

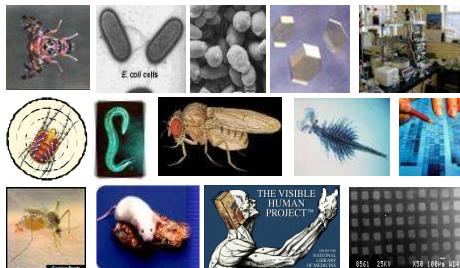
Greek Life Sciences Business Day

Institute of Molecular Biology & Biotechnology

Technologies

Models

Services



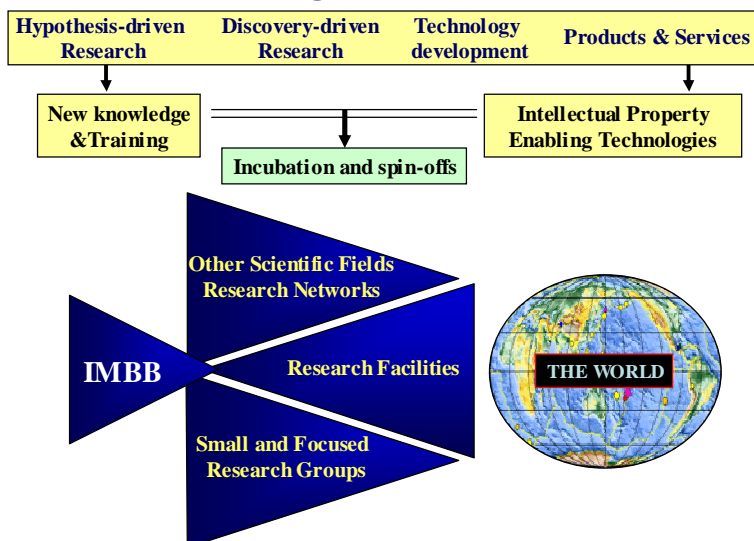
...in the postgenomic era

Dimitris Kafetzopoulos
Principal Researcher
PostGenomic Research Applications
kafetzo@imbb.forth.gr

IMBB
FORTH

IMBB-FORTH

aiming at excellence



IMBB-FORTH SAC Committee



Dr. Fotis C. KAFATOS, Chair
Ex- IMBB & Ex-EMBL director,
Imperial College & Chairman of the ERC

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Max-Planck-Institute Germany

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Dr. Elliot M. MEYEROWITZ
California Inst. of Technology, USA

Dr. Frank GROSVELD
Erasmus Univ Rotterdam

Dr. Edwin M. SOUTHERN
University of Oxford, UK

Dr. Jules HOFFMANN
CNRS, Strassbourg

Dr. Christoph W. MÜLLER
EMBL Grenoble Outstation



Organizational Structure of IMBB

DIRECTOR SCIENTIFIC COUNCIL

RESEARCH GROUPS

| | | | | |
|------------|------------------------------|-----------------------------|------------------------------------|--------------------------|
| SAC | Protein Structure & Function | Computational Biology | Developmental & Functional Biology | Insect Molecular Biology |
| | Gene Expression | Multi disciplinary Research | Plant Sciences | |

FACILITIES

| | | | | |
|-----------------------------|-------------------------|------------------------------|--------------------------|--------------------------------|
| Fermentation & Purification | Protein Crystallography | Unit of Quantitative Biology | Advanced Microscopy Unit | Insectarium-Transgenic Insects |
| Animal Cell Culture | Insect Cell Culture | Transgenic Animals | Animal House | DNA Sequencing |
| | | | | Post-genomics |
| | | | | Computing |

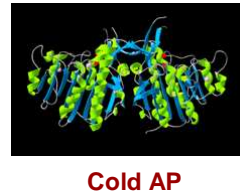
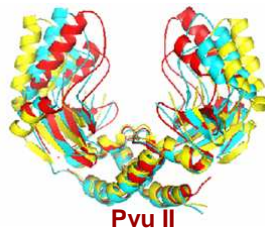
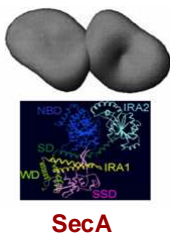
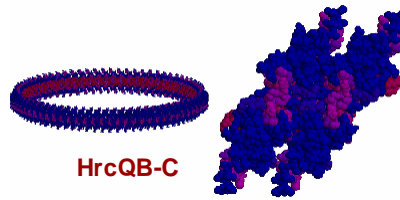
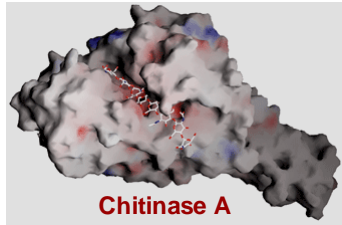
SERVICES: MINOTECH and Microchemistry Laboratory

