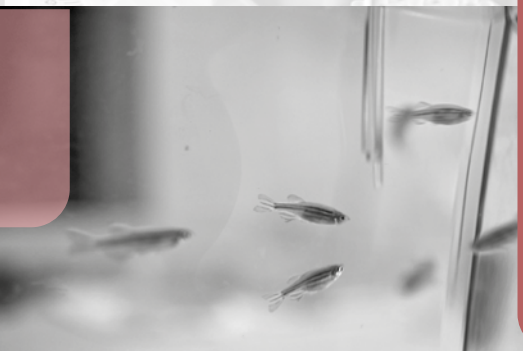
biogem

Research Activities

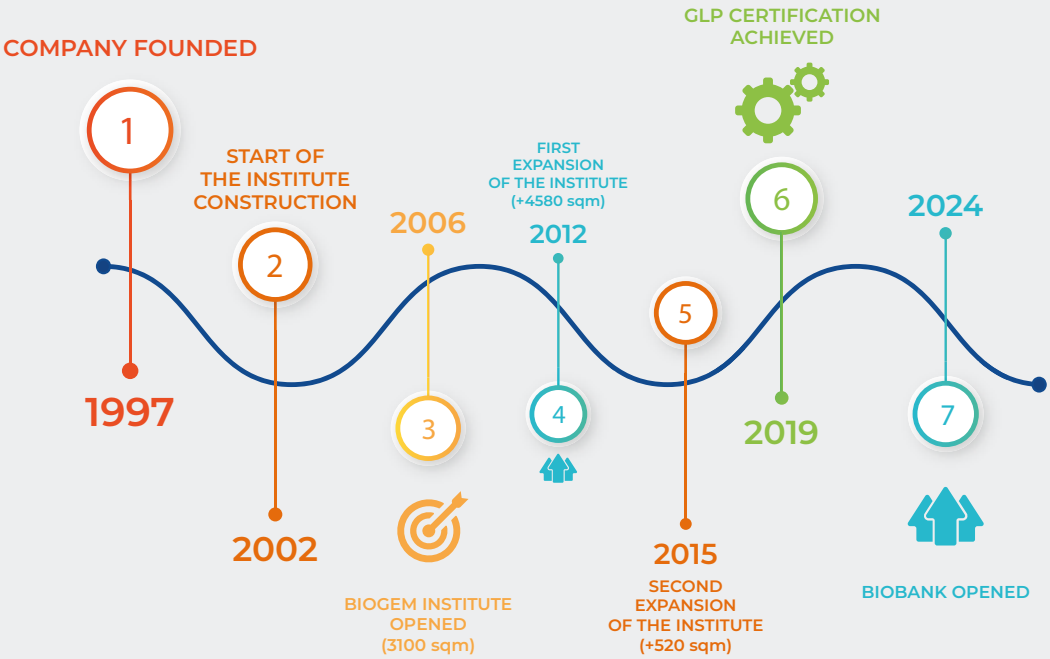


GOOD LABORATORY PRACTICE
GLP
CERTIFIED

since 2019

ISO 9001
BUREAU VERITAS
Certification
BUREAU VERITAS
1828

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO


COMPANY FOUNDED
1
1997
START OF
THE INSTITUTE
CONSTRUCTION
2
2002
2006
3
BIOGEM INSTITUTE
OPENED
(3100 sqm)
FIRST
EXPANSION
OF THE INSTITUTE
(+4580 sqm)
2012
4
5
2015
SECOND
EXPANSION
OF THE INSTITUTE
(+520 sqm)
GLP CERTIFICATION
ACHIEVED
6
2019
2024
7
BIOBANK OPENED

