

AO

Research Institute Davos

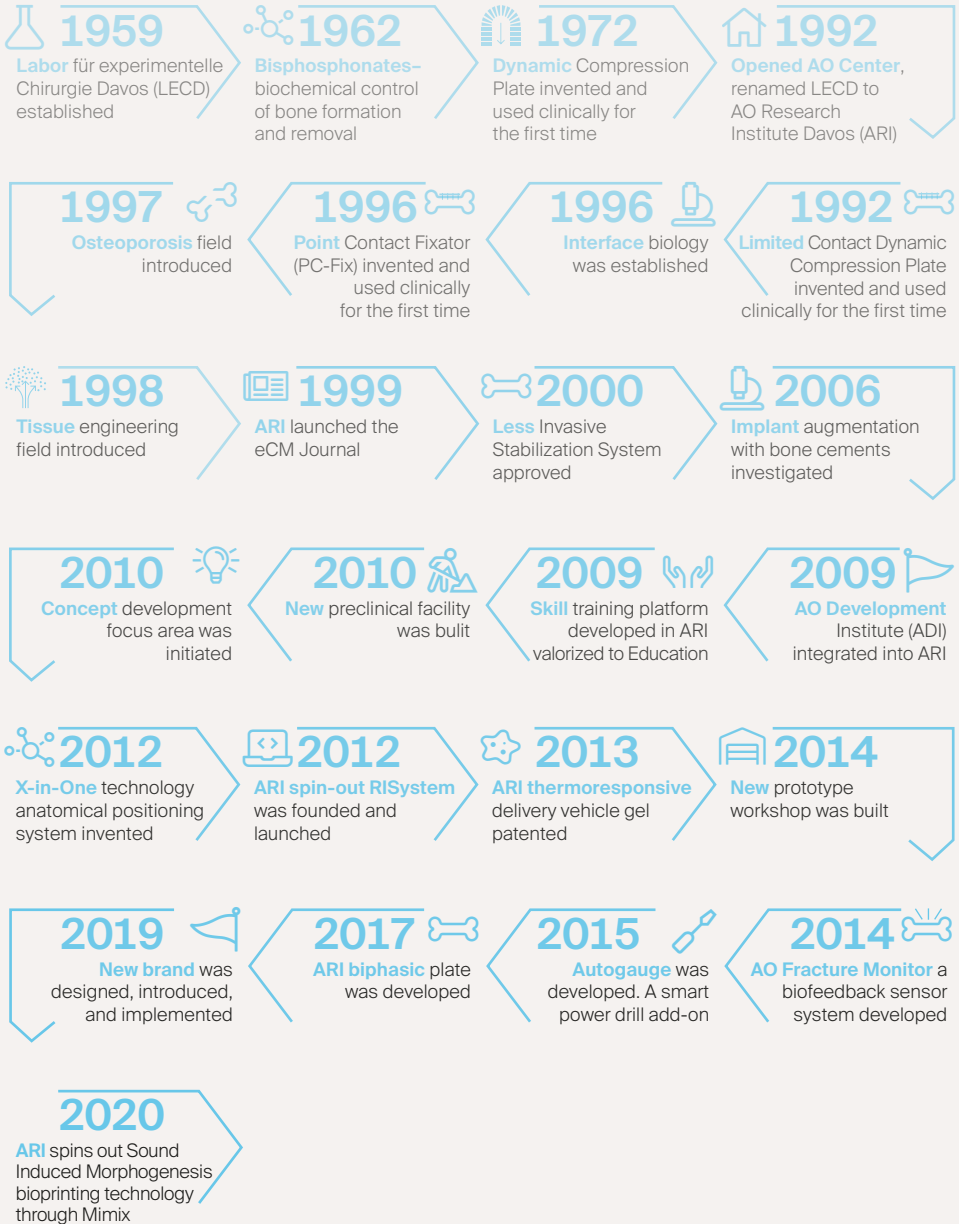
AO Research Institute
Davos (ARI)

**High quality scientific
studies—on time and
tailored to your needs**



AO Research Institute Davos history

We are proud to take over 60 years of cumulative knowledge and experience in musculoskeletal research and make it available to industrial and academic partners within defined timelines.



