



Fraunhofer Institute for
Organic Electronics, Electron Beam
and Plasma Technology FEP

Biomedical Laboratory Unit

A multimodal service and technology platform



Introduction

The modern biomedical laboratory complex of the Fraunhofer FEP with biosafety levels 1 and 2 consists of laboratory units for microbiology, cell biology, bioanalytics, as well as for surface chemistry and biotechnological processes. This enables us to carry out interdisciplinary and industry-oriented research and development for a wide range of life science applications.

With our laboratory and measurement equipment, we can offer a wide range of services for customer-specific requirements in a variety of fields such as medical technology, pharmaceuticals, environmental technology, and biotechnology. We see ourselves as a platform where comprehensive technological expertise can be combined with application-relevant evaluation for medical and biotechnological questions. In-vitro microbiology and in-vitro cell biology play a crucial role in understanding complex interrelationships and principles of action with high practical relevance.


Exploring the potential applications of technologies based on ionizing radiation is one of the core competencies to be emphasized. One of our most important multifunctional tools is the low-energy electron beam technology (<300 keV). From

sterilization or biological inactivation and stimulation processes to the modification and crosslinking of materials, we use this tool for a wide range of applications. New technical solutions for efficient and gentle disinfection of surfaces are investigated through the use of plasma and UV technologies as well as by the direct production of biocidal surfaces. The development and characterization of biocompatible materials using a variety of approaches is another area of research. Integrated bioreactor systems for establishing innovative biotechnological processes using suitable bacteria and cell strains complete our technology portfolio. Connecting biotechnological processes with electron beam processes opens up new perspectives for diversified bioprocesses such as resource extraction and sustainable energy production of bio-based materials, and in the pharmaceutical and food industries.



We are technology-driven, application-oriented and interdisciplinary. Your idea is in the best hands with us!«

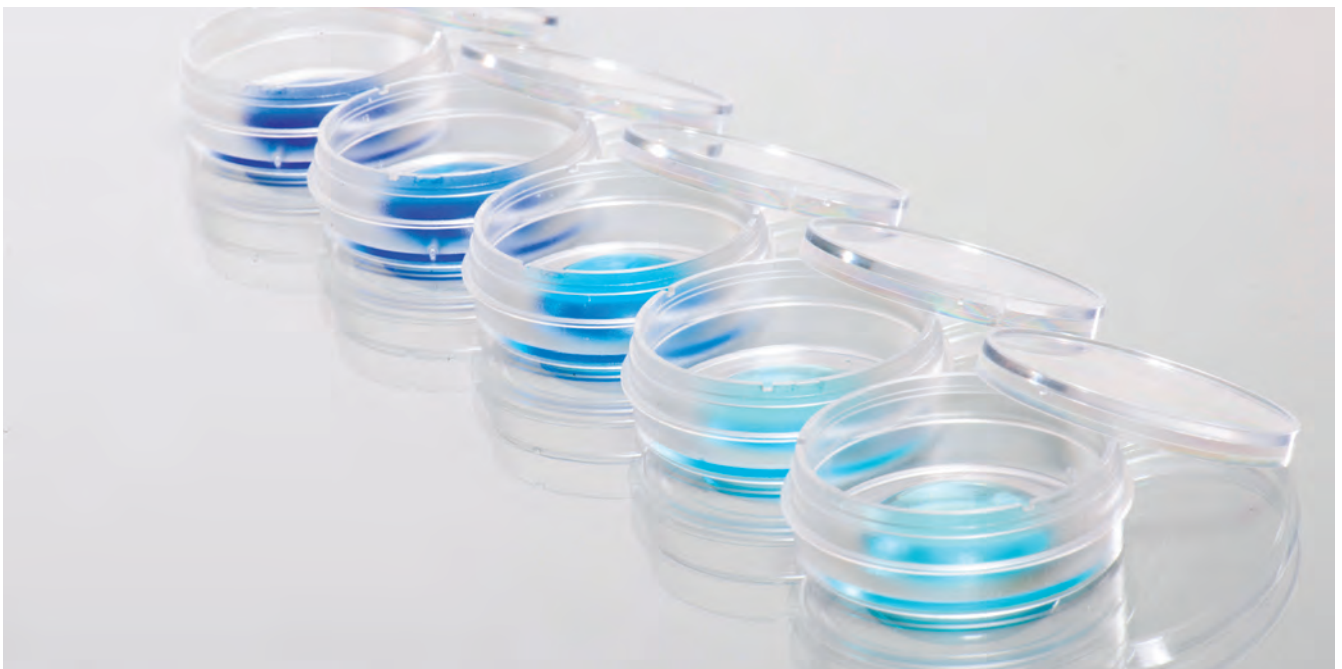
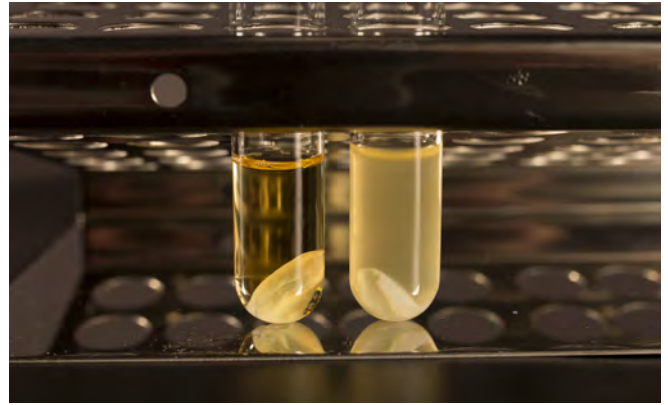


