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Area of activity

Genomics / Postgenomics

Biophysics / Biochemistry

Bio-informatics / Mathematics

Engineering Sciences
MAIN TOPIC
- Biophysics/Structural biology/Therapeutics.

ACTIVITY (KEYWORDS)
- NMR, structure, mutations, tubulin, dystrophin, gp41, cancer, muscular dystrophies, nervous system, AIDS.

RESEARCH THEMES
- General themes:
  - Protein folding, structure, stability and dynamics.
  - Protein-protein interactions.
  - Effects of disease mutations on protein structure & stability and on protein-protein interactions.
- Specific themes:
  - Tubulin dynamics: structure of tubulin and associated proteins; role in cell division and neuronal function.
  - The ZZ and EF-ZZ domains of dystrophin: structure and functional consequences of point mutations in these domains associated with Duchenne muscular dystrophy.
  - Nuclear Id2 protein: structure and function in transcriptional regulation and cancer.
  - HIV protein gp41: domain structure, preventive and vaccinal immunogenicity.
  - Nanodiamonds as multifunctional vectors for therapeutic biomolecules.

HOLDER OF A GENOPOLE RESEARCH GROUP ESTABLISHMENT («ATIGE») GRANT
- “Microtubules, the cell cycle and neuronal function”.
  Leader: Patrick Curmi.
Center for Mechanical Engineering and Automation Studies and Research (CERMA)

**MAIN TOPIC**
- Engineering sciences.

**FIELD OF ACTIVITY**
- Development of new technologies, production tools, feasibility studies and specifications for products and machines requiring a multidisciplinary approach.
- Applications in the manufacturing industry, research and biology. The CERMA has been awarded «Technical Resource Center» status (CRT 97/6) by the French Ministry of Research.

**ACTIVITY (KEYWORDS)**
- Mechanical engineering, robotics, automation, instrumentation.

**RESEARCH THEMES**
- The CERMA covers the full range (from initial specification to commissioning) of complex projects, including mechanical engineering, electronics, special sensors and industrial IT. As a Technology Transfer Center of the University of Evry, it designs, builds and implements innovative machines, products and automated processes for a range of industrial sectors (notably in the field of biology).

The CERMA has particularly focused its work on the high-throughput automation of electrophoretic analysis and related techniques: sample preparation, dilution, PCR, UV luminescence imaging, etc. The CERMA collaborates with other public- and private-sector establishments: CNS, Génétion, University of Evry (CEMIF Lab), University of Paris 7, University of Paris 11, the Gustave Roussy Institute, INRET (LIVIC) etc.
Epigenomics Program

MAIN TOPIC
- Bioinformatics/Mathematics/Theoretical Biology.

FIELD OF ACTIVITY
- Modeling and simulation of biological processes in a (post-) genomics context. Epi-organization of the genome.

ACTIVITY (KEYWORDS)
- Modeling, simulation, macromolecular networks.

RESEARCH THEMES
- The Genopole Epigenomics Program (created in 2002 and whose slogan is «model to understand») aims first and foremost to be a forum for dialogue in order to catalyze research on complex biological problems via contributions from a range of disciplines: biology, informatics, mathematics, theoretical physics, artificial chemistry. The Program simultaneously serves as i) a vector for training researchers in disciplines other than their own, ii) a visiting researcher program (one of whose missions is to attract world-renowned scientists to Evry, iii) a mainly French-speaking, multidisciplinary research network with regular meetings, iv) a hotbed of pioneering science (stimulating the invention of new research subjects and supporting them through targeted, thematic activities) and v) a joint service which centralizes campus-based research efforts on modeling in biology.

Researchers meet together at the center via four operating modes: regularly-convened working groups, the incubation of new research groups, targeted, thematic activities and national/international conventions. Every activity funded by the Epigenomics Program is highly thematically targeted and is based around a small number of leading researchers. This program has inherited the activities of the Genopole Working Groups which have been tackling the issue of modeling and the impact of the new, post-genomic era in biology.

