

# ATTRACT 3DNANOCELL



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### New challenges in medicine

An aging society poses enormous challenges to medical care. The rising demand for prostheses, implants, and artificial tissue in the treatment of age-related diseases, degenerated joints and skin or cartilage defects implicates a growing need for novel bioactive materials. In addition, the increasing number of cancer and degenerative diseases requires new forms of therapy and earlier diagnosis. Faster and more reliable test methods are needed for new drugs or active substances, not only to save costs but also to shorten the time to market.

### Single source solutions

Fraunhofer ISC offers a unique infrastructure for multi-disciplinary research on the highest level. The ATTRACT 3DNanoCell team of researchers includes biologists, chemists, physicists and materials scientists, all working together to design and analyze biofunctional materials, structures, surfaces, and suitable test environments.

## FIELDS OF APPLICATION

- Investigating cell-surface interaction
- Control of cell functions
- Tailoring and control of parameters such as chemical composition, elasticity, homogeneity or size of 2D/3D scaffolds
- Customized surface structuring and functionalization
- Individualized diagnostics
- Cell culture and assay performance under dynamic flow conditions, e. g. blood flow or heartbeat simulation
- Cell sorting assays
- Integration of additional system parameters for novel types of analyses in customized test assays
- Implant colonization assays
- Long-term studies of cell adhesion on implant surfaces
- Long-term studies of cell migration
- Targeted drug delivery
- Nanoparticles for the delivery of poorly soluble active substances and cell-type specific drugs
- Magnetic nanoparticles for cell manipulation by magnetic tweezers

## OUR EXPERTISE, YOUR BENEFIT

Decades of experience in the development of new materials add up with a GMP/GLP compliant infrastructure to make the Fraunhofer ISC your ideal partner for future-oriented medical R&D tasks involving biofunctional materials and assays.

### Make your products safe

We perform state-of-the-art experiments and analyses in a high-tech infrastructure.

### Find cost-saving alternatives

We provide custom-made solutions for your demands on small-series testing under realistic conditions.

### Improve the comparability of results

Ask for our long-term studies with documented standards.

### Look for better tolerability

We design surfaces, 3D structures, and cell assays.

### Ensure the successful implementation of your idea

We investigate cell behavior, simulate drug effects, and functionalize materials.

# CONTACT



FRAUNHOFER ATTRACT 3DNANOCELL

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R&D SERVICES AND CONSULTING  
FOR MEDICAL PRODUCTS  
OF TOMORROW

You are looking for a sound and competent partnership to develop novel products in biomedicine, implant technology or pharmacology?

Ask us!

### We can answer all your questions regarding:

- Surface structuring and functionalization (e. g. in prosthetics)
- Complex 3D structuring of novel materials (e. g. for cartilage reconstruction or tissue engineering)
- Cell behavior analysis (e. g. for better tolerability of drugs and implants)
- Cell assay simulation
- Design and performance of assays (e.g. for drug delivery)
- Drug screening
- Multifunctional nanoparticles in diagnostics and theranostics

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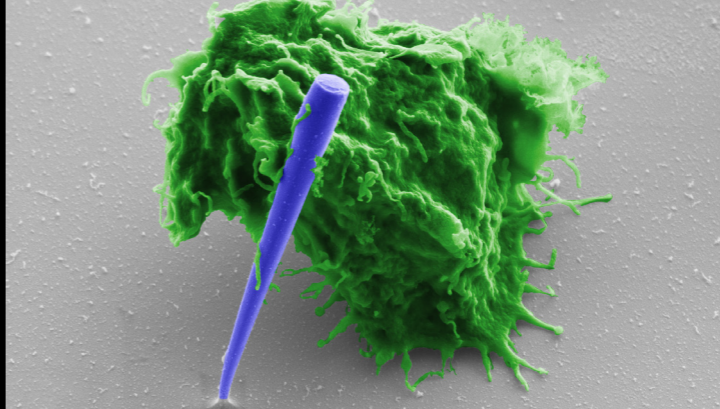
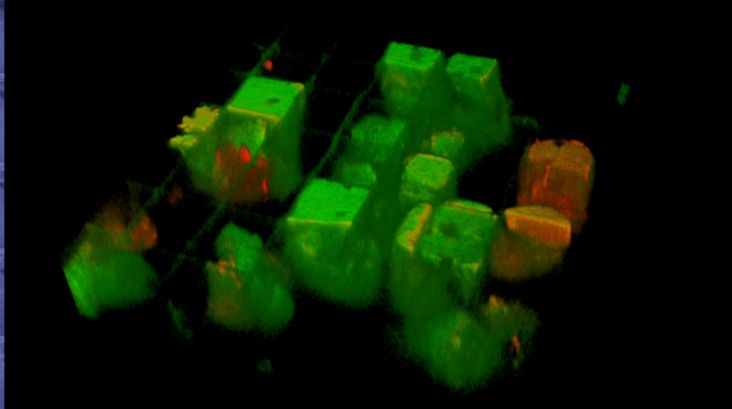
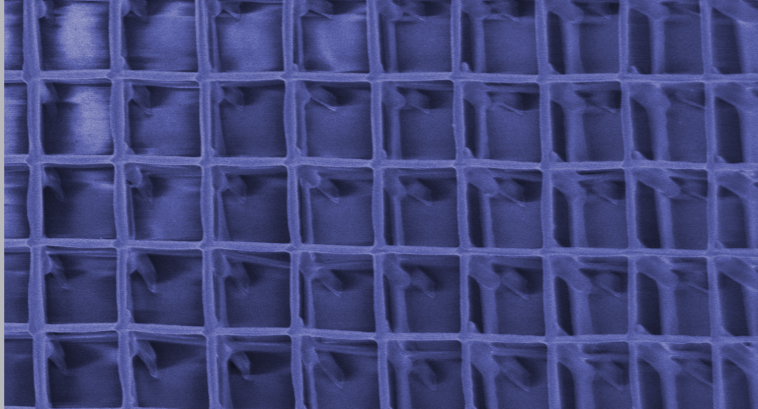
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# OUR EXPERTISE



