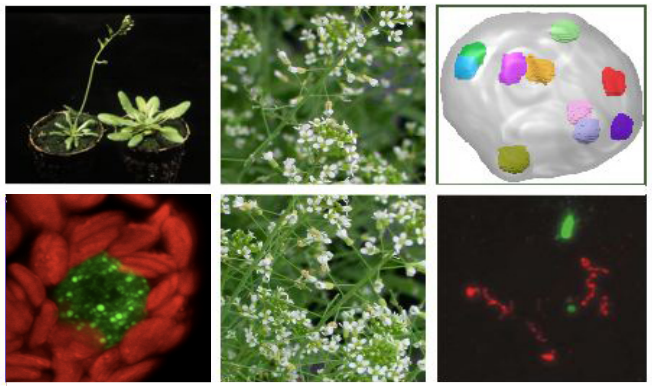
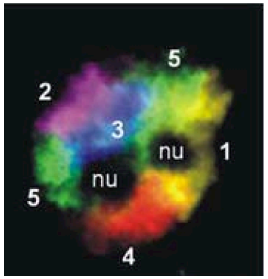
Dynamique de la chromatine et Régulation génique chez Arabidopsis

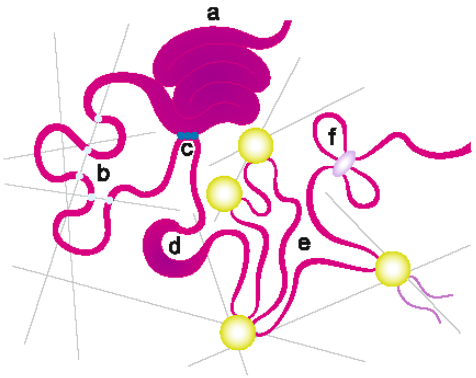


Valérie Gaudin
Institut Jean-Pierre Bourgin
INRA Versailles

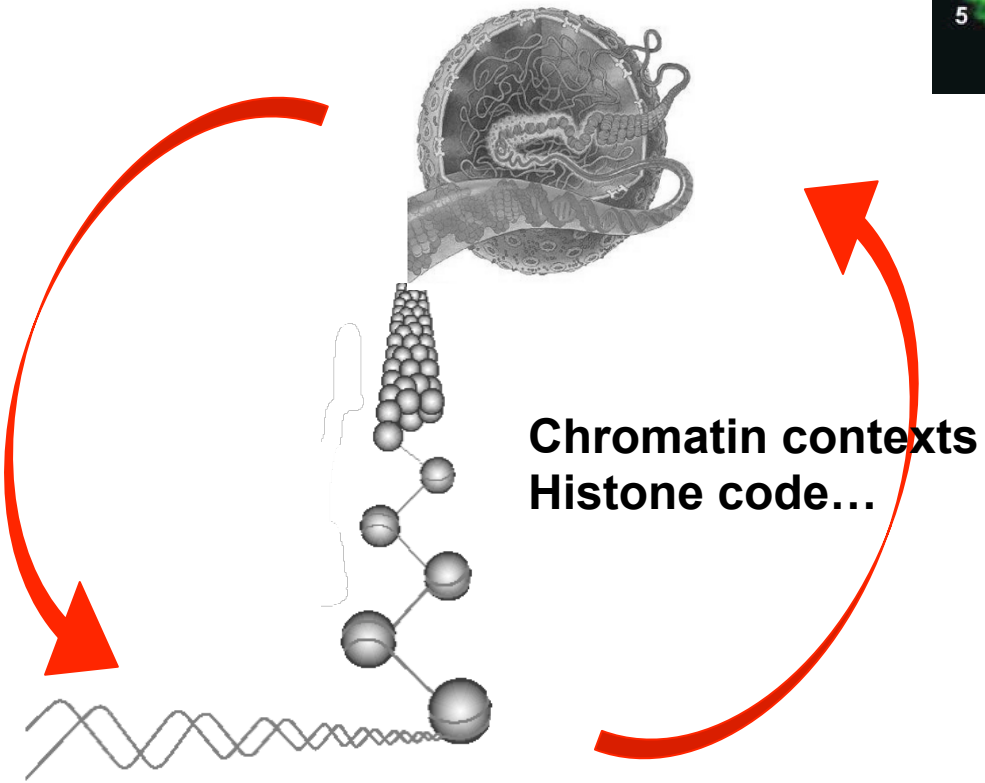
Three main layers in control of genome expression