This activity represents a regularly-convened «core» of 80 researchers (mainly representing labs in Evry, Rouen, Bordeaux and Montpellier: 70 people with permanent positions and a dozen or so without permanent positions) and a «halo» of between one and two hundred attendees at the Program’s annual events (e.g. thematic courses). The Epigenomics Program is currently acting as an incubator for a promising young research group with Genopole Research Group Establishment («ATIGE») funding, in order to reinforce France’s profile in this domain.
MAIN TOPIC
• Genomics/Post-Genomics.

FIELD OF ACTIVITY
• Ankylosing spondylitis. DNA bank and a clinical/immunological database.

ACTIVITY (KEYWORDS)
• Genetics - Immunology - Spondylarthropathies.

RESEARCH THEMES
• Ankylosing spondylitis (the second most common chronic, rheumatoid, inflammatory disease after rheumatoid arthritis) represents the archetype and the most frequently encountered form of a group of ailments - the spondylarthropathies.
  The objective of the collection currently being constituted by Euroas is to characterize the genes involved in spondylarthropathies via the identification of a very large cohort of afflicted families (at least 500 multiplex families, i.e. about 5,000 people).
  With samples already collected from 350 European families, the collection will enable constitution of the “core” of a genomic bank and will allow French and European labs to access the genetic material and clinical phenotypes needed to find the genes responsible for the disease and to determine their roles.

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European Research Laboratory for Rheumatoid Arthritis – GenHotel

MAIN TOPIC
• Genomics/Post-Genomics.

FIELD OF ACTIVITY
• Research on genetic predispositions to rheumatoid arthritis (a multifactorial disease and the most common auto-immune pathology) and on the pharmacogenetics of treatments for the condition.

ACTIVITY (KEYWORDS)
• Rheumatoid arthritis, auto-immunity, multifactorial diseases, pharmacogenetics, cardiovascular disease.

RESEARCH THEMES
• Rheumatoid arthritis (the most common auto-immune disease) is a very painful condition which leads to progressive destruction of the joints. It is a multifactorial disease which probably involves a number of genetic factors (only one of which has been clearly identified). Novel biotherapies have been used, with varying therapeutic results. GenHotel is participating in the international search for genetic factors in this disease, with the goal of developing a definitive treatment. Strengthened by a bank of more than 5,000 DNA samples from families suffering from rheumatoid arthritis and its high-precision genome screening techniques (with more than 1,000 highly informative markers), GenHotel is pursuing the analysis of candidate genes likely to play a role in rheumatoid arthritis and in the response to biotherapies. GenHotel relies on a collaboration with Genopole, the «Statistics and the Genome» Laboratory headed by Professor Bernard Prum and the Genoscope headed by Professor Jean Weissenbach. In view of its ideal location at the South Ile-de-France Medical Center at Evry-Corbeil and the Lariboisière Hospital in Paris, GenHotel is developing a French national project on the pharmacogenetics of rheumatoid arthritis biotherapies. In order to increase the chances of discovering pathways towards a definitive treatment, and thanks to funding from the French Association of Rheumatoid Arthritis Sufferers, GenHotel is:
  1. sharing its resources by hosting researchers at its «science hotel».
  3. producing data on DNA supplied by external research groups as part of complementary projects.

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Exercise Physiology Laboratory (LEPHE)
Research Group EA 3872

MAIN TOPIC
- Genomics/Post-Genomics.

FIELD OF ACTIVITY
- Genomics and bioenergetics of muscle activity in healthy subjects and patients.

ACTIVITY (KEYWORDS)
- Motor performance, mitochondrion, heart, muscle, exercise.

RESEARCH THEMES
- The LEPHE’s work is set against a public health context, with the objective of optimizing motor performance. Our group analyzes the bioenergetic responses to muscle exercise (from physiology to molecular biology) in humans and animals (with murine and equine models). Our skills have earned us an international reputation in the field of effort training and re-training, thus enabling an improvement in motor performance regardless of whether the subject is a patient or an experienced athlete. In fact, we develop physical training methods which are specifically adapted to an individual’s physiological profile, in order to reconcile performance and health. Our group publishes an average of about ten articles a year on this subject in international applied and basic physiology journals (indexed in the SCI).