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APPROX. VOLUMES

Our laboratory complex as a multimodal service and technology platform

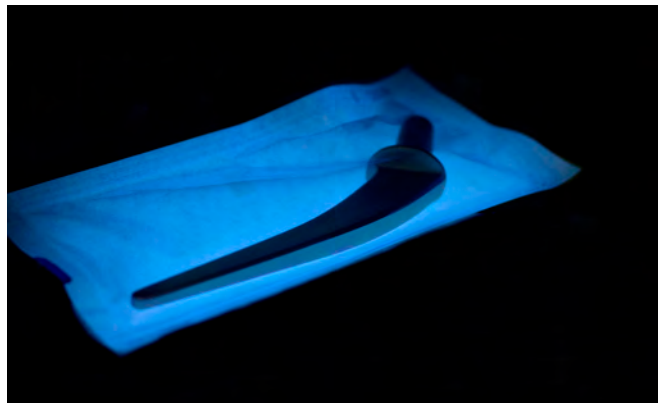
- Modern equipped laboratory units with biosafety level 1 and 2
- Combination of technological core competencies with medical and biotechnological applications
- R&D services in the fields of hygienization, surface modification, (bio)material and (bio)process development
- Broad scientific expertise through a high level of interdisciplinarity
- Application of UV, plasma and electron beam technologies for customized applications
- Processing of customer orders according to requirements based on DIN standards
- Development and adaptation of individual, situation-specific test setups and test regimes
- Application-oriented service portfolio based on DIN standards