biogem

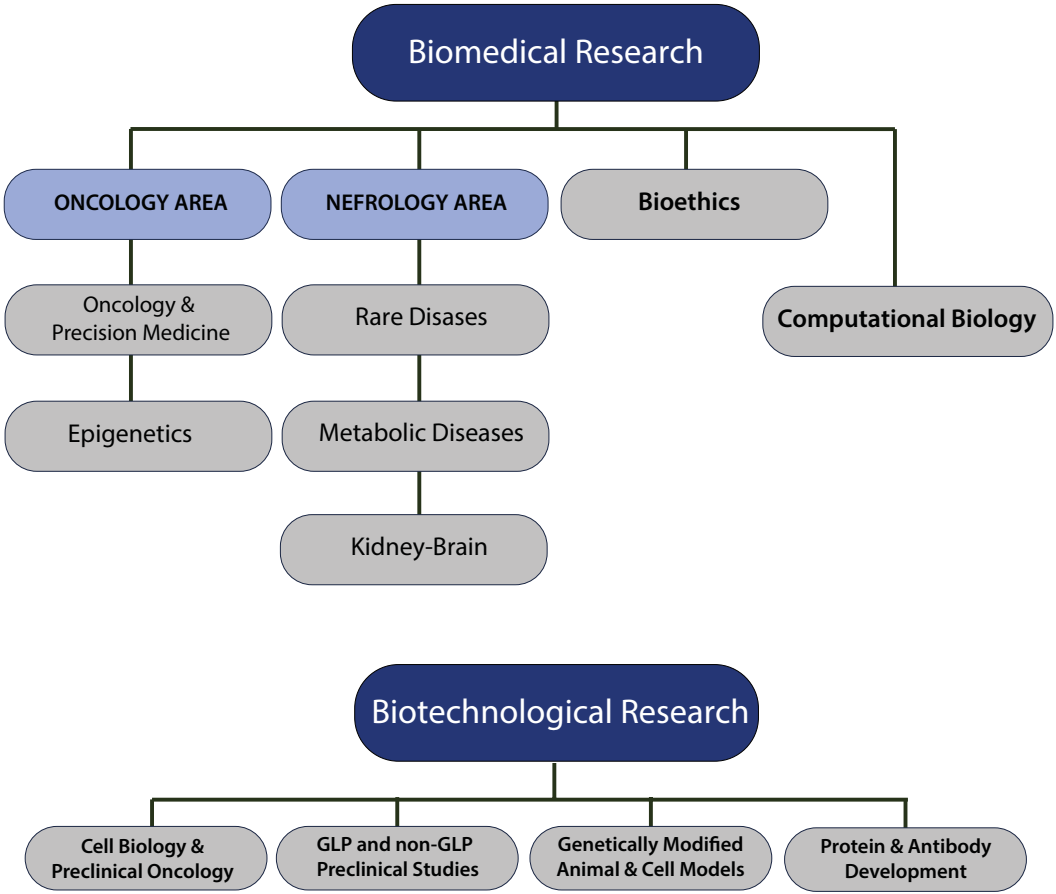
Biogem is an Italian biology and molecular genetics research institute.

Biogem's research is structured in two macro-areas: biomedical research and biotechnological research.

Biomedical research:

- Oncology Area, including Oncology and Precision Medicine, and Epigenetics
- Nephrology Area, including Rare diseases, Metabolic diseases, and Kidney and brain.
- Bioethics
- Computational Biology

Biotechnological research covers various fields of life sciences, providing highly specialized services in preclinical research, experimental pharmacology, analytical biochemistry, pathology, bioanalytics, protein and antibody development, nutraceutics, functional genomics, genetically modified animal and cell models, and biobank.


Biomedical Research
ONCOLOGY AREA
NEFROLOGY AREA
Bioethics
Oncology & Precision Medicine
Rare Disases
Computational Biology
Epigenetics
Metabolic Diseases
Kidney-Brain
Biotechnological Research
Cell Biology & Preclinical Oncology
GLP and non-GLP Preclinical Studies
Genetically Modified Animal & Cell Models
Protein & Antibody Development

Management

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Dott. Tullio **Bongo**

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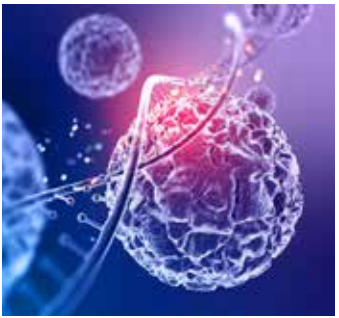
Prof. Enrico **Rizzarelli**

Molecular Oncology and Precision Medicine (Prof. Michele Caraglia)

The research activities of the laboratory include the following areas:

- Identification of miRNA signatures and cancer genotyping
- Characterization of circulating intra-cellular miRNA signatures, with the aim of determining a circulating miRNA signature with innovative nanosensors, for the diagnostic and prognostic determination of squamous cell carcinoma of the larynx and more generally in tumours. Identification of miRNAs as new targets in anti-cancer therapy and study of their involvement in cell signalling and programmed cell death.
- Genotypic characterization in next generation sequencing (NGS) of human cancers, such as colorectal, breast, bladder, lung and hepatocellular carcinoma. Study of the total RNA expression in tumours and their correlation with metabolic, signalling functions and programmed cell death.
- Single cell RNA sequencing of tumours for the study of microenvironment and identification of new tumour markers.
- Tumour organoids from head and neck cancers.
- Establishment of organoids and patient derived xenografts from patients for the validation of new experimental therapies.
- Characterization of the circulating methylated DNA from patients