ACCOUNTING & PURCHASING ADMINISTRATION

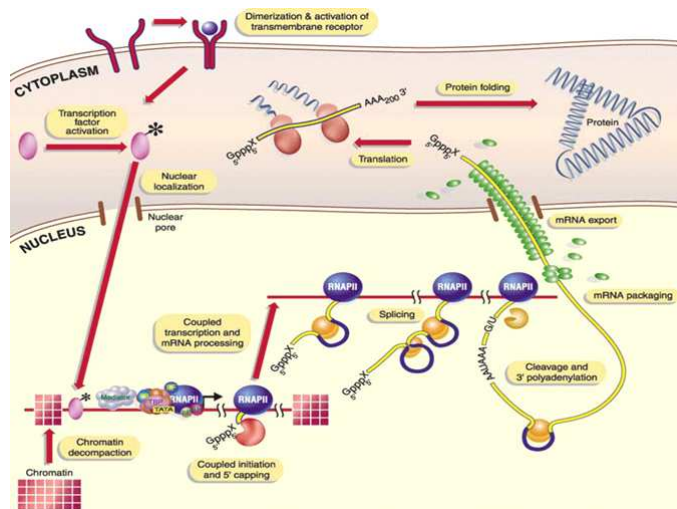
TECHNICAL & OPERATIONAL SUPPORT

| | | |
|-------------------------|---------------------|------------------------------------|
| Photographic Laboratory | Electronic Workshop | Glassware & Laboratory Maintenance |
|-------------------------|---------------------|------------------------------------|