Over the last two years, the LEPHE has studied exercise-related molecular adaptations by using a molecular approach to detect transcriptome modifications induced by endurance exercise in horses competing in long-distance (140 km) events (Genopole® Research Group Establishment Grant («ATIGE») held by Eric Barrey).

In collaboration with Xavier Gidrol (Director of the CEA Functional Genomics Service), we have validated horse DNA chips by starting from murine and human DNA chips. The laboratory remains at the cutting edge of new technological developments for analyzing the bioenergetic responses to exercise. This has led to the establishment of new phenotypic determinants of sporting performance, such as variability indexes for physiological signals like heart rate and respiratory rate. In this respect, the laboratory advises top-level sportspeople (such as the best Kenyan distance runners) and young sportspeople. By comparing humans with animals and physiology with genetics, the laboratory has adopted a truly novel approach on the Genopole® campus.
Functional Genomics Service

MAIN TOPIC
• Functional genomics.

FIELD OF ACTIVITY
• Radiobiology, cell therapy.

ACTIVITY (KEYWORDS)
• Biochips, microarrays, bioinformatics, stem cells, carcinogenesis, differentiation, irradiation, toxicogenomics.

RESEARCH THEMES
• Since its creation in 1999, the CEA Functional Genomics Service in Evry has pursued the following missions:
  - development of a DNA microarray production facility, in order to make this technology more accessible to academic groups.
  - development of new microarray concepts and cell-based chips for functional genome exploration.
  - advancement of our biology research themes by using these technological developments.

• Genetic networks in differentiation
  By comparing the expression profiles of differentiated cells (keratinocytes, hematopoietic cells) to those of progenitor and stem cells, we seek to identify molecular signatures at each stage of differentiation and to characterize the genetic regulatory networks involved.

• The response to genotoxic stress
  Thanks to the technological and theoretical tools that we have developed, we are able to study the polymorphism of the response to ionizing radiation and other types of genotoxic stress by stem and differentiated populations. We are seeking to understand the underlying molecular mechanisms.

For all of its activities, the laboratory relies on an expert bioinformatics team which develops the algorithms required to produce and analyze our chips.
Gene Therapies Research and Application Center (CNRS Joint Research Unit 8115)

MAIN TOPIC
• Genomics/Post-Genomics/Immunology/Formulation/Therapeutics.

FIELD OF ACTIVITY
• Neuromuscular disease/Genetics/Immunology.

ACTIVITY (KEYWORDS)
• Cell biology, gene transfer, gene and cell therapy, stem cells, dendritic cells, regulators T-lymphocytes, Duchenne and limb-girdle muscular dystrophies, formulation, chromatin integration and context.

RESEARCH THEMES
- Research on viral, adeno-associated and synthetic vectors.
- Regulation of transgene expression.
- Targeting and expression systems.
- Chromatin integration and context.
- Stem cells.
- Immunology and gene transfer.
- Duchenne and limb-girdle muscular dystrophies.
- Molecular approaches in hematopoiesis and immunomodulation.
- Molecular and cellular physiology of antigen presentation and the induction of immune tolerance by dendritic cells.
- Formulation.

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GENETHON
A not-for-profit association

MAIN TOPIC
• Development of innovative therapeutics for rare, genetic diseases.

FIELD OF ACTIVITY
• A development and production center for gene transfer vectors.
• Gene therapy and cell therapy for rare diseases in general and neuromuscular diseases in particular.

ACTIVITY (KEYWORDS)
• Vector technology, gene transfer, stem cells.

RESEARCH THEMES
• Since 1997 (and thanks to donations raised during the French Telethon - a televised, nationwide fundraising event), this not-for-profit biotechnology laboratory (almost 100% funded by the AFM, the French Muscular Dystrophy Association) has focused on gene and cell therapies and their applications in rare genetic diseases in general and neuromuscular pathologies in particular.

Génèthon’s gene therapy program (set up in January 1997) includes:
- research activity (performed in collaboration with the CNRS*, the INSERM and the University of Evry) on the fundamental problems posed by the transfer of therapeutic genes and on the causes of rare diseases.
- drug development activity (based on research performed at Génèthon), notably for the treatment of Duchenne and limb-girdle muscular dystrophies, Wiscott-Aldrich syndrome, etc.
- analytical development activity, the goal of which is to establish reproducible, reliable and optimized procedures for the production of viral vectors for use in humans in compliance with the current legislation and safety requirements.
- a GMP-certified unit for producing and supplying therapeutic batches for use in preclinical and clinical trials.