Chromosome territories
Pecinka et al Chromosoma 2004



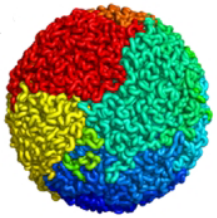


Nuclear architecture
Final context



Chromatin contexts
Histone code…

Linear DNA code



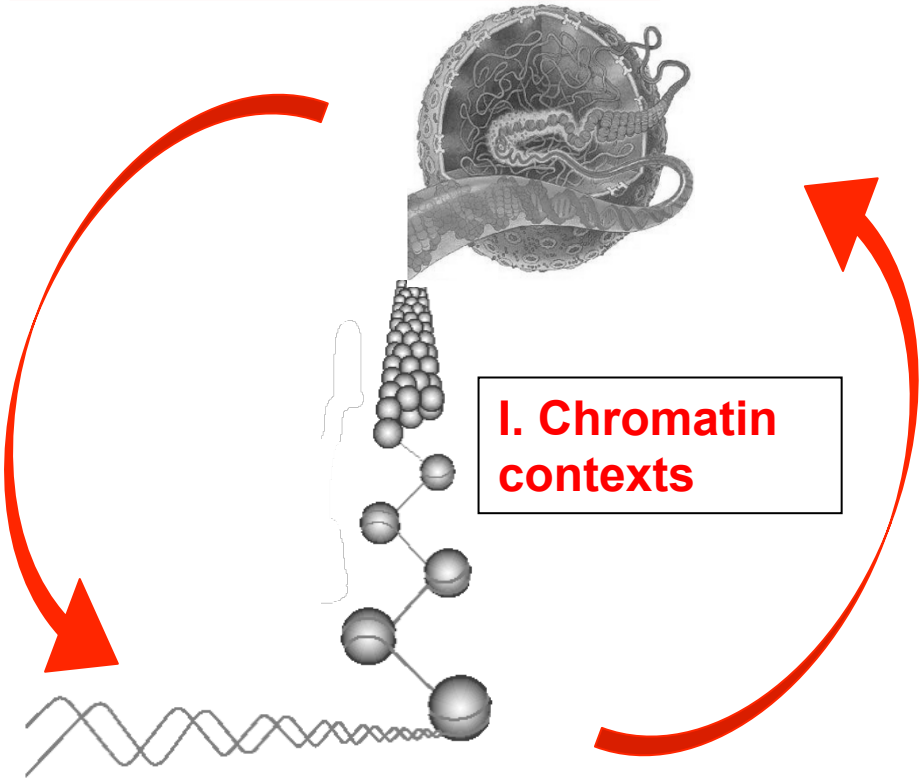
Nuclear globules by Hi-C
Lieberman et al Science 2009