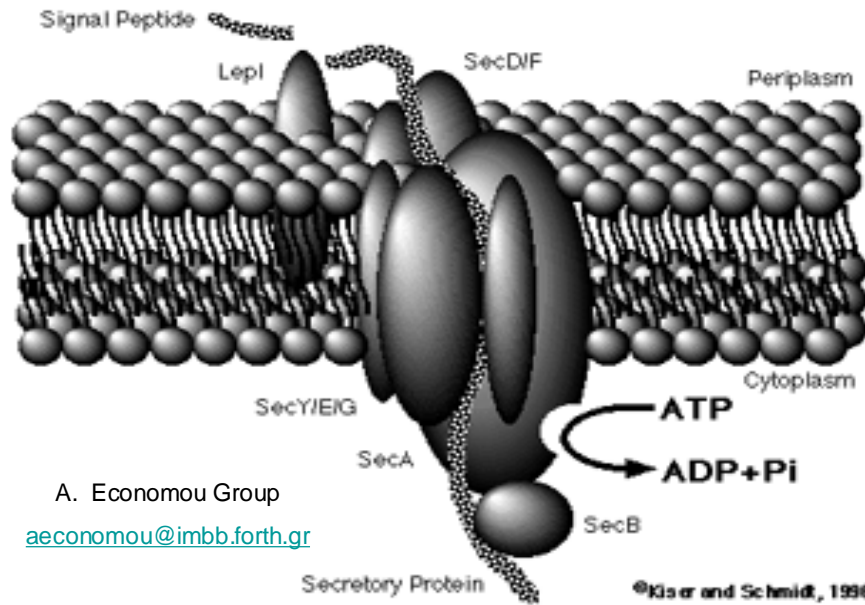
Bacterial Protein Structures



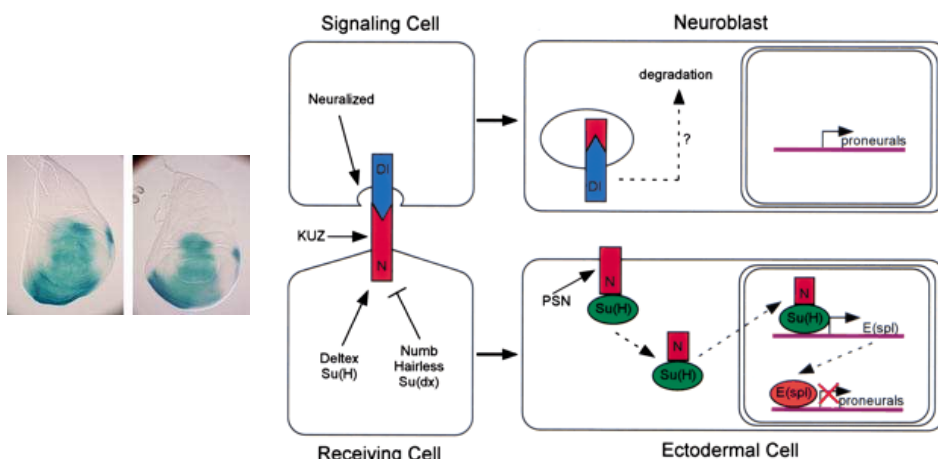
Regulation of Gene Expression



Bacterial Protein Secretion



Signaling cell fates



What we do with worms



Neurodegeneration - Necrotic Cell Death



Learning and Memory



Sensory Perception - Mechanotransduction



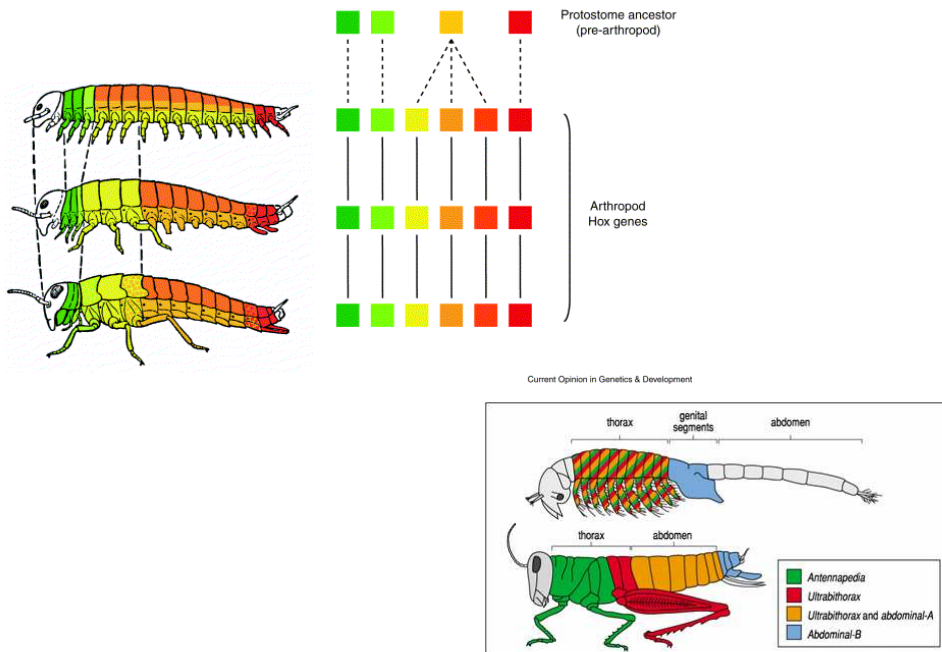
Ageing - Senescent Decline



Tool Development:

- Transposon mediated mutagenesis and transgenesis
- Versatile/improved RNAi methodologies

EVO-DEVO



THE model for human disease



The obese mouse

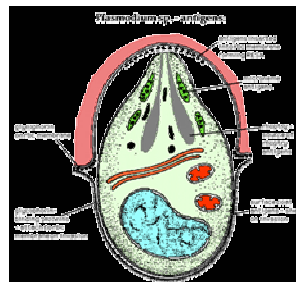
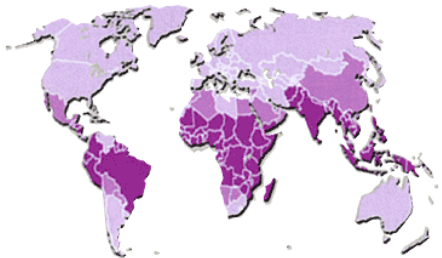


The diabetic mouse



The oncomouse

Malaria research



IMBB member of the Anopheles Genome consortium

The
ProgenoChip
PROJECT



➤ The first, and till now the only, national post-genomic research project funded under the “Operational Programme for Competitiveness - Thematic field: Health” of the GSRT

➤ It brings together a broad variety of experts surgeons, anatomists, molecular biologists, bioinformaticians and biostatisticians

➤ Aims to identify and validate molecular classification and prognosis markers for breast cancer (one of the most common and heterogeneous malignancies affecting women with life time risk ~ 10%).