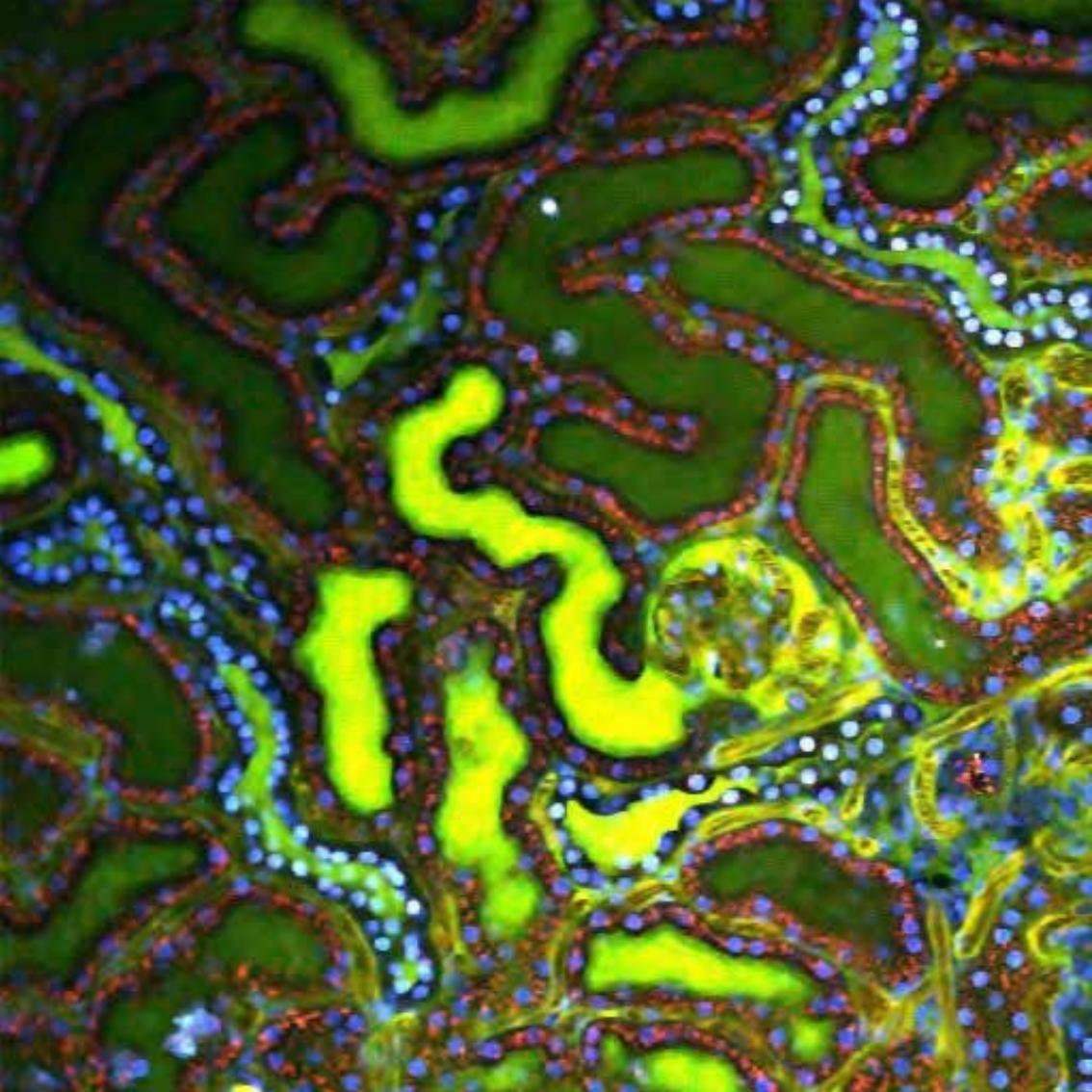


- Identification of circulating methylated DNA profiles and ctDNA fragmentation for early diagnosis, detection of minimal disease residue and prediction of response in several cancers (i.e.: melanoma, colo-rectal, breast, lung, prostate and bladder cancer).