Three main layers in control of genome expression

Modeling

Philippe Andrey
IJPB-INRA Versailles

II. Nuclear architecture
Final context



I. Chromatin contexts

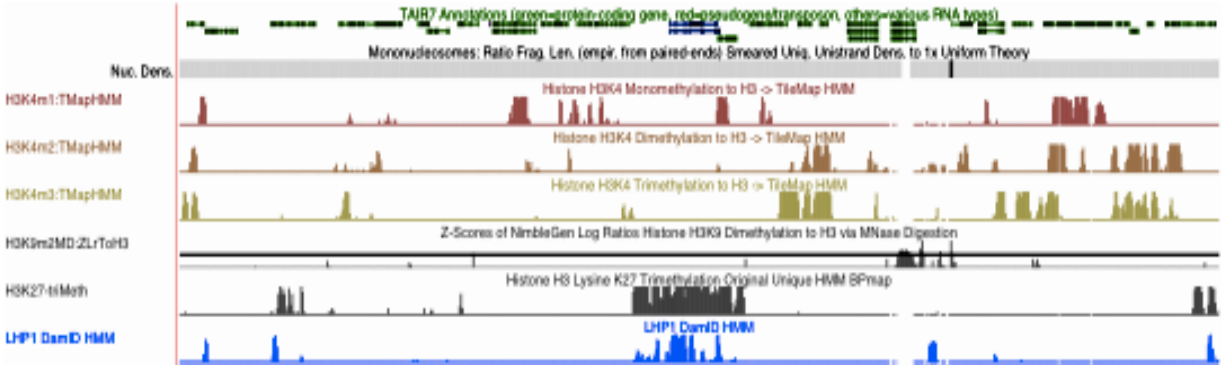
Linear DNA code

Polycomb Repressive Complex1
PRC1

Arabidopsis thaliana, a powerful model

Small genome with 5 pairs of chromosomes and well-defined chromocentres

Epigenomes, transcriptomes…



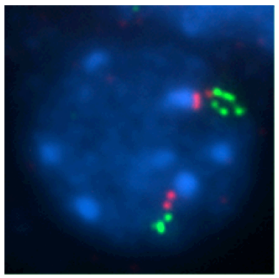
Histone marks

LHP1

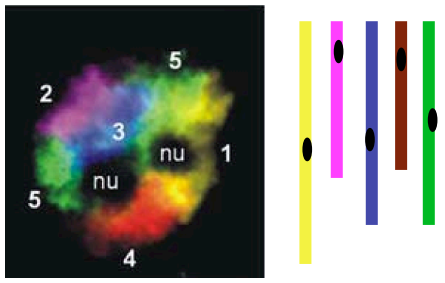
http://epigenomics.mcdb.ucla.edu/LHP1/index.html

Large genetic resources: collections of knock out

Imaging tools to study compartments at different scales from gene to chromosome territory in 3D



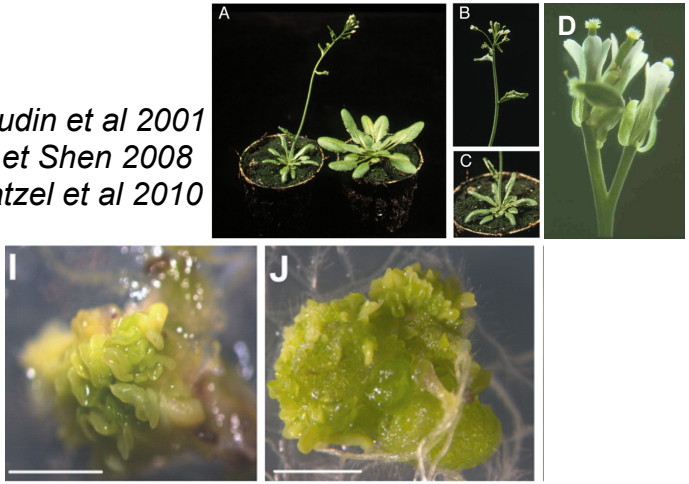
Fransz *et al* 2002



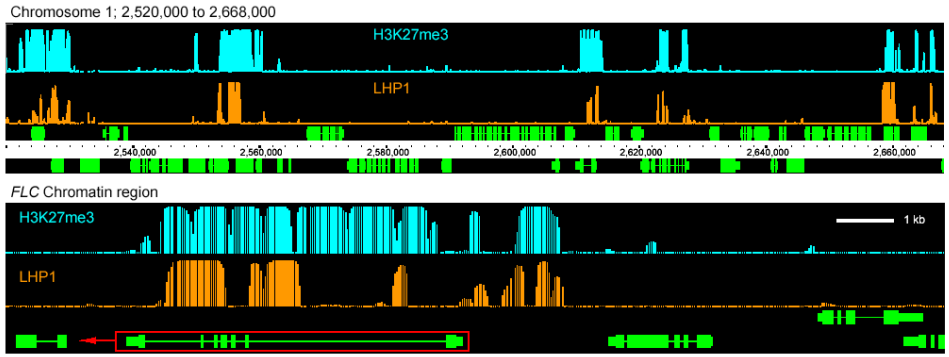
Pecinka *et al* 2004

A PRC1-like complex in plants

Gaudin et al 2001
Xu et Shen 2008
Bratzel et al 2010