➤ **ProgenoChip technological developments:**

- Establishment of the first Biospecimen Bank
- Maintenance of e-Health record for all included cases
- Full-human-genome gene expression profiling
- Integration clinical and post-genomic data
- A suite of data-mining tools for the analysis

IMBB Facilities



Animal House



Protein Crystallography



Cell Culture



Insectarium-Transgenic insects



Transgenic Animal facility



Fermentation & Purification



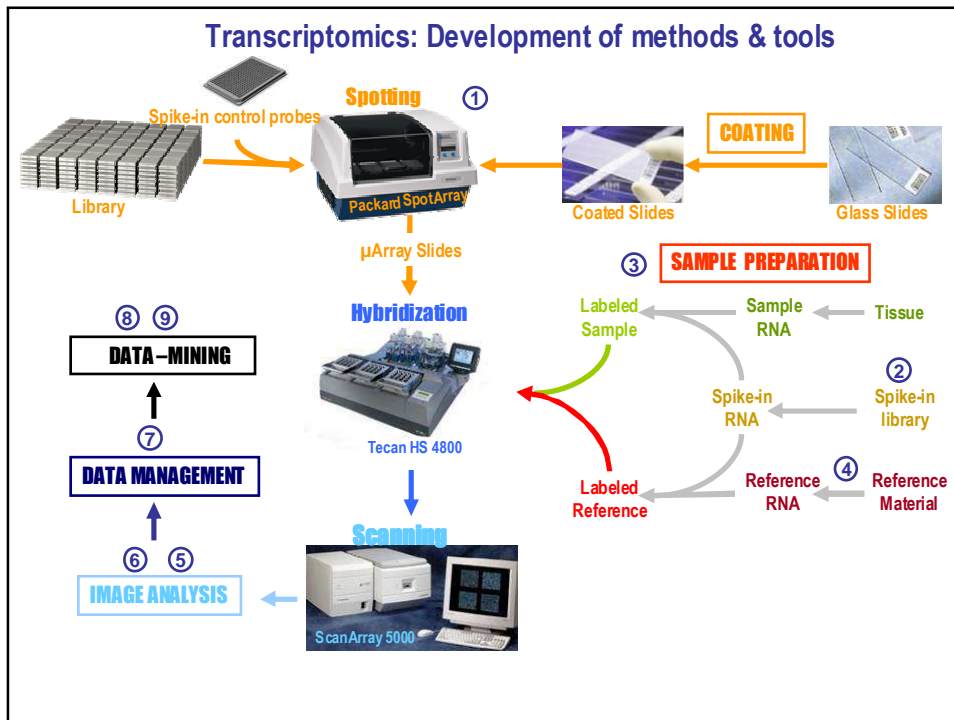
Post-genomic facility



DNA Sequencing



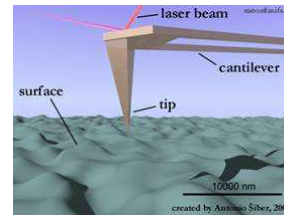
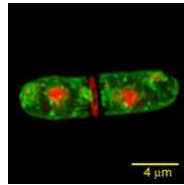
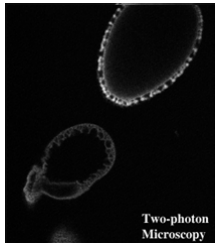
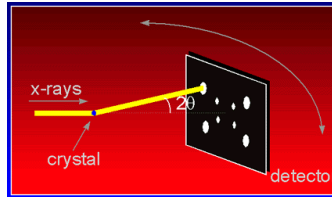
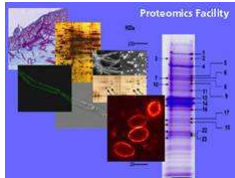
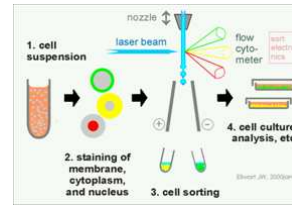
Advanced Microscopy