Epigenetics (Prof.ssa Lucia Altucci and Prof. Vincenzo Carafa)

The research activities of the laboratory include:

- Study of the role of epigenomic alterations and epigenetic modifications, also at the single cell level, in human pathologies, with a focus on leukemia and solid tumors, degenerative, cardiovascular and metabolic pathologies.
- Development of diagnostic and prognostic methods for identifying the disease and the response to treatments.
- Identification and characterization of innovative treatments based on the use of new molecules that target chromatin.
- Study and characterization of the main molecular and cellular players involved in immunomodulatory activity and induction of regulated cell death.



Nephrology Area (Prof. Francesco Trepiccione)

The laboratory aims to advance the knowledge of the molecular mechanisms underlying kidney diseases in order to identify new therapeutic targets or new prevention and diagnosis factors. It includes three thematic areas:

Rare diseases (Dr. Anna Iervolino)

Starting from the generation of mouse and zebrafish models of kidney diseases, it focuses on the causal mechanisms of specific rare kidney diseases, such as Fanconi syndrome, Bartter syndrome, nephrogenic diabetes insipidus, Bardet-Biedl syndrome and focal segmental glomerulosclerosis.

Metabolic diseases (Dr. Yoko Suzumoto)

The main interest is the translational research on metabolic diseases, with a focus on obesity, diabetes and hypertension. Our goal is to advance the understanding of metabolic disease pathophysiology, identify novel cardiometabolic markers and develop targeted therapeutic strategies.

Kidney-Brain (Prof. Giovambattista Capasso)

Kidney failure, especially the advanced one, is often complicated by a significant reduction in cognitive abilities. Using experimental models of chronic kidney failure and the technologies necessary for the characterization of cognitive functions in rodents and zebrafish, it studies the factors responsible for the correlation between kidney failure and cognitive decline, in order to identify the relevant molecular processes and possibly discover potential new therapies.

Bioethics (Dr. Michele Farisco)

The Bioethics Unit collaborates with philosophers, cognitive and computational neuroscientists, and researchers in AI and robotics to reflect on the ethical and societal impact of scientific research. Specifically the Bioethics Unit is currently engaged in the theoretical and ethical analysis of consciousness and related disorders (i.e., coma, vegetative state, minimally conscious state) and of AI, including the possibility of developing an artificial consciousness.

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The Bioethics Unit collaborates with the EU project "Counterfactual Assessment and Valuation for Awareness Architecture" (CAVAA), which is about artificial awareness, and with the Cost Action AFFECT-EVO, which is about animal affective and emotional states.

Computational Biology (Prof. Michele Ceccarelli)

The laboratory is a multidisciplinary research group dealing with computational biology and precision oncology. The main research areas of the laboratory are:

- Cancer genomics and drug resistance. This research area focuses on the in-depth analysis of the molecular mechanisms that drive cancer progression and the development of resistance to oncological treatments.

- Immunological characterization of tumors. Using advanced technologies such as Next-Generation Sequencing (NGS), the laboratory develops computational approaches to analyze the tumor microenvironment.

- Development of bioinformatics tools. The laboratory is specialized in the development of open-source bioinformatics software for the analysis and integration of omics data, improving the identification of genetic mutations and the immune characterization of tumors.

- Early diagnosis of tumors. The laboratory research focuses on the development of advanced tests for the early diagnosis of tumors, based on the DNA methylation analysis from liquid biopsies.

Cellular Biology & Preclinical Oncology (Prof. Geppino Falco)

The laboratory research focuses on understanding the molecular mechanisms that regulate self-renewal and differentiation of stem cells.
The goal is to identify molecular targets capable of inducing differentiation of gastric cancer stem cells in order to improve diagnosis and therapy of cancers associated with the gastric tract through "precision medicine".