Range of services

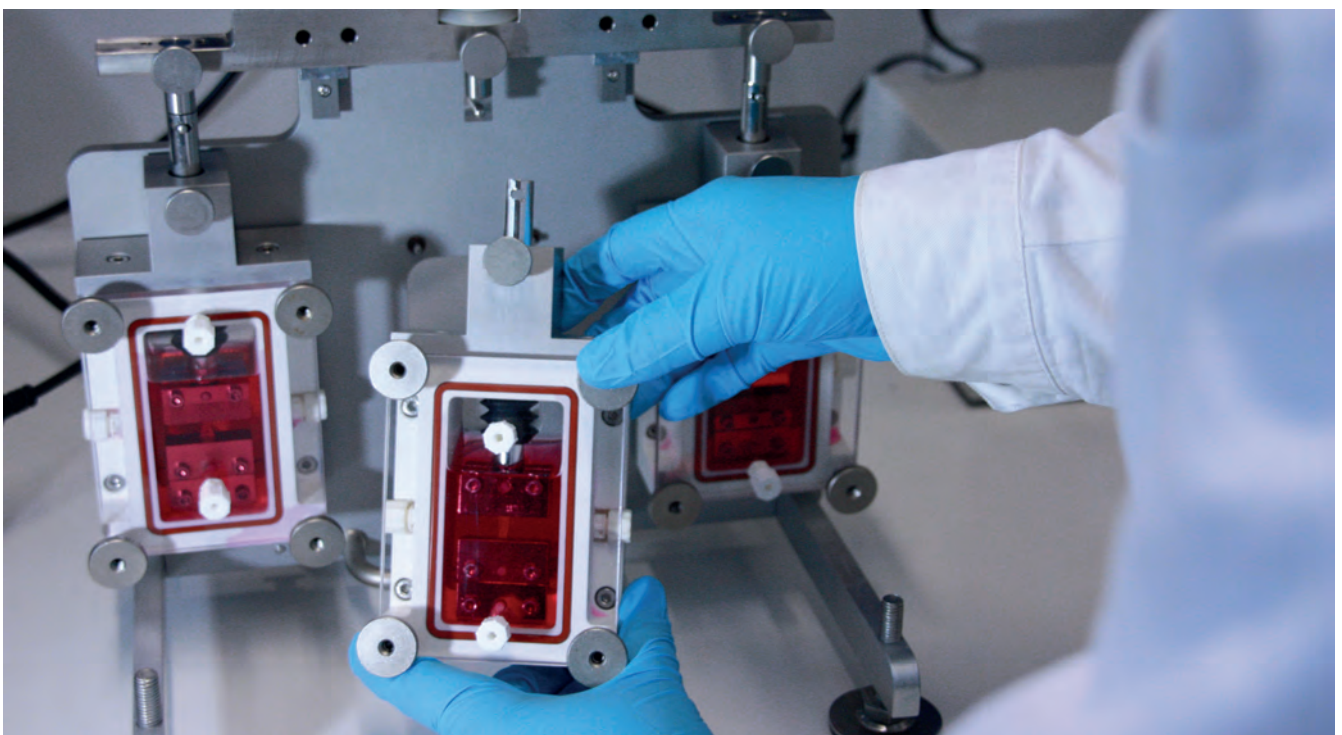
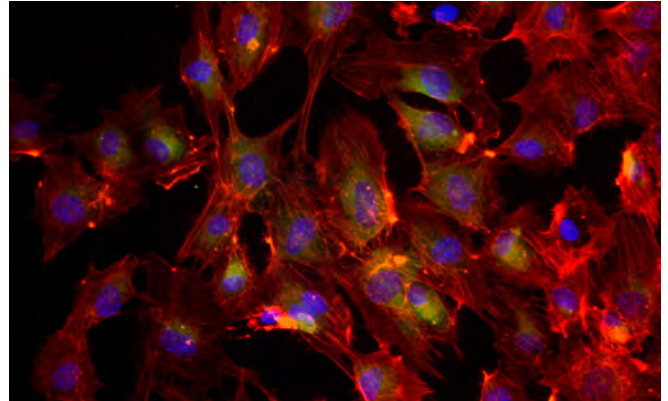
Microbiology laboratory unit

- Aerobic and anaerobic cultivation of microorganisms
- Assessment and detection of surface selective contamination and degree of contamination
- Hygienization concepts for sterilization and disinfection using electron beam, UV and plasma technology
- Sterility and bioburden testing
- Targeted contamination with subsequent application of selective strategies for the hygienization of materials
- Testing of biocidal substances, substrates and surfaces
- Antimicrobiological evaluation of coatings
- Investigation of biofilm formation
- Investigation of the effect of low-energy electron irradiation on microbial activity
- Investigation of factors influencing the biomass and product synthesis of phototrophic microorganisms