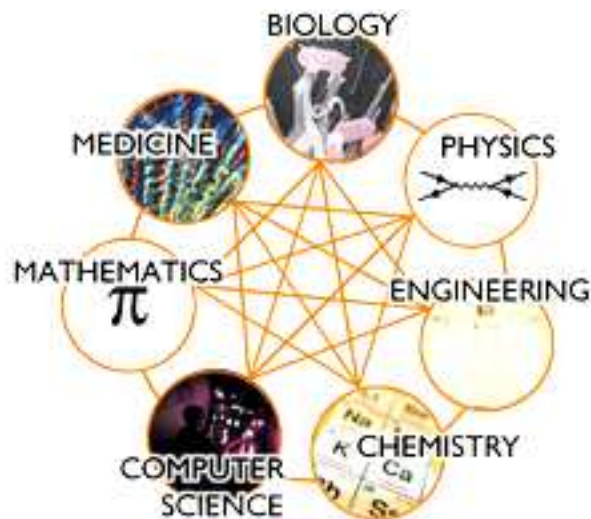
Affymetrix platform technology

- Transcription Profiling
- Genotyping
- Mutation analysis
- Re-sequencing
- Transcription factor binding
- Chromatin modification
- Origins of replication

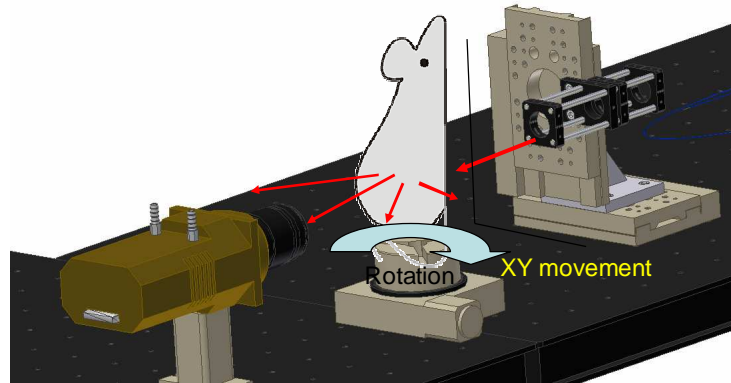
Expansion and addition of Facilities



Inter-disciplinary research



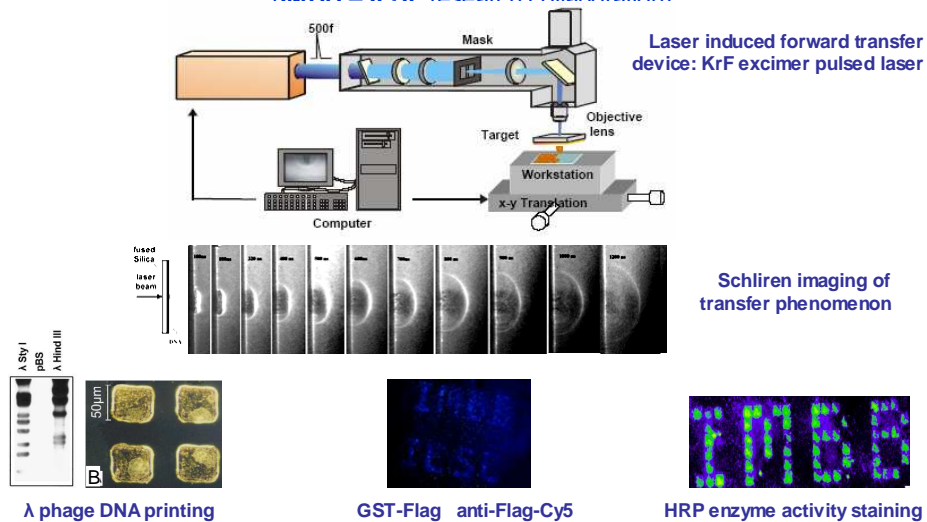
DEVELOPMENT OF OPTICAL TOMOGRAPHY



Imaging of FPs and Fluorochromes in VIVO: Gene expression, cell trafficking, disease diagnosis & progression

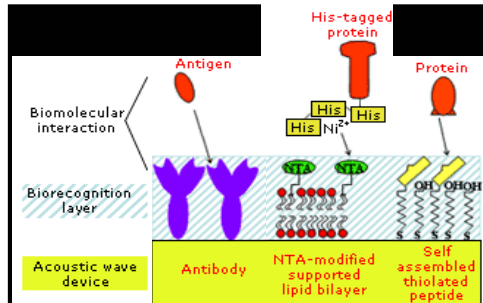
Ultrafast Lasers Print Biopolymers

(IMRR – IFSI research collaboration)

