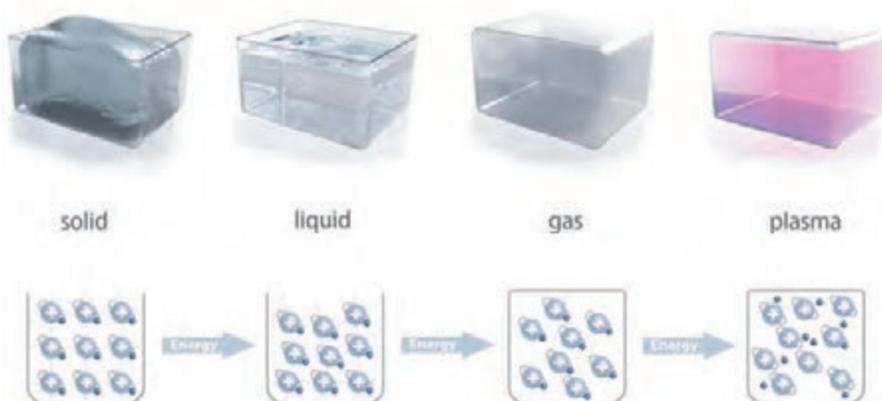


*KINPen® MED: This CE-certified atmospheric plasma jet for medical applications is produced by neoplas med GmbH*

## WHAT IS PLASMA?

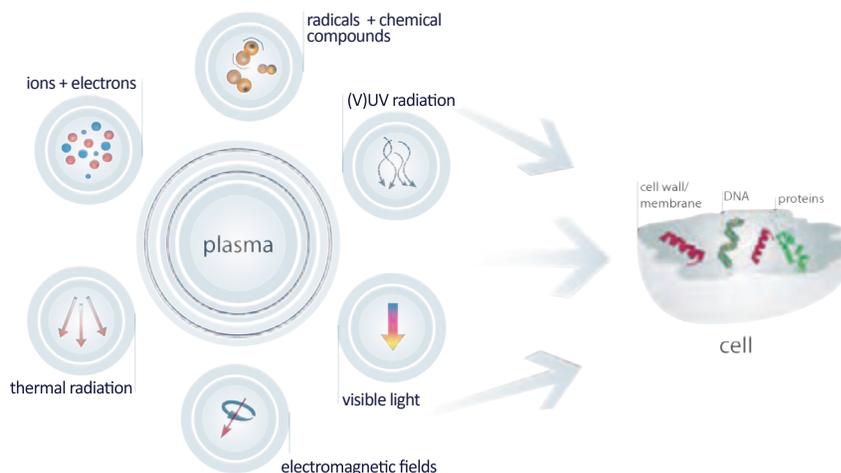
Physical plasma is the fourth state of matter after solid, liquid and gas. By adding energy, a solid is transformed into a liquid and further into a gas, whereby the atoms and molecules that form the substance increase in mobility until they move freely in the gaseous state. If energy is added to a gas, for example by means of strong electric fields, partial or complete ionisation of the particles takes place.

This state of an excited, electrically conductive gas is called plasma. In addition to freely moving electrons and ions, plasmas contain low-molecular chemically reactive species and emit electric fields, visible light, UV and thermal radiation. A rough distinction can be made between hot (thermal) and cold (low-temperature) plasmas as well as between high-pressure, atmospheric-pressure and low-pressure plasmas. Cold atmospheric pressure plasmas are of particular interest for applications in the field of decontamination.



## EFFECTS ON HUMAN CELLS

The biological and medically relevant effects of cold atmospheric pressure plasma are primarily mediated via so-called reactive oxygen and nitrogen species, whereby electric fields transmitted through the plasma and emitted UV radiation can play a supporting role. The reactive species are basically the same molecules that are also produced in the course of normal cell metabolism and are used, among other things, as signalling molecules. Thus, cellular redox processes and cellular signalling cascades are influenced by plasma treatment which are involved in complex processes like wound healing.



The competence area „Plasma Medicine“ is coordinated by Leibniz-INP and neoplas med GmbH

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FROM IDEA TO PROTOTYPE

**neoplas med**  
ADVANCED COLD PLASMA THERAPY

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## DIAGNOSIS. THERAPY. MONITORING.

### PUBLICATIONS

Th. von Woedtke, A. Schmidt, S. Bekeschus, K. Wende, K.-D. Weltmann. **Plasma medicine: a field of applied redox biology.** In Vivo 33 (2019) 1011-1026; DOI:10.21873/invivo.11570

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A. Privat-Maldonado, A. Schmidt, A. Lin, K.-D. Weltmann, K. Wende, A. Bogaerts, S. Bekeschus. **ROS from Physical Plasmas: Redox Chemistry for Biomedical Therapy.** Ox. Med. Cell. Longev. 2019 (2019), 9062098; DOI: 10.1155/2019/9062098

H.-R. Metelmann, T. von Woedtke, K.-D. Weltmann (eds.): **Comprehensive Clinical Plasma Medicine. Cold Physical Plasma for Medical Application.** Springer International Publishing AG, part of Springer Nature 2018, 526 p.