(*) the French National Center for Scientific Research (Joint Research Unit 8115, Center for Gene Therapy Research and Applications).
Genomics Research Unit - Info

MAIN TOPIC
• Bioinformatics.

FIELD OF ACTIVITY
• Genomics and computing in plant biology.

ACTIVITY (KEYWORDS)
• Bioinformatics applied to plant genomics.

RESEARCH THEMES
• The Genomics Research Unit - Info is an INRA bioinformatics platform. Its primary missions are as follows:
  - implementation of plant genomics information systems, notably in collaboration with partners laboratories as national (Genoplante) and European collaborative projects.
  - data integration (sequences, cartography, transcriptomics, proteomics, sequence polymorphism) providing to INRA researchers (in both the plant and animal sciences).
  - development of analytical tools and interfaces for value-added exploitation of genomic data.
  - specification and implementation of high-throughput analyses.
GENOSCOPe
National Sequencing Center (CNS)

MAIN TOPIC
• Genomics/Post-Genomics.

FIELD OF ACTIVITY
• High-throughput production and analysis of genome sequence data from a range of biological sources. The Genoscope’s activities are divided into in-house projects and collaborative projects.

ACTIVITY (KEYWORDS)
• Sequencing, annotation.

RESEARCH THEMES
• As France’s first national, large-scale biology facility founded in 1997, the Genoscope focuses its activity on genome sequencing and analysis of sequence data generated by major international projects (on the human, rice and Arabidopsis genomes, for example) and in-house projects. Over recent years, a significant proportion of the center’s sequencing capacity has been dedicated to collaborative projects with academic groups. These deal with: whole genomes and genomic regions, gene expression products, the detection of sequence variants (polymorphisms, mutations). The species under study all have fundamental, medical or economic importance. Many full or draft genome sequences have been published to date, including more than 30 bacterial genomes, 8 microbial fungi projects and 3 projects representative of a variety of animal species. The large genome studies are performed in collaboration with other sequencing centers (3 projects) or international consortiums (4 projects). Hence, Genoscope has participated in sequencing of i) the genome of the model plant Arabidopsis thaliana (completion in 2000), ii) the human genome (sequencing of chromosome 14, 2003), iii) the genome of Anopheles Gambiae, the malaria mosquito and iv) the rice genome (chromosome 12).

In the year 2000, genome sequencing of the Tetraodon nigroviridis fish enabled researchers to estimate the number of human genes at around 30,000 which helped to postulate and define the genome of the common ancestor of bony fish and terrestrial vertebrates.

In addition, the Genoscope scientists explore microbial biodiversity through a detailed re-examination of bacterial metabolism using functional genomics, develop bioinformatics tools for genome annotation and identify novel enzyme activities to select bacterial strains with an economically useful metabolism.
Laboratory

Immuinochemistry of Cell Regulation and Viral Interaction

MAIN TOPIC
• Genomics/Post-Genomics.

FIELD OF ACTIVITY
• The cancer/immune system interface
  - Analysis of signal transduction mechanisms in human B lymphoma proliferation.
  - Analysis of the role of the novel RB18A gene (discovered in this laboratory) in cell death.
  - Inhibition of tumor and metastasis development in human melanomas.

ACTIVITY (KEYWORDS)
• Signaling, Proliferation, Differentiation, Lymphomas, Metastases, Tumors, Melanomas.

RESEARCH THEMES
Theme 1: Regulation of the proliferation and differentiation of human B lymphomas.
  a) Identification and analysis of signal transduction pathways specifically recruited during cell surface activation of the Epstein-Barr virus (EBV) receptor and the C3d growth factor (EBV/C3dR, gp140, CR2, CD21).
  b) Analysis of the role of RB18A, a transcription cofactor which regulates the functions of the p53 oncoprotein.