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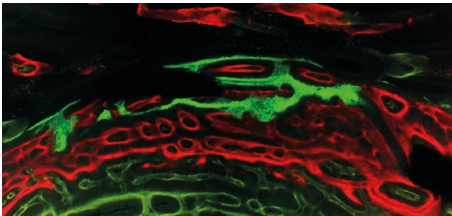
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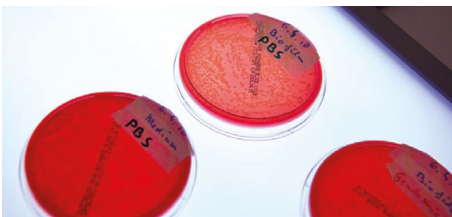
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Preclinical surgery

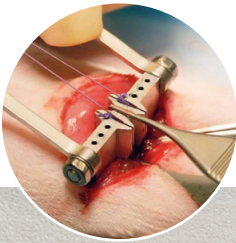
Conducting high-quality preclinical studies tailored to your research question

Preclinical models | study design

- Wide range of standardized preclinical models for musculoskeletal research, infection research and medical device testing
- Customized model development tailored to the study goal and research questions

Surgery | anesthesia

- Fully equipped surgical suites
- Biosafety level 2 facilities

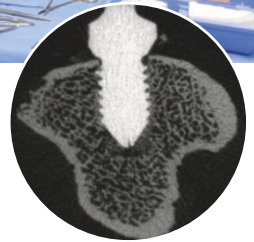


Post operative care

Housing and care facilities for:

- Sheep
- Rabbits
- Rodents (conventional and individually ventilated caged (IVC))
- Minipigs
- Goats





In vivo analysis

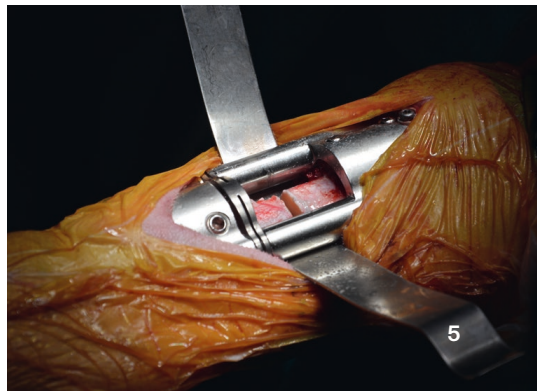
- Digital radiography of hard tissue
- Ultrasonography of soft and hard tissue
- Computed tomography of all animal models in vivo and postmortem possible
- Analysis of different blood parameters (eg, C-reactive protein, serum level of antibiotics)

Qualifications

- Team of veterinary doctors including a European College of Laboratory Animal Medicine (ECLAM) board-certified veterinarian and a diplomate of the American College of Veterinary Surgeons-Large Animal (DACVS-LA)
- Doctors of philosophy (PhDs) doctorates supervising studies
- Animal caregivers with up to 30 years of individual experience
- Master of science in biology (MSc)

Certification

- ISO 9001
- Good Laboratory Practice (GLP)
- Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC)



Biomechanical testing and modeling

Biomechanical testing, modeling and prototyping to find optimal solutions to clinical questions

Biomechanical testing

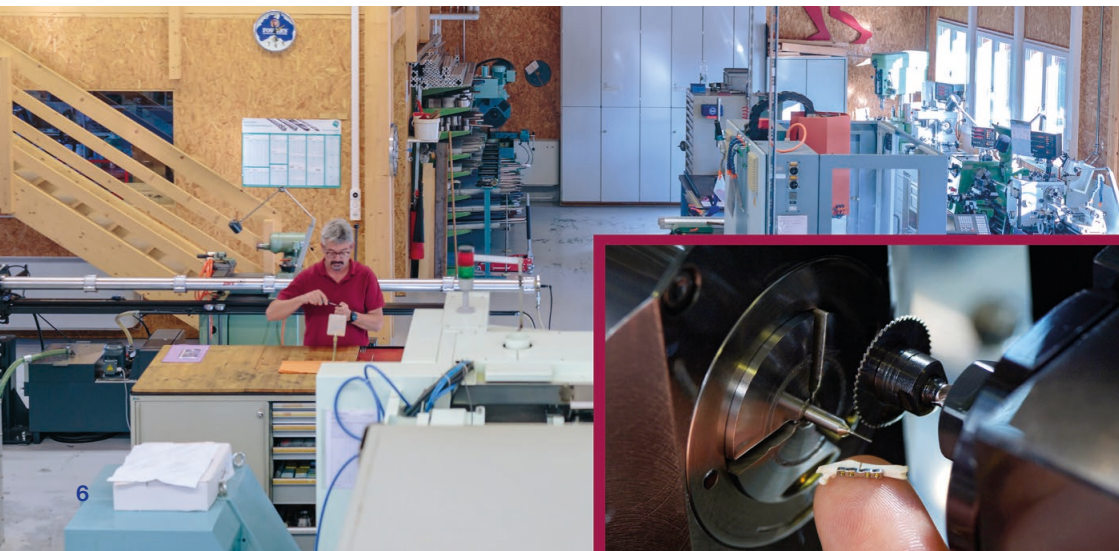
State-of-the-art test equipment:

- Servo hydraulic, electrodynamic, and electro mechanical test machines
- X-ray, video and motion tracking analyses
- Tailored test setups
- Advanced testing protocols using in vivo recorded load patterns

Computer-aided design and finite element analysis

- Design, testing, and analysis of implants, instruments, endoprotheses, and bone-implant constructions
- Customized experimental model development to answer a wide range of research questions

Biomechanical and finite element (FE) studies: support from project design to publication





Prototyping

- Well-equipped prototype workshop
- Milling, turning, wire cutting electrical discharge machining (EDM) and surface finishing
- Production of high-quality instruments, test rigs, and prototype implants

Anatomy laboratories

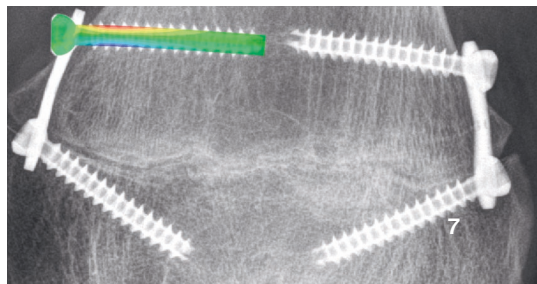
- Well-equipped anatomy laboratories for specimen preparation, instrumentation, and embedding
- Testing on a variety of human and animal anatomical bones

Qualifications

- Multidisciplinary team (engineers, physicists, technicians, medical fellows)
- Highly trained polymechanics for computer numerical control (CNC) machines

Certification

- ISO 9001



Medical imaging

Extensive range of advanced medical imaging services for morphological bone investigations

Image acquisition

- Wide range of imaging modalities (in vivo/ex vivo): clinical computed tomography (CT), HR-pQCT, μ CT X-ray, ultrasound
- Contrast media injector for use with clinical CT
- External sources: magnetic resonance imaging (MRI), dual-energy X-ray absorptiometry (DXA), laser scanning
- In vivo, ex vivo, and in vitro measurement capabilities (ranging from patients to bioresorbable scaffolds)

Image processing

- Image preprocessing
- Image filtering and segmentation
- Surface model generation
- Bone mineral density (BMD) calibration

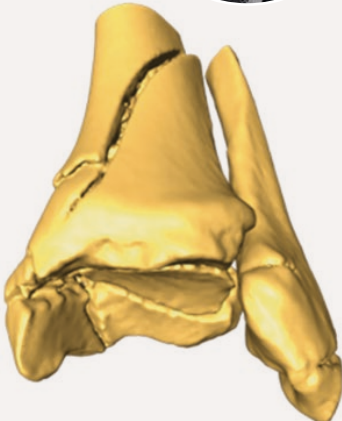
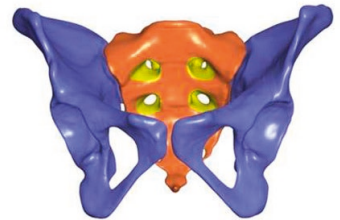
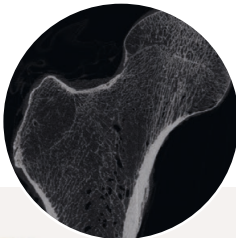
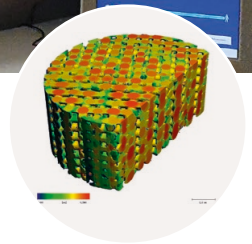




