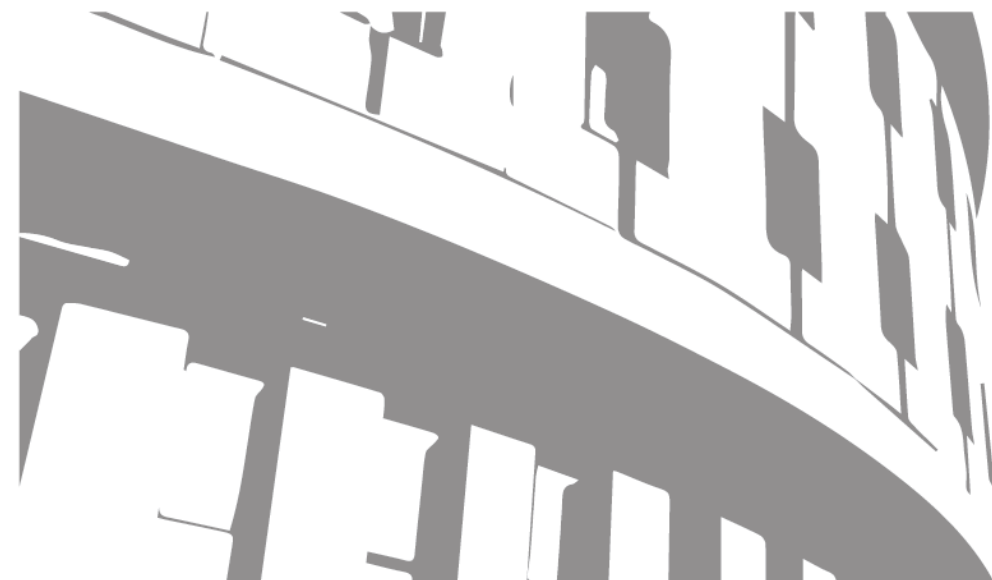




RIZZOLI-RESEARCH (IOR-Ric)



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Date of issue: 10/13/2026



RETE ALTA TECNOLOGIA
EMILIA-ROMAGNA
HIGH TECHNOLOGY NETWORK

RIZZOLI-RESEARC (IOR-Ric) Brochure



Il moto è causa d'ogni vita

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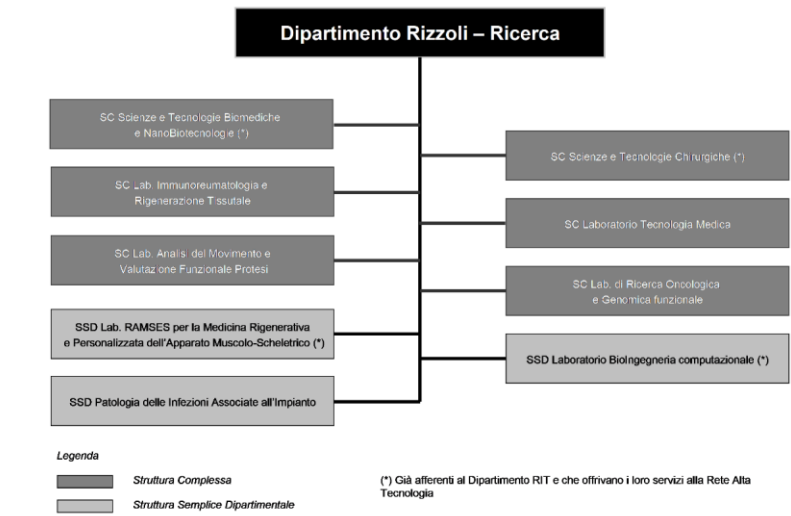
IOR-Ric

The Rizzoli Research Department (IOR-Ric) carries out translational research in the biomedical field and is accredited within the Rete Alta Tecnologia Emilia-Romagna. Musculoskeletal diseases have a high incidence and represent a growing problem from both a health and a socio-economic standpoint, also due to the progressive aging of the population.