Theme 2: Inhibition of the tumorigenic and metastatic power of human melanomas.
Use of ScFv anti-cathepsin-L in a new cell therapy approach now under development.
Institute for Stem Cells in the Treatment and Study of Monogenic Diseases (I-STEM)

MAIN TOPIC
- Post-genomics/cell therapy of monogenic diseases.

FIELD OF ACTIVITY
- The lab’s activity is based around three keywords: “stem cells”, “therapeutics” and “monogenic diseases”. The goal is to assess the overall potential of all types of stem cells for the treatment of monogenic diseases. Set against this background, the group is particularly exploring cell therapies for degenerative diseases on one hand and the use of stem cell lines carrying pathological mutations as targets in drug screening on the other.

ACTIVITY (KEYWORDS)
- cell therapy; disease modeling; stem cells; monogenic diseases.

RESEARCH THEMES
- The I-STEM group is currently focusing on human embryonic stem cells (hESCs) and six major, interconnected themes:
  (i) a technology development program aimed at obtaining cells of interest. It comprises two parts: mass stem cell production and automated long-term culture for guided differentiation.
  (ii) use of the cardiomyocyte progeny of native ESCs in regeneration medicine for patients suffering from Duchenne muscular dystrophy.
  (iii) the ability of native hESC-derived GABAergic striatal neurons to replace the fetal neural tissue currently used in the intracerebral graft treatment of patients suffering from Huntington’s disease.
  (iv) the immunosuppression conditions specifically required by this type of stem cell transfer in various tissues.
  (v) modeling of monogenic diseases in hESC lines derived from embryos rejected following pre-implantation genetic diagnosis. The first line carries the DM1 mutation which causes myotonic dystrophy. We are seeking mutation-linked biomarkers in the progeny of these cell lines for use in studying the disease mechanisms and screening for drug candidates.
  (vi) development of the functional genomics tools required for gene overexpression or extinction under high-throughout screening conditions.
IT for Integrated Biology and Complex Systems (IBISC)

MAIN TOPIC
- Computing, bioinformatics, ICT, engineering, biology.

FIELD OF ACTIVITY
- Bioinformatics; modeling, identification and simulation of biological processes; software engineering; operational research; communication and transport networks; agent-based and communicative systems. Biomedicine and healthcare; biometrics, multimodal man-machine interfacing, road safety. Modeling in physiology.

ACTIVITY (KEYWORDS)
- Bioinformatics, post-genomics, data integration and advanced databases; formal methods; algorithmics, optimization, learning; complexity sciences. Data, signal and image processing; virtual reality, augmented reality, haptics; intelligent vehicles. Cell migration; the physiome.

RESEARCH THEMES
- Development of computing, automated and data processing methods and applications in two domains: biology on one hand and the autonomous or human-interfaced intelligent machine on the other. The research is structured into the following three axes: ICT and Living Systems (SIV), Interface and Interaction (I2) and Methods and Tools for Artificial Complex Systems (MOSCA).

The IBISC lab studies the value and applications of computer science and automation in the fields of genomics and systems biology.

The main research themes are as follows:
- the representation, analysis and comparison of DNA, RNA and protein sequences; the determination of functional motifs, annotation, etc.
- the development of tools particularly suited to systems biology (transcriptome, proteome, metabolome and statistical learning).
- the representation, modeling and simulation of biological processes: simulation of cellular and tissue processes (renal physiology, development); regulatory networks and cell/micro-environment interactions during metastatic spreading.

HOLDER OF A GENOPOLE RESEARCH GROUP ESTABLISHMENT («ATIGE») GRANT
“Bioinformatics of genome architecture and cell life organization”. Leader: Rachid Gherbi.
Laboratory for Analysis and Modeling in Biology and the Environment (LAMBE)

MAIN TOPIC
- Chemistry, Chemical Physics, Electrochemistry, Biochemistry, Biophysics.

FIELD OF ACTIVITY
- Study and modeling of processes involved in the environmental containment of toxic or radioactive elements. Electrochemistry and reactivity of these materials at interfaces or in contained milieus. Study of the process of cationization of organic molecules. Mass spectrometry proteomics. Structural analysis of biologically relevant macromolecular systems. In silico modeling of the physical chemistry of proteins, nucleic acids, membranes and of interactions between these species. Vibrational spectroscopy of biological macromolecules.