Image analysis

- Image-based morphological studies
- 3D statistical modeling
- Computerized preoperative planning
- Development of surgical strategies
- Bone mineral density assessment
- Bone microarchitecture evaluation
- Monitoring of fracture healing
- Large bone defects, delayed union models, infection models
- Micro-finite element analysis
- Optimization of implant anchorage

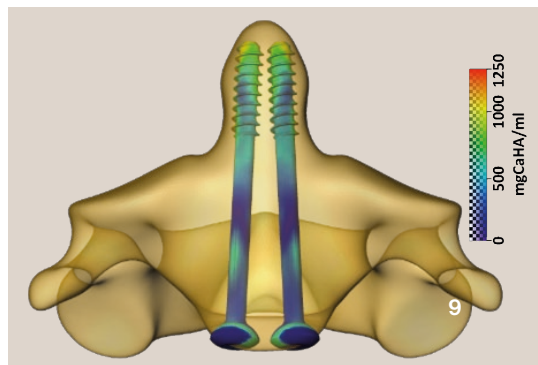


Qualifications

- Multidisciplinary experienced team (mechanical engineers, medical doctors, computer scientists)
- Qualified staff for working with experimental animals
- Close collaboration with expert surgeons

Certification

- ISO 9001
- GLP



AO Research Institute Davos's purpose statement

In its work to further the AO mission, ARI's purpose is to advance orthopedic patient care through innovative research and development.





Histology, tissue morphology, and microscopy

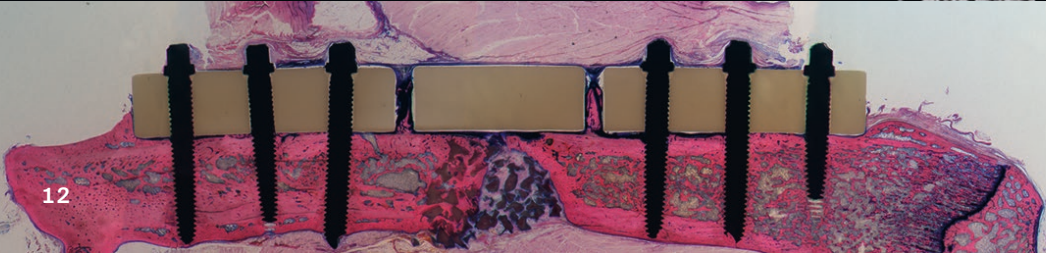
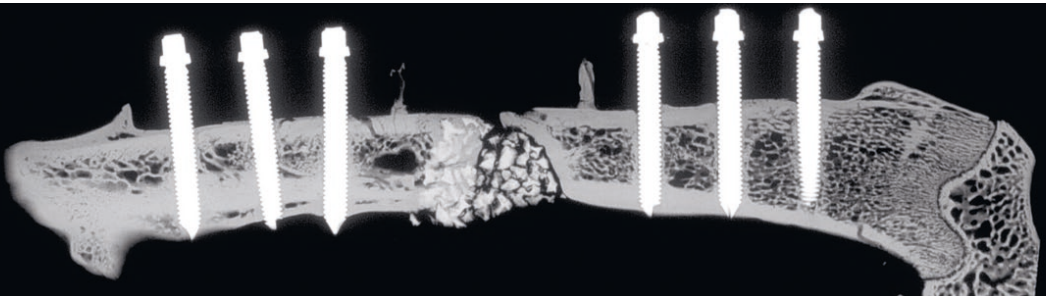
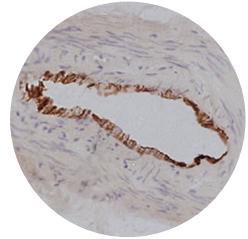
Highly skilled tissue processing, imaging, and analysis