ORGANIZATION CHART

OR-Ric consists of nine research laboratories of the IRCCS Istituto Ortopedico Rizzoli.

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MISSION AND VISION

The **mission** is to develop processes and products for the prevention and treatment of musculoskeletal diseases, up to the recovery of motor function.

The **vision** follows two directions:

- increasing knowledge of musculoskeletal pathophysiology, also through the use and development of high-technology tools;
- effectively transferring this knowledge to healthcare services, also in collaboration with companies, in order to prevent and treat orthopedic diseases.

TEMATICHE DI RICERCA

Technologies for Diagnostics, Biomarkers and Motor Physics

Preclinical disease models (3D cultures, microfluidics) for diagnostic assays with morphological evaluation by live imaging, ultramicroscopy and confocal microscopy. Single-cell analysis. Isolation and characterization of exosomes for diagnostic and prognostic purposes.

Technologies for Pharmacology, Nutraceuticals and Orthobiologics

Therapies based on mesenchymal stem cells, growth factors and other biological products for repair/regeneration purposes, In vitro and ex vivo efficacy testing of drugs, nanocarriers, nanomaterials, and molecules of therapeutic and nutraceutical interest. Models for precision medicine.

Materials, technologies, planning, and surgical therapies

In vitro and in vivo evaluation of biomaterials and implantable devices. Analysis of biocompatibility (safety), bioactivity, biofunctionality, and therapeutic efficacy (proof-of-concept studies). Customized solutions for tissue defects, notably bioprinting techniques. Evaluation of bone substitutes and custom-made devices, including functionalized ones. Evaluation of decellularized biological matrices and synthetic constructs from electrospinning.

Computational sciences and experimental biomechanics applied to orthopedic surgery

Calculator-assisted surgical planning. Development, validation, and clinical application of numerical models of osteoarticular mechanics. Software for rapid prototyping of medical devices and functional assessments. Comparative evaluations of the mechanical strength of musculoskeletal tissue reconstruction techniques. Experimental tests using international standards or in-house-developed protocols to determine the mechanical performance of implantable and non-implantable orthopedic devices.

Musculoskeletal oncology

Genetic analysis of bone tumors conducted on experimental models, tissue samples, and blood samples using advanced technologies such as NGS, Digital PCR, and qPCR. Development of new preclinical models for bone sarcomas, such as patient-derived xenografts and 3D models that recreate the tumor microenvironment. Crosstalk between tumor cells and immune system cells; exosomes as mediators of intercellular communication; and epigenetic mediators.

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Inflammation and Infection

Study of the etiopathogenetic mechanisms of musculoskeletal diseases, changes in the immune system during aging, and in osteoarticular diseases. Pathogenesis of prosthetic infections, the study of virulence factors and bacterial antibiotic resistance, molecular epidemiology, interactions between bacteria, tissues, and the immune system, and the development of innovative coatings and biomaterials to prevent infections and promote osseointegration.

Technologies for joint kinematics and dynamics

Study of in vivo measurements on individual patients or patient populations, using stereophotogrammetric, dynamometric, electromyographic and baropodometric systems. Their integrations with biomechanical modeling, with 3D skeletal reconstructions from biomedical images, and custom-made device designs.

SERVICE

- Preclinical in vitro tests on static, dynamic 2D and 3D models;
- Molecular biology tests, enzyme immunoassays, flow cytometry;
- Confocal, electronic microscopy;
- Preclinical in vivo tests;
- Histological, morphometric, and microdensitometric analyses;
- Material analysis for implantable devices;
- Biomechanical, kinematic and tribological analyses;
- Surface functionalization of implantable devices (nanotechnology);
- Prototyping and 3D printing;
- 3D scanning tools;
- Computational Biomechanics;
- Quantitative analysis of biomedical images;
- Development of biomedical software applications;
- Instrumental functional assessments of motor activities;
- Navigation and technologies for the Operating Room.
- Genetic analysis using next-generation sequencing techniques
- Molecular analysis of tissue and circulating biomarkers by applying digital and quantitative PCR techniques

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