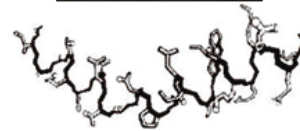
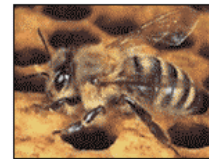


Karaiskou A, et al. *Applied Surface Science*, Vol. 208-209, pp. 245-249, 2003.
 Zergioti I., et al. *Applied Physics Letters*, Vol 86, 163902, 2005
 I. Zergioti, et al *Applied Surface Science* (in press)
 Fotakis K. et al. *PCT/EP02/14761 (24-DEC-02)*

ACOUSTIC BIOSENSORS



... and their use in the development of anti-microbials



Melittin

Magnetic Capacitive Biosensor a proprietary platform



OBI
Hellenic
Industrial
Property
Organization

Patent Title:

“Biosensor by monitoring magnetically induced capacitance changes”

Application Number: 20080100140

Application Date: 4/3/2008

Inventors: Kafetzopoulos D., Andreakou P., Chatzandroulis S,
Boutopoulos C, Goustouridis D, Zergioti I, Normand P, Tsoukalas D.

The present invention relates to a biosensor and a method for the identification, characterization, qualitative and quantitative detection of target molecules and molecular interactions by the means of monitoring magnetically induced pressure changes on capacitive sensors.



VectorBase

AnoBase

THE ANOPHELES DATABASE

| | | |
|--|--|---|
| | Maps | Information on cytogenetics and in situ hybridizations , other maps |
| | Sequences | Information on genomes transposons and cDNA |
| | Genes & Gene products | New genomic map available: Search ENSEMBL's set of Anopheles genomes and ESTs Access the proteomic databases of Anopheles gambiae and stephensi |
| | Ano-Xref | Use our local blast server to run your sequence versus Anopheles sequences |
| | Blast server | CV for Malaria Anatomy , more to come soon. |
| | Controlled Vocabularies and Ontologies | |
| | Constructs & Transposons | Information on constructs , mutated transposons or transposon insertions |
| | Inversions | Information on inversions |
| | Markers | Information on microsatellites , RFLPs , SNPs , etc. |
| | Population | Information on population data studies |
| | Insecticide Resistance | Information on insecticide resistance studies in Anophelines |
| | References | Information on published references |
| | The Coluzzi Papers | Recent collection of Dr. Mario Coluzzi |
| | Species | Information on Anopheles species (sequences etc.) |
| | Community | People , networks , etc. |
| | Documents etc. | New Documents , Conferences , Contributions , etc. |
| | Links | Interesting links |
| | Coming soon! | Resources in grey letters are not yet available! |

AnoBase is a database containing genomic/biological information on anopheline mosquitoes, with an emphasis on *Anopheles gambiae*, the world's most important malaria vector. AnoBase is the continuation of AnDB, a database established and maintained since 1996 at the Institute of Molecular Biology and Biotechnology (IMBB) of the Foundation of Research and Technology - Hellas (FORTH) in Heraklion, Crete, Greece.

AnoBase was funded by grants from the UNDP/World Bank/World Health Organization Special Programme for Research and Training in Tropical Diseases (SPRTD) and is now supported by the NCI of various disease vectors. The help of several colleagues was (and still is) invaluable in the setting up and the further development of this database. These are many people who were (and still are) Anopheles: Kate Neilson, Marc Bonfield, Steve Reynolds, Ursula Bremer, Frank Collins, David Hamon, Bill Gething, Anthony de Grey, Tracy James, Pierre Baldino, Julio Mojigas, Maria Mouton et al. here. Thank also to the [John D. and Catherine T. McArthur Foundation](#) for its support at the initial phase of this project.