ACTIVITY (KEYWORDS)
- Mass spectrometry, modeling, proteomics analysis, radionuclide reactivity and thermochemistry, redox reactions of the actinides, solution chemistry, electrochemistry. Biomolecular modeling and simulation.

RESEARCH THEMES
- Prediction and modeling of the long-term behavior of final nuclear waste.
- Study of the role of metal cations in the catalysis and activation of model biological compounds (amino acids, nucleotides, saccharides, etc) in the gaseous phase.
- Mass spec structural analysis of biomolecules (post-translational modifications, non-covalent associations, etc.) using MALDI/TOF, electrospray/QTOF and capillary electrophoresis/ion trap spectrometers.
- Molecular and multiscale modeling and simulation of the structure and function of biological assemblies, with three main themes: solvation of complex molecules; biomolecular interactions; infrared spectroscopy of biological macromolecules.

HOLDERS OF A GENOPOLE RESEARCH GROUP ESTABLISHMENT («ATIGE») GRANT
Leader: Marie-Pierre Gaigeot - Development of force field methods for modeling the vibrational spectra of biomolecules.
Laboratory for Polymeric Materials at Interfaces (MPI)

MAIN TOPIC
• Physics, biophysics and chemistry of polymers and membranes.

FIELD OF ACTIVITY
• Macromolecular synthesis, electrophysiology, radiation scattering.

ACTIVITY (KEYWORDS)
• Polymers, nanopores, bio-nanotechnology, vectors.

RESEARCH THEMES
• The «Polymeric Materials at Interfaces» laboratory has greatly evolved since its creation ten or so years ago, when the University of Evry’s «materials» focus and the «polymer» activities of its founders gave rise to the lab’s title. The MPI lab is now a multidisciplinary laboratory where chemists and physicists work together on subjects at the interface of polymer chemistry, physics and biology, with a particular focus on bio-mimetic systems or those of therapeutic interest. The lab members have acknowledged skills in macromolecular synthesis, supramolecular chemistry, the synthesis and study of polymers at interfaces, the physics of polymers, colloids and biological membranes and in radiation scattering.

Over the last three years, our work has been structured into two main themes, associating chemists and physicists.
- study of the transport (translocation) of single macromolecules through natural (protein) and artificial (nanolithographic) nanometer-scale pores, with applications in the analysis and micromanipulation of biological macromolecules.
- synthesis of polymer vectors for gene therapy and study of their structure and function in vitro and in vivo.
Labo 104
Laboratory

Genomics / Postgenomics

MAIN TOPIC
• Genomics/metabolic genomics.

FIELD OF ACTIVITY
• Prokaryotic central metabolism, bioinformatics analysis of eukaryotic and prokaryotic genomes.

ACTIVITY (KEYWORDS)
• in silico annotation, functional annotation, metabolism, microbial biodiversity.

RESEARCH THEMES
- bioinformatics analysis of eukaryotic and prokaryotic genomes.
- generation of prokaryote gene inventories using a metagenomics approach: metagenomics of the water purification process (the «Cloaca maxima» project).
- analysis of biological networks.
- the genomics of central metabolism via the Metabolic «Thesaurus project».

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Molecular Neurogenetics Unit

MAIN TOPIC
- Post-genomics/physiopathology and post-genomics approach.

FIELD OF ACTIVITY
- Main objective: the understanding and therapeutic approaches of human neurodegenerative diseases using murine models.

ACTIVITY (KEYWORDS)
- Neurodegenerative and neuromuscular diseases, murine models, physiopathology, therapeutics.