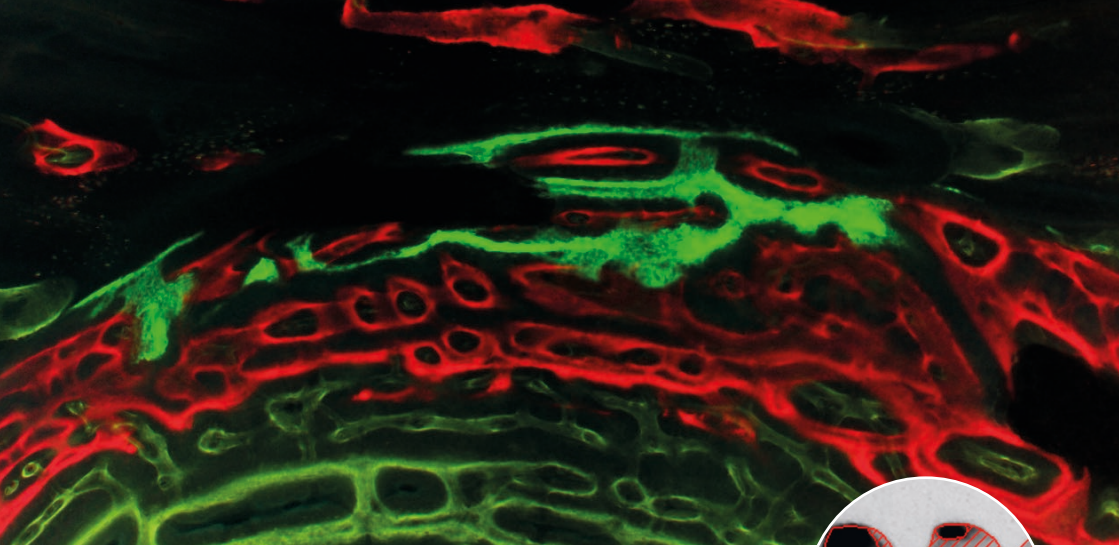
Study design

- Assistance in project planning and experimental set-up based on scientific question
- Evaluation of samples, photodocumentation, and report writing

Histological preparation and techniques

- Undecalcified bone histology with or without implants (eg, metal, calcium phosphates, polymers)
- Sectioning of resin-embedded samples with specialty equipment
- Contact radiography
- Decalcification of tissues
- Paraffin embedding and sectioning
- Cryosectioning
- Immunohistochemistry (with protocol planning)
- Routine to special stains (for resin- and non-resin-embedded samples)





Microscopy and image analysis

- Bright-field light microscopy for sections with or without implants
- Epifluorescence microscopy for fluorochrome labelled sections (eg, bone labels, marked antibodies)
- Macrophotography for overview images of larger samples
- Confocal laser microscopy for optical sectioning
- Scanning electron microscope equipped with Energy-dispersive X-Ray spectroscopy (EDX or EDS)
- White light profilometry for surface characterization (eg, roughness values)
- Quantitative analysis (eg, lengths, areas, numbers) on histological samples

Qualifications

- Certified veterinary pathologist

Certification

- ISO 9001
- GLP



Tissue engineering and cell biology

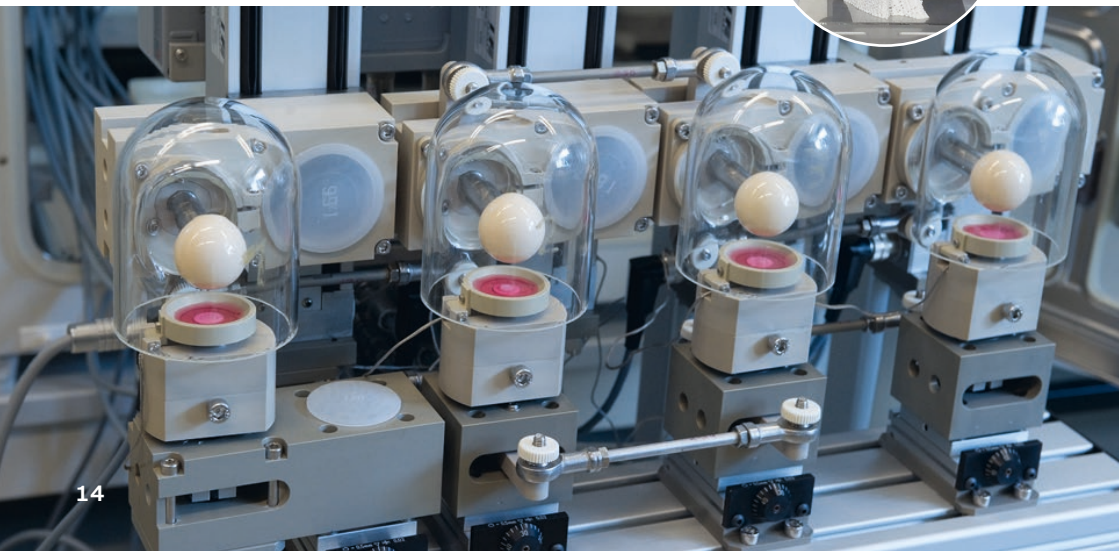
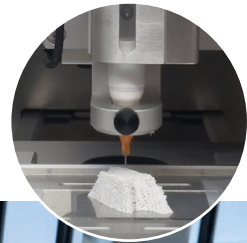
Developing novel trauma repair treatments within the musculoskeletal system