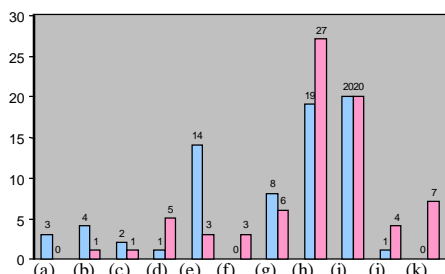
<http://www.anobase.org>

Advancing Clinico-Genomic Trials on Cancer

The ACGT project aims to deliver to the cancer research community an integrated Clinico-Genomic ICT environment:

- (a) **GRID**: European Biomedical GRID infrastructure offering seamless mediation services for sharing data and data-processing methods and tools, and advanced security;
- (b) **Integration**: semantic, ontology based integration of clinical and genomic/proteomic data - taking into account standard clinical and genomic ontologies and metadata;
- (c) **Knowledge Discovery**: delivery of data-mining GRID services in order to support and improve complex knowledge discovery processes.
- (d) and promote **open source, open access** an **global federation** of clinico-genomic data to accelerate cancer research.

Distribution of IMBB personnel



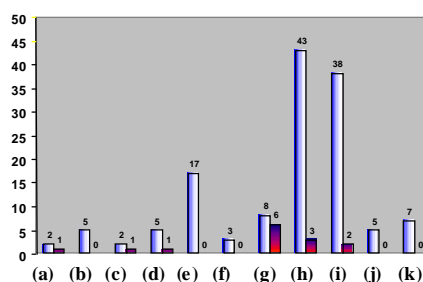
- (a) Researchers A
- (b) Researchers B
- (c) Researchers C
- (d) Functional Scientific Personnel
- (e) Visiting Researchers
- (f) Senior Scientists
- (g) Postdoctoral Fellows
- (h) Scientists under research training
- (i) Technical personnel
- (j) Administrative Personnel
- (k) Auxiliary Personnel

... by sex

■ Males
■ Females

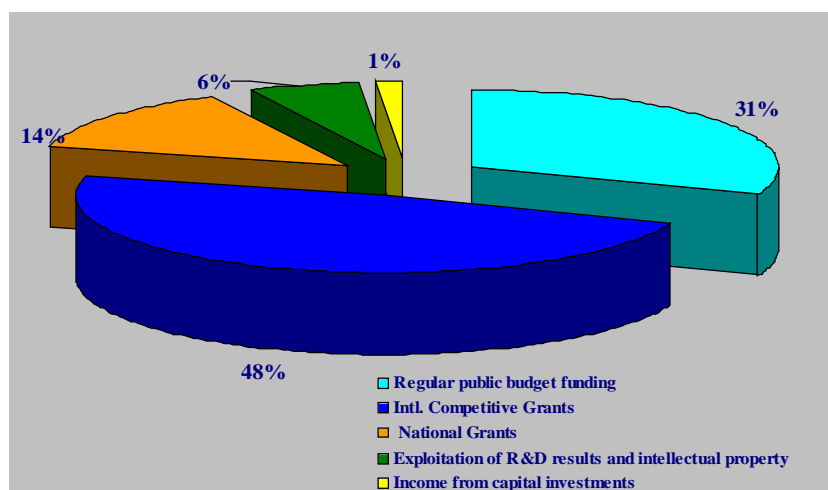
... by nationality

■ Greek
■ Other



Income 2004

(5,855,777€)



IMBB-FORTH: Research output...

| ... since the establishment of the IMBB (1983) | | | | | |
|--|-----------|---------|-----------|---------|-----|
| Publications | Citations | Cit/Pub | Pub/Res/Y | Patents | PhD |
| 818 | 11.511 | 14,07 | 2,10 | 10 | 64 |

IMBB-FORTH Products & Services

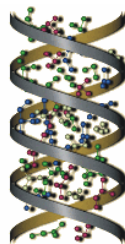
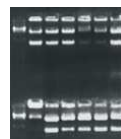
MINOTECH Biotechnology

PRODUCTS

DNA restriction enzymes
DNA modification enzymes
Cytokines

SERVICES

Fermentation
Protein expression
Protein purification



IMMUNOLOGY

PRODUCTS

Hormonal immunodiagnostics
Reproductive management of cows
Procedure employed by DELTA S.A.