RESEARCH THEMES
- The laboratory has been located on the Genopole campus in Evry since its creation in 1999. The lab is currently funded by the INSERM, the AFM (the French Muscular Dystrophy Association), the University of Evry-Val d’Essonne and the newly established French National Research Agency. Research for understanding and treating disabling diseases. The lab’s research focus is on human neurodegenerative and neuromuscular genetic diseases, such as spinal muscular atrophy, amyotrophic lateral sclerosis and spastic paraplegia - all of which are particularly serious, disabling and incurable. The objective of our research is two-fold: 1) to better understand the physiopathology of these diseases; 2) to develop innovative strategies for pharmacological or cell therapies. The research (based on close collaboration between clinicians and scientists) is situated at the interface of preclinical biomedical research and clinical medicine. Our work has already led to the development of animals (essentially murine) models developing human diseases. It is now moving through to the development of medical applications for the treatment of rare genetic diseases. All the research work performed by Judith Melki and her group is the fruit of close collaborations on the Evry campus with, notably, the AFM (the French Muscular Dystrophy Association), the National Genotyping Center, the National Sequencing Center and South Ile-de-France Medical Center.
Molecular, Cellular and Tissue Biophysics Laboratory (BioMoCeTi)

MAIN TOPIC
- Biophysics and physical chemistry of macromolecules of therapeutic interest.

FIELD OF ACTIVITY
- The group’s activities are essentially based on optical methods: UV-vis absorption, circular dichroism, Raman spectroscopy, fluorescence spectroscopy, microspectrofluorimetry, phase-modulated time-resolved fluorescence spectroscopy, flow cytometry, fluorescence imaging, laser flash photolysis, stopped-flow, photochemistry, and so on.

RESEARCH THEMES
1. Nucleic acids: structure, dynamics and interactions
   Structures and dynamics of the interaction of nucleic acids with:
   a) modified synthetic oligonucleotides used in the application of antigen and antisense strategies.
   b) amphipathic, cationic peptides (inducing DNA compaction, in relation to transmembrane drug transport).
   c) transcriptional regulatory proteins.
   This work relies on modeling the electronic, dynamic and folding properties of single strands of RNA and DNA (the BCE approach - Biopolymer Chain Elasticity).
2. Drug transport systems
   For gene therapy applications: a) development of synthetic nucleic acid transfer systems (non-viral transport of antisense oligonucleotides or siRNA) derived from minimal-length cationic peptides or antifungal compounds. b) transport of therapeutic molecules (photosensitizers, natural or synthetic oligonucleotides) by exosome-like vesicles secreted by a eukaryotic micro-organism: Dictyostelium discoideum.
3. Molecular biophotonics and biomedical applications
   - Study of the mechanisms of action of photoactivatable molecules (photosensitizers) of biological and therapeutic interest: dynamics of photo-induced molecular processes, interaction of photosensitizers with biomolecules, model membrane systems and natural transporters. Correlation with the cellular location of these molecules.
National Genotyping Center (CNG)

MAIN TOPIC
• Genomics/Post-Genomics.

FIELD OF ACTIVITY
• Genomics research and identification of genes in human diseases.

ACTIVITY (KEYWORDS)
• Genotyping and related genomic technologies.

RESEARCH THEMES
• The CNG is a national research laboratory whose objective is to meet the need for high-throughput genotyping via the development of innovative, integrated technologies. Its organizational structure helps optimize research into human genetics and functional genomics, by creating essential analytical links between cohort constitution (DNA samples), genotyping and gene function identification.

The CNG collaborates with academic and industrial research groups in order to determine the genetic factors responsible for a certain number of diseases with major impacts on public health.

Current studies include: autoimmune disease (insulin-dependent diabetes, autoimmune thyroid diseases, acute lupus erythematosus, asthma, psoriasis), cardiovascular disease (myocardial infarction, stroke, hypertension), infectious disease (malaria, AIDS), cancer (heterozygote loss, genetic predisposition to lung cancer) and monogenic diseases (monogenic forms of diabetes, deafness, skin diseases, muscular dystrophies, renal diseases, etc.).

The CNG’s activities are shared in three project categories: technology platform development, scientific projects initiated by external groups (visiting researchers or external collaborations) further to calls for proposals and, lastly, scientific projects initiated by the CNG itself (notably pilot projects). Since July 1999, the date on which the CNG became fully operational, the Center has established a range of well-defined scientific projects with the principal stakeholders on the Evry campus (CNS, Genoplante/INRA, Aventis/INSERM, Généthon/AFM (French Muscular Dystrophy Association - psoriasis studies; genetic studies in French Polynesia - in the planning stage) and AFM/Corbeil-Essonnes Hospital (Study of diabetes complications) as well as a wide range of international collaborations.
**MAIN TOPIC**
- Genomics/Post-Genomics.