Main research lines:

- Epigenetics and Energy Metabolism of stem cells
- Role of calcium channels in the apoptotic resistance of gastric cancer cells: identification of presumed molecular targets
- Comparison of adjacent tissue and tumor tissue
- Role of cellular heterogeneity and self-renewal capacity in the chemo-resistance of gastric cancer

GLP Test Facility (Dr. Luigi Marvasi)

Animal Facility: In vivo phase of regulatory studies with rodents (rats and mice) and rabbits, including laboratories for biological sample collection

Formulation Laboratory: Preparation of relevant formulations (solutions, suspensions, emulsions, etc.) and storage of test products under controlled conditions

Histopathology Laboratory: Preparation of histopathological samples and their microscopic evaluation

Hemato-biochemistry Laboratory: Hematological and biochemical analyses on blood and serum samples, and urine analyses

Molecular Biology Laboratory: Development and validation of molecular biology analytical methods and execution of molecular analyses on nucleic acids and proteins from cells and tissue samples

Bioanalytical Laboratory: Development and validation of chromatographic analytical methods: HPLC-MS/MS, HPLC-UV

Cell Culture Laboratory: Biocompatibility studies (cytotoxicity, genotoxicity), drug discovery, cell lines management

Quality Assurance: Monitoring of the compliance of the test facility and experimental studies with GLP standards

Genetically modified animal & cell models (Prof. Concetta Ambrosino)

Gene targeting and experimental embryology

Genetically Modified Cellular Models

Biogem offers a high quality custom generation of cell models using advanced molecular biology technologies.

List of services:

- Design of a custom strategy
- Construction of a targeted vector
- Electroporation, transfection, and infection of murine and human cell lines
- Selection, validation, and sequencing of inserted gene modifications

Genetically Modified Mouse Models

Biogem offers a high quality custom generation of mouse models using advanced molecular biology technologies.

List of services:

- Design of a custom strategy
- Writing of the project for ragulatory authorization
- Construction of a targeted vector
- Electroporation of mouse embryonic stem (ES) cells
- Evaluation of ES cells for homologous recombination

- Generation of chimeric mice by morula or blastocyst injection
- Import and use of ES clones obtained from consortia such as KOMP and EUCOMM
- Evaluation of germline transmission
- Breeding of chimeric mice by heterozygosity
- Import and breeding of genetically modified mice from international distributors
- Rederivation of acquired lines
- Sperm freezing of generated and acquired lines

Zebrafish Models

List of services:

- Generation of genetically modified in vivo models for the study of different human pathologies;
- Generation of xenograft models for the study of different types of tumor;
- Screening of molecules to evaluate their toxicological or antitumor effect.
- Definition of the targeting strategy
- Writing of the project for ragulatory authorization
- Injection through transgenesis, constitutive and conditional knockouts, over-expression (CRISPR/Cas9 system)
- Phenotypic characterization of the model
- Behavioral studies
- Sperm freezing of the lines generated
- In vitro fertilization (IVF)

Protein & Antibody Development Unit (Dr. Alessandra Fucci)

It serves as an interface between advanced molecular biology and applied diagnostics and therapeutics. Its activities span the Technology Readiness Level (TRL) continuum, from early molecular design and expression screening (TRL 3 - 4) to process optimization and analytical validation (TRL 6).
The platform combines IP-free vector libraries with tailored engineering strategies to enhance yield, stability and functional performance of recombinant proteins and antibody derivatives. Quality and molecular integrity are ensured through advanced analytical technologies including: SPR for kinetic and affinity profiling, HPLC for purity and structural assessment, and LC-MS/MS for high-resolution molecular characterization.

Core Research pillars are:
-Therapeutic innovation: development of proteins, antibodies and next-generation formats such as nanobodies, scFv, and Antibody-Drug Conjugates (ADCs)
-Diagnostics development: design of ELISA platforms and prototypization of biomarker-based detection systems
-Functional genomics: target validation and pathway analysis to support emerging therapeutic strategies.

Current research programs focus on:
-Optimized protein fragments with improved pharmacological properties (PNRR–PoC)
-Next-generation ADCs using site-specific conjugation to minimize off-target toxicity in solid tumors
-Innovative diagnostic platforms for early detection and monitoring of cognitive impairment

Animal Facility (Dr. Francesco Cardile)

The Biogem animal facility covers an area of 1,400 sqm and is authorized to have the following animals for biomedical research by the Ministry of Health with ministerial decree no. 08/2023-UT in accordance with Legislative Decree 26/2014 concerning the protection of animals used for scientific purposes:

1. Mice, rats, rabbits
2. Medaka, zebrafish

The facility is able to conduct in vivo safety and efficacy studies of human pathologies on animal models to check the properties of a drug revealed in vitro. To this aim, the facility includes different areas for experimental activities:

- GLP area
- Specific Pathogen Free, SPF, area
- Germ Free area

Biobank (Dr. Antonello Calcutta)