MICROCHEMISTRY

PRODUCTS

Custom DNA oligonucleotides

SERVICES

DNA sequencing
GMO testing

IMBB-FORTH

Intellectual property-Technologies

PATENTS

- Process for isolating and preparing purified chitin deacetylase (Univ.Liege)
- Insect Control System (Assigned to Minos Biosystems)
- Pest Control System (Assigned to Minos Biosystems)
- Eukaryotic transposable element (Assigned to Minos Biosystems)
- DNA encoding chitin deacetylase (Marine Polymers Inc., Univ. Liege)
- DNA encoding an arthropod chitin synthase (Bayer)
- An inhibitor of Arthropod Chitin Synthase (Bayer)
- Fabrication of biopolymer patterns by means of laser transfer
- MagnetoCapacitive Sensor

Platform Technology – MINOS BIOSYSTEMS LTD

- Eukaryotic transposable element

ENABLING TECHNOLOGIES

- Production of recombinant proteins → functional verifications
- Structural and functional genomics → gene discovery
- DNA profiling
- Mouse transgenesis
- Insect transgenesis

IMBB

Industrial partners

| | |
|-----------------------------------|---|
| <i>SecA inhibitors</i> | <i>Pfizer</i> |
| <i>Chitin deacetylation</i> | <i>Chitozyme, Marine Biopolymers</i> |
| <i>Chitin synthase inhibitors</i> | Bayer |
| <i>Secretion Biotechnology</i> | <i>SmithKlein Beecham</i> |
| <i>Molecular Biology Enzymes</i> | <small>NEW ENGLAND</small> BioLabs BOEHRINGER MANNHEIM |
| <i>Molecular Diagnostics</i> | Βιοδιαγνωστική |

Concluding from our Experience in Applied Research (1)

- The ultimate goal for a research institution is to generate ground breaking knowledge that would lead to innovation and applications.
- This requires awareness of the technological significance of scientific results and proper intellectual property management
- Services and Products from Research institutions should occur only on unique expertise, should respect the market laws and should not compete with enterprises.
- Spin-offs and Start-ups should enjoy a defined incubation period (3-5 years) and then after operate on their own.
- Industry – academy research collaborations give academy the chance to raise its social and technological awareness and industry the chance to overcome innovation deficit and lack of agility in new technological fields.



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Concluding from our Experience in Applied Research (2)

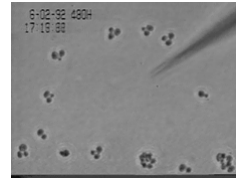
- Research outsourcing should obey rules and occur on **mutual benefit basis**.
- Services from **expert personnel**, share of know-how and **access to facilities** are important for cost effectiveness & agility
- Research contracts are **significant income** and **reasonable charges** should apply (100-150% overhead on labour cost)
- Research collaborations provide an excellent basis for **seeking further funding** National and European.
- Understanding life and trying to tame it –**basic and applied research** – are no separate realms. They are mutually dependent
- **Proper protection and management of intellectual property rights** and technological awareness are essential for a balanced and a mutual benefit research collaboration and vital for the success of innovation.
- Inventors should maintain ownership of IPR (unless sponsors specifically define the field of invention) and technology transfer practices should apply.



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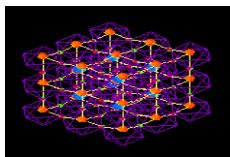
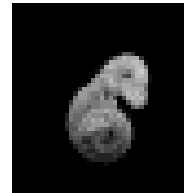
IMBB Investigates...

Gene expression under stress & in differentiation



The nervous system aging & neurodegeneration

Development & differentiation



Protein trafficking & molecular machines

Mosquitoes and malaria



IMBB Develops ...

Insect control systems (Minos Biosystems, Bayer)



New antibiotics (Pfizer)



DNA microchip prognostics (Breast cancer)



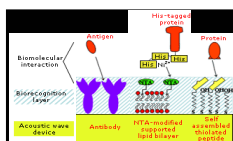
Gene silencing technologies (Crop protection)



Protein products (Enzymes & Biopharmaceuticals)



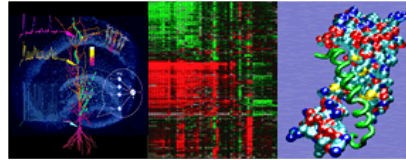
Acoustic biosensors



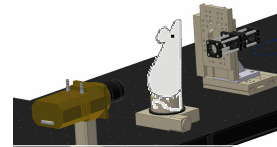
IMBB Promotes...

Interdisciplinary research

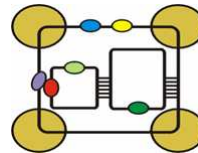
- → Computational Biology & Biomedical Informatics (IMBB-ICS)



- → Molecular imaging & tomography (IESL-IMBB)



- → Nano-biotechnology (IMBB-ICE/HT-IESL)



If you thought of Crete as a hot island only for leisure...



...think different.