**FIELD OF ACTIVITY**
- Genomics and computing resources in plant biology.

**ACTIVITY (KEYWORDS)**
- Plant genomics.

**RESEARCH THEMES**
- The URGV’s goals are to develop plant genome analysis tools and to use the latter to identify genes which impact on agronomy (main genes for crop plants), the environment (disease resistance genes) and the agrifood industry (genes influencing the quality of crop-derived products).

The unit’s research themes are shared into three main topics:

**a) functional analysis of the Arabidopsis genome**
- development of transcriptome analysis tools and the ChIP/Chip system.
- analysis of the Arabidopsis ORFeome.
- development of gene inactivation techniques.
- analysis of the epigenetic regulation of gene expression on Arabidopsis chromosome 4.
- analysis of the PPR (pentatricopeptide repeat) family involved in organelle function.

**b) analysis of crop genomes**
- creation of cartography tools and high-throughput genotyping techniques.
- comparative analysis of plant genome structure (wheat, canola and grapevine in particular).
- positional cloning of genes from crop plants.
- development of reverse genetics tools (TILLING).
- grapevine genome transcripts.

**c) bioinformatics**
- development of i) a database (FLAGdb) on the model genome Arabidopsis and ii) bioinformatics tools for managing and analyzing the data outputs.
- creation of new tools for genomes analysis and gene regulation sequences.
- collaboration with the Genoscope on grapevine genome annotation.
Statistics and the Genome

MAIN TOPIC
- Mathematics/Biomathematics/Bioinformatics.

FIELD OF ACTIVITY
- Development of mathematical tools for the analysis of biological sequence data, Markov chains and hidden Markov chains. Analysis of expression and SNP data.

ACTIVITY (KEYWORDS)
- Biomathematics, statistical analyses, modeling, sequence evolution, large-scale comparisons.

RESEARCH THEMES
- Design of statistical methods for the analysis of DNA and protein sequence/expression data.
- Making these methods available to the biology community via electronic networks.

Our research axes notably include:
- sequence analysis using Markov chains (searching for rare motifs) or hidden Markov chains (searching for horizontal transfers, annotation support).
- analysis of genomic data for the identification of genes involved in the etiology of diseases (SNP analysis); time-domain analysis of gene expression mechanisms (Markovian modeling or otherwise).
- study of inter-gene relationships, support for automatic annotation via large-scale sequence comparisons.
- study of protein sequence evolution.
- analysis of transcriptome/proteome data.
Unit for Statistical Methodologies and Genetic Epidemiology of Multifactorial Diseases

MAIN TOPIC
• Epidemiological genetics.

FIELD OF ACTIVITY
• Human genetics, statistical methods in genetics, multifactorial diseases.

ACTIVITY (KEYWORDS)
• Epidemiological genetics.

RESEARCH THEMES
• The group aims at identifying genes involved in the determinism of multifactorial diseases, understanding the mechanisms of action of these genes and describing their interactions with environment-related risk factors. Our research is mainly based on two complementary themes:
  1. The development of statistical methods in genetics which could lead to definition of optimal analytical strategies for complex diseases; mathematical models, simulation studies of the statistical properties of the resulting methods and the design and development of software packages.
  2. Study of the genetic components and gene-environment interactions in multifactorial diseases (essentially cancer, asthma and neuropsychiatric diseases). Both family-based approaches and population-based approaches are employed.

Identification of the genetic determinants of human, multifactorial diseases requires large-scale, multidisciplinary studies and access to high-performance technologies in the new fields of biology (genomics, transcriptomics, proteomics, etc.) within technical facilities (such as those located on the Evry campus), as well as new developments in bioinformatics and biostatistics.

Genetic research into multifactorial diseases represents a major public health issue; it can result in better definition of prevention and monitoring policies for these common diseases and can guide the development of novel therapeutic targets which reflect the molecular mechanisms of such pathologies.