The Biobank is dedicated to the biobanking activities of biological material manipulated by both Biogem research groups and external collaborators. Its main focus is translational medicine for the treatment of tumor diseases. The services it offers include:

- Collection of biological samples, including blood, tissues, saliva, urine, DNA, RNA and other biological materials from patients, healthy volunteers or donors
- Rental of storage spaces, either all cryopreservation spaces, such as dewars operating at -180°C, or freezers operating at -80°C
- Participation in national and international research projects with both public and private bodies

Scientific Outputs

Publications

The scientific production of the Biogem researchers in the period 2020-2025 has the following bibliometric indicators:

- Total articles with Biogem authors: 410
- Total articles with first and/or last or corresponding Biogem authors: 179
- Average Impact Factor of articles with first and/or last or corresponding Biogem authors: 7.31

Selected Publications

- Del Gaudio N, Di Costanzo A, Liu NQ, Conte L, Dell'Aversana C, Bove G, Benedetti R, Montella L, Ciardiello F, Carafa V, Ambrosino C, Tucci V, Conte M, Martens JHA, Stunnenberg HG, Nebbioso A, Altucci L. CBX2 shapes chromatin accessibility promoting AML via p38 MAPK signaling pathway. Molecular Cancer. 2022 Jun 9;21(1):125. doi: 10.1186/s12943-022-01603-y. PMID: 35681235; PMCID: PMC9178829.
- De Falco A, Caruso F, Su XD, Iavarone A, Ceccarelli M. A variational algorithm to detect the clonal copy number substructure of tumors from scRNA-seq data. Nat Commun. 2023 Feb 25.
- Noviello TMR, Di Giacomo AM, Caruso FP, Covre A, Mortarini R, Scala G, Costa MC, Coral S, Fridman WH, Sautès-Fridman C, Brich S, Pruneri G, Simonetti E, Lofiego MF, Tufano R, Bedognetti D, Anichini A, Maio M, Ceccarelli M. Guadecitabine plus ipilimumab in unresectable melanoma: five-year follow-up and integrated multi-omic analysis in the phase 1b NIBIT-M4 trial. Nat Commun. 2023 Sep 22.

- Trepiccione F, Iervolino A, D'Acierno M, Siccardi S, Costanzo V, Sardella D, De La Motte LR, D'Apolito L, Miele A, Perna AF, Capolongo G, Zacchia M, Frische S, Nielsen R, Staiano L, Sambri I, De Cegli R, Unwin R, Eladari D, Capasso G. The SGLT2 inhibitor dapagliflozin improves kidney function in glycogen storage disease XI. Science Translational Medicine 2023 Nov.
- Capasso G, Franssen CFM, Perna AF, Massy ZA, Menzies RI, Zoccali C, Tessitore A, Nedergaard M, Okusa MD, Ortiz A, Wagner CA, Unwin RJ. Drivers and mechanisms of cognitive decline in chronic kidney disease. Nat Rev Nephrol. 2025 Apr 25. doi: 10.1038/s41581-025-00963-0.
- di Paola, G., Albano, F., Zoppoli, P., Bravoco, D., D'Amore, T., Amendola, E., Lucci, V., Roberto, L., Brancaccio, M., Salerno, P., Calice, G., Laurino, S., Russi, S., De Stefano, C., Mariello, M., Merla, G., Falco G., Hormonally upregulated neu tumor-associated kinase (HUNK) modulates gastric cancer progression through the regulation of cell homeostasis. Cell Communication and Signaling 23, 320 (2025). https://doi.org/10.1186/s12964-025-02329-2.
- Bocchetti M, Cossu AM, Porru M, Ferraro MG, Irace C, Tufano R, Vitale G, Misso G, Amodio N, Scrima M, Simeone I, Ceccarelli M, Chianese U, Altucci L, Desiderio V, Regad T, Caraglia M, Zappavigna S. MiR-423-5p is a metabolic and growth tuner in hepatocellular carcinoma via MALAT-1 and mitochondrial interaction. J Exp Clin Cancer Res. 2025 Sep 30;44(1):270. doi: 10.1186/s13046-025-03524-2. Erratum in: J Exp Clin Cancer Res. 2025 Nov 7;44(1):301. doi: 10.1186/s13046-025-03562-w. PMID: 41029313; PMCID: PMC12487375.

Patents

Biogem currently holds two international patents, one on retinoid derivatives with antitumor properties and one on a miRNA molecular signature biosensor with diagnostic interest in human diseases.

Media & Contacts

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