Cell Biology Laboratory Unit

- Cell cultivation of suspension cells and adherent cells (primary cells, cell lines) in mono- and co-culture.
- Biocompatibility and biofunctionality testing of materials and surfaces including selective surface treatment technologies
- Cell analysis: assessment of viability, proliferation, differentiation of changes in cell number, cell cycle and membrane potential
- Evaluation of cell and tissue damage by assessment of apoptotic damage through assessment of apoptosis, necrosis and DNA damage
- Evaluation of cell adhesion: interaction of surfaces with cells
- Cytotoxicity testing
- Preparation and modification of biological tissues using electron beam technology
- Targeted manipulation on cell function through electron beam technology (inactivation or stimulation)



Range of services

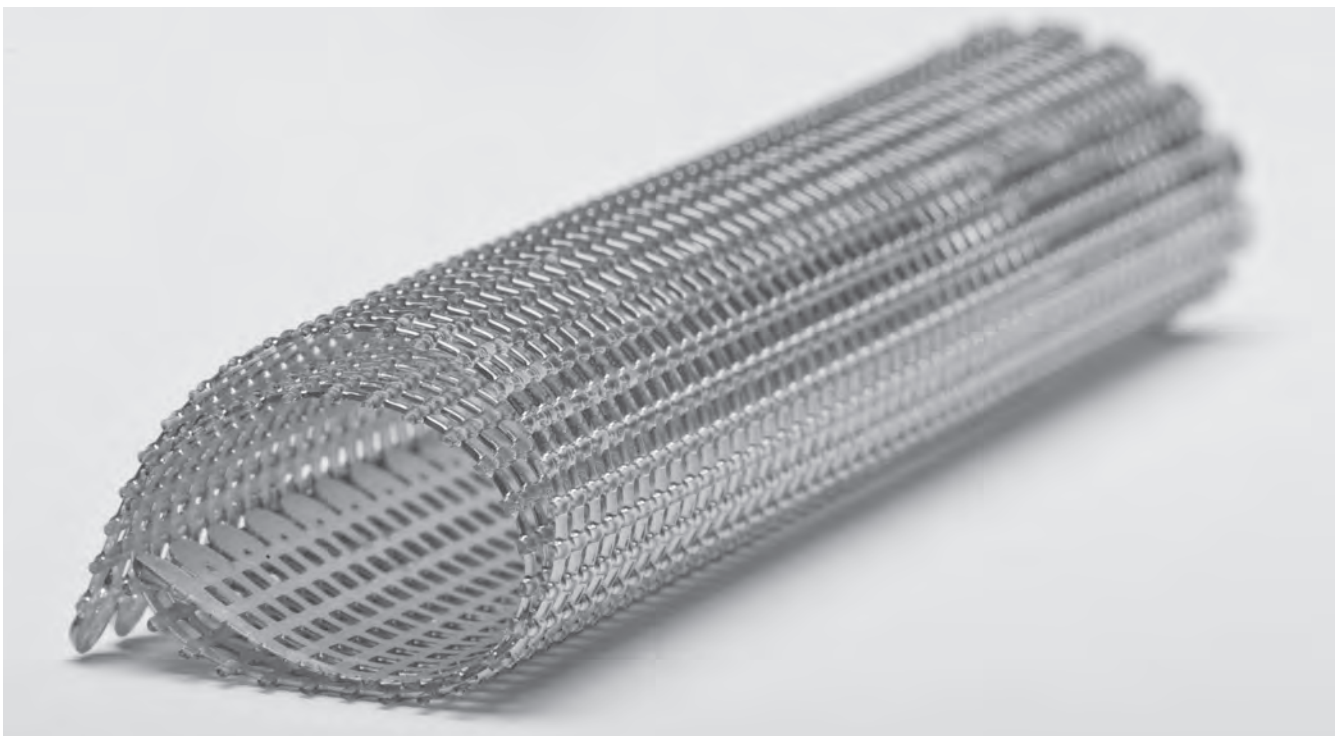
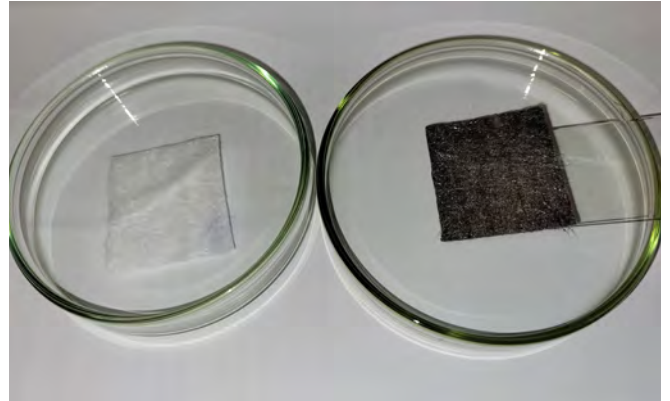
Biotechnological processes