Cell and tissue culture

- Cell isolation (eg, osteoblasts, chondrocytes, stem cells) from various tissues (eg, bone, cartilage, disc, veins, bone marrow, peripheral blood) and from various species (eg, human samples, bovine, sheep, rat)
- Tissue biopsies from various locations and species (eg, cartilage and intervertebral disc)
- Two-dimensional and three-dimensional cell culture
- Differentiation of precursor or stem cells in specific cell types (eg, osteoblasts or chondrocytes)
- Bioreactor culture systems for intervertebral disc (organ culture) and articular cartilage (pin-on-ball)
- Gene transfer: non-viral and viral

Analysis

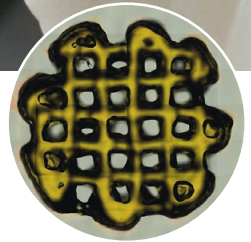
- Gene expression
- Isotope incorporation
- Biochemical analysis (eg, glycosaminoglycan, DNA, alkaline phosphatase)
- Cell viability
- Time lapse microscopy
- Protein analysis
- Fluorescence activated cell sorting
- Biomarker screening





Biopolymers and biofabrication

- Production of porous scaffolds, films, membranes, micro- and nano-particles
- High-performance liquid chromatography (HPLC), rheometry, viscosimetry, Fourier-transform infrared spectroscopy (FT-IR), UV-vis spectroscopy, in vitro degradation, contact angle
- 3D bioprinting, 3D-Sound-Induced Morphogenesis (3D SIM)

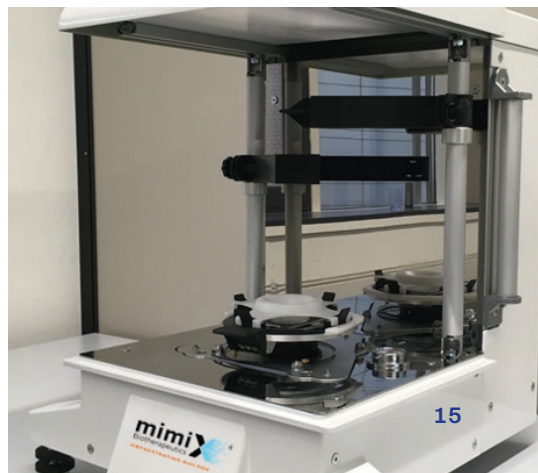


Qualifications

- Experienced scientists (PhDs) supervise studies
- Multidisciplinary team (biologists, chemists, engineers, medical fellows)
- Highly qualified technicians with up to 25 years experience