## MATERIALS DEVELOPMENT

### Improved cancer therapy

Early diagnosis is crucial to increase the chances of recovery for cancer patients. Additionally, improved therapies with new types of medication are required. Biochemical functionalization enables drug delivery targeted to specific cell types. This prevents damage to surrounding tissues and minimizes adverse reactions.

### Nanocarriers

We develop novel particle systems for use in both *in vivo* diagnostics and drug delivery. Multifunctional particles are modified to specifically affect the targeted cells.

### Applications include

- Delivery of poorly soluble active substances
- Targeted drug delivery
- Magnetic nanoparticles: manipulation by magnetic tweezers
- Personalized diagnostics

## SURFACE FUNCTIONALIZATION

### Advanced implants

Endoprostheses, e. g. artificial hip joints and stabilizing implants for tissue or bone reconstruction, are state of the art in today's medicine. However, numerous patients experience delayed wound healing or implant loosening after surgery. Make use of our expertise to accelerate and improve the healing process.

### Functionalized surfaces minimize risks

The surface of an implant, being in direct contact with surrounding body tissue, holds the key for a complication-free ingrowth. A suitable surface functionalization can lower the risk of infection or encapsulation. Latest technologies facilitate the adaption of implant surfaces and material elasticity to match the surrounding body tissue.

### Applications include

- Individualized implants with patient-specific surfaces
- Active implants

## TISSUE ENGINEERING

### Optimized scaffolds for tissue engineering

Accidents or chronic diseases may put a limit to a patient's natural regenerative capacity. Modern medicine offers the chance to replace tissues like ossicles, blood vessels or skin by tissue engineered constructs grown from patient-derived cells. Biodegradable and individually adaptable materials are required as a matrix for the targeted biological and physiological environments.

### Complex 2D and 3D structures

We design and fabricate complex 3D scaffold structures with features tunable from the micro to the nano scale. Our materials include biodegradable ORMOCER®s, hydrogels and silica-based fibers. These materials are suitable for specific functionalization to match the designated cell environment.

### Applications include

- Biodegradable implants
- *In-vitro* tissue engineering
- Cell specific scaffolds

## COMPATIBILITY TESTING

### Cell-type specific 3D assays

For a reliable evaluation of drug effects on living cell behavior, screening assays in realistic 3D environments are inevitable. We are able to mimic and spatio-temporally control diverse stimuli influencing specific cell functions. For example, advanced microfluidic systems allow for the application of chemotactic gradients of cytokines.

### From idea to product

To meet your requirements, we design customized 3D surroundings for your investigations on living cells. To this effect, we make use of simulation tools and program individual evaluation routines for a fast and thorough analysis and interpretation of your data. Live-cell imaging enables in-depth characterization of cell migration processes und determination of cell forces. Biochemical analyses serve to investigate intracellular processes and indicate possible immune responses.

### Applications include

- Drug screening
- Functional assays
- Cell sorting
- Lab-on-a-chip

## HIGH-END PROCEDURES

Our Imaging Center provides the ideal infrastructure for *in vitro* investigations of materials and drugs destined for the use in the human body. Our range of services covers the entire process from cell preparation to the performance of single assays or test series. The subsequent data processing and evaluation is facilitated by our profound know-how in analyzing biological interactions of living cells with active substances and 3D environments. Our customers and project partners fully benefit from our equipment and our expertise in biological and materials research.

### Imaging Center

- Confocal laser scanning microscopy (CLSM)
- Spinning disk confocal microscopy (SDCM)
- Förster resonance energy transfer (FRET)

Super-resolution fluorescence microscopy:

- Stimulated emission depletion (STED)
- Stochastic optical reconstruction microscopy (STORM)

### Structuring methods

- Two-photon polymerization (TPP)
- Nanoimprint
- UV lithography
- 3D printing
- Printed electronics