- Application of accelerated electrons to aqueous systems containing microorganisms or cells, which can positively influence biotechnological processes:
 - environmental applications (e.g. recycling processes, renewable energy production, chemical supply, waste water treatment, resource recovery)
 - Life science areas (vaccine production, cancer therapeutics, blood treatment).
- Monitoring of bioprocesses via sensors (pH, pO₂, conductivity)
- Colorimetric assays for the detection of microbial activity, e.g. bioluminescence assay for ATP quantification, for the quantification of dissolved metals, for the quantification of dissolved nutrients
- Methods to quantify the cell density: UV/VIS spectroscopy, impedance spectroscopy, respiratory activity, and viability determination e.g. via live/dead staining
- Sum parameter determination in wastewater analysis (BOD)
- PCR-based identification of microorganisms
- Development of new methods for dose monitoring in aqueous systems focusing on radiochromic liquid-dosimeters
- Establishment of bioreactor systems with/without integrated electron beam sources



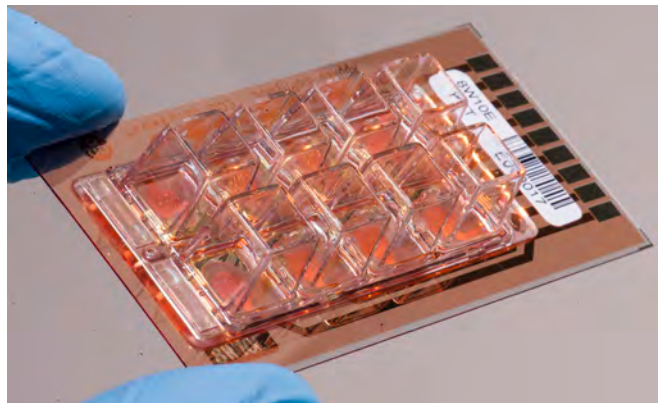
Surface chemistry processes

- Electron beam-assisted surface modification guarantees the sustainable preservation of material properties and allows surface properties to be customized:
- Modulation of wetting properties through surface functionalization.
- Improvement of material-specific adhesive properties
- Selective influence on the biocompatibility of material surfaces
- Grafting processes for functional surface coating (non-stick coatings, biocidal coatings)
- Cross-linking and curing of surface selective coatings
- Material-friendly surface hygienization



Range of analytical methods

- Extensive instrumentation for the analysis of microbiological, cell biological, biotechnological and surface-selective questions
- Microscope pool (light, fluorescence, phase contrast microscope, SEM, AFM)
- Micro- and cell biology analysis systems (impedance meter, flow cytometer, UV/VIS spectrometer)
- DNA and protein analysis (PCR, gel electrophoresis, blotting systems, chemiluminescence system)
- Material and surface analysis (UV-VIS spectrometer, ATR-FTIR, contact angle meter)
- Process parameter monitoring (pH, conductivity, oxygen content, temperature)
- Modular sensor test bed
- Different dosimeter systems (film and liquid dosimeters) including use of different analytical measurement technology (flatbed scanner, ESR spectroscopy, UV/VIS spectrophotometer)
- Cooperative design and construction of experimental setups and modules for the production of thin liquid films for low energy electron beam technology





For more information, please visit the website of our business unit
Medical and Biotechnological Applications:
www.fep.fraunhofer.de/MBA

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