Certification

- ISO 9001



Infection studies

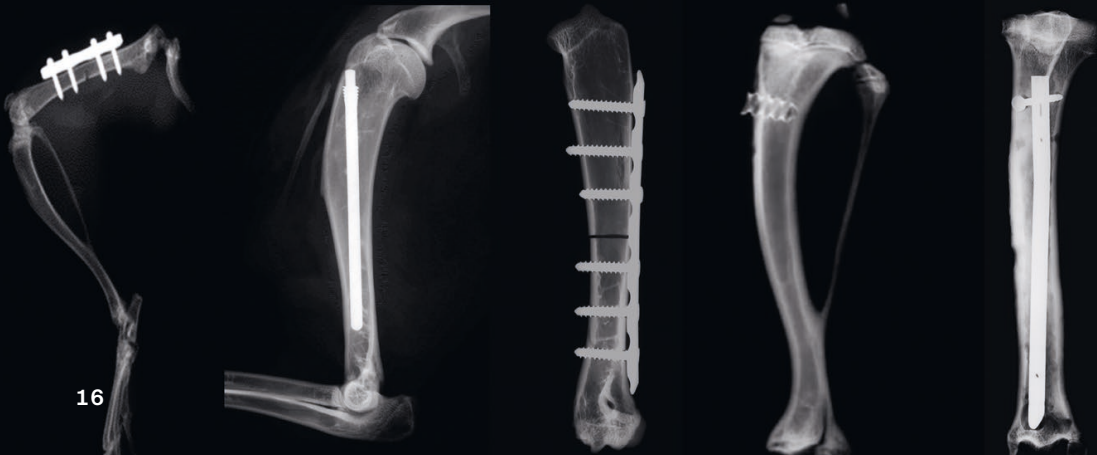
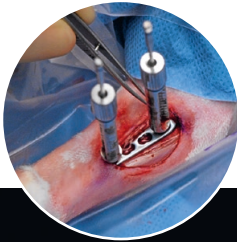
Understanding the pathogenesis of musculoskeletal infection and developing customized interventions

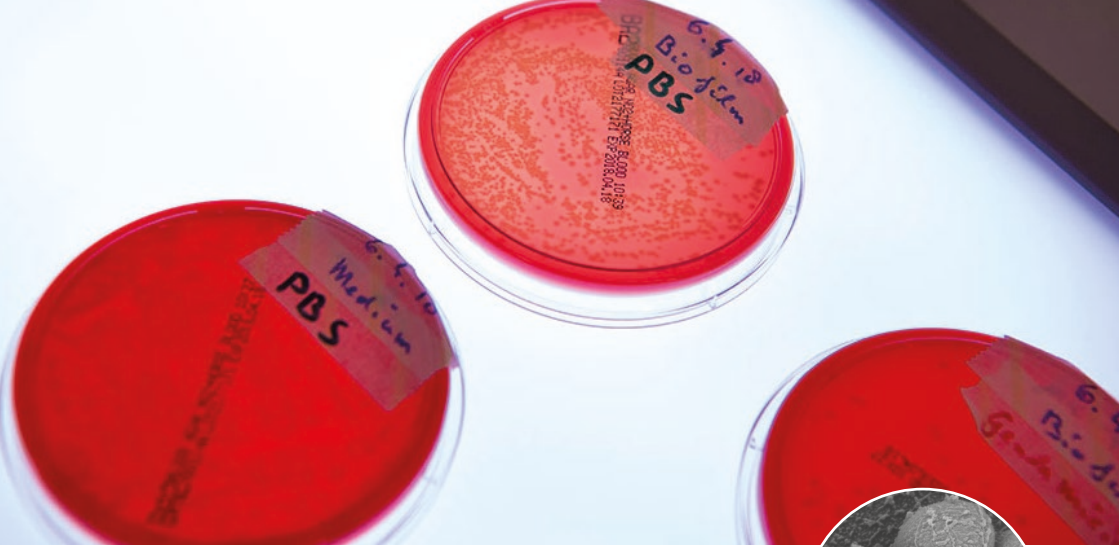
In vitro testing

- Antimicrobial efficacy testing of anti-infective surfaces
- Bacterial adhesion and biofilm formation on test materials
- Imaging of test surfaces with or without bacteria/biofilm using Scanning Electron Microscopy (SEM)
- Biobank of clinical bacterial isolates from patients with bone and Implant Infection.

Preclinical models

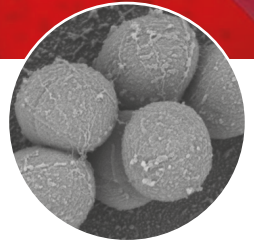
- Mouse, rat, rabbit, and sheep models of infection prevention and treatment
- Models available using mechanically relevant conditions and commercially available implants
- Experience in working with antibiotic resistant pathogens (eg, MRSA)
- Systemic and local application of antibiotics/antimicrobials





Histological preparation

- Histological analysis of infected tissues with bacteria-specific staining



Analysis

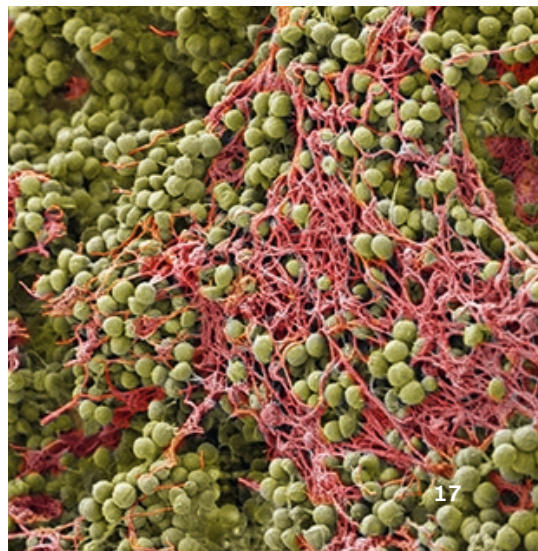
- Determining antimicrobial efficacy of specific devices or biomaterials
- Quantitative bacteriological analysis of biological specimens including bone
- Quantitative analysis of explanted hardware for biofilm utilizing sonication

Qualifications

- Microbiologists (PhDs) experienced in infection studies
- PhD-level scientists and experienced project leaders
- Highly qualified technicians

Certification

- ISO 9001
- GLP



Quality management

High-quality work is important for successful research. ARI works hard to ensure the highest quality in all our research projects.

ISO 9001:2015 and EN ISO 13485:2016 certification

- The entire ARI is certified according to ISO 9001:2015 and we have good reason to be proud of this.
- ARI is one of very few academic research organizations to have achieved this certification.
- Additionally, the biomechanics and modeling and concept development focus fields are certified according to EN ISO 13485:2016, which demands a much higher level of documentation and traceability.

Good Laboratory Practice (GLP) certification for our preclinical facility

We are very proud to have received the official Statement of GLP Compliance from the Swiss Federal Office of Public Health, of the Swiss Confederation through Swissmedic (Swiss Agency for Therapeutic Products), together representing the Swiss GLP monitoring authorities, in October 2018. ARI is one of only two academic institutes certified for GLP in Switzerland.

These accreditations demonstrate ARI's commitment to fulfilling the highest standards in research.

GLP is an internationally recognized quality system concerned with the organizational process and conditions under which non clinical health and environmental safety studies are planned, performed, monitored, recorded, archived, and reported. We are now able to conduct preclinical studies with potential customers and any partners of the AO network in the only Swiss GLP- and AAALAC-accredited institute. This is of special importance, for future approval of medical devices by the United States Food and Drug Administration (FDA), since the FDA has new guidelines in review (general considerations for animal studies for medical devices) for preclinical studies, which will make GLP and AAALAC virtually mandatory for any submission to the FDA.





AO Research Institute Davos

AO Foundation

Davos Platz, Switzerland

25 February 2013

Association for Assessment and Accreditation of Laboratory Animal Care International



Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC)

ARI's preclinical facility has been granted accreditation from AAALAC international, a private, nonprofit organization that promotes the humane treatment of animals in science through voluntary accreditation and assessment programs. We are extremely proud of this accreditation as it clearly defines ARI as having the highest possible animal care ethics.

More than 870 companies, universities, hospitals, government agencies, and other research institutions in 36 countries worldwide have earned AAALAC accreditation, demonstrating their commitment to responsible animal care and use. These institutions volunteer to participate in AAALAC's program, in addition to complying with the local, state, and federal laws that regulate animal research.

ARI is one of three accredited institutions in Switzerland and one of the few academic research institutes in Europe.

In addition AAALAC has accepted the Tierversuchskommission Graubünden (TVKGR) as the Institutional Animal Care and Use Committee (IACUC) for ARI. The IACUC is a self-regulating entity that, under United States federal law, must be established by institutions that use laboratory animals for research or instructional purposes to oversee and evaluate all aspects of the institution's animal care and use program.

Transforming Surgery— Changing Lives



AO Research Institute Davos (ARI) is your contract research organization (CRO) for preclinical projects in the medical device field. Our strength is to have the complete service chain under one roof, offering modular or complete research solutions within ISO9001-, ISO13485-, GLP-, and AAALAC-certified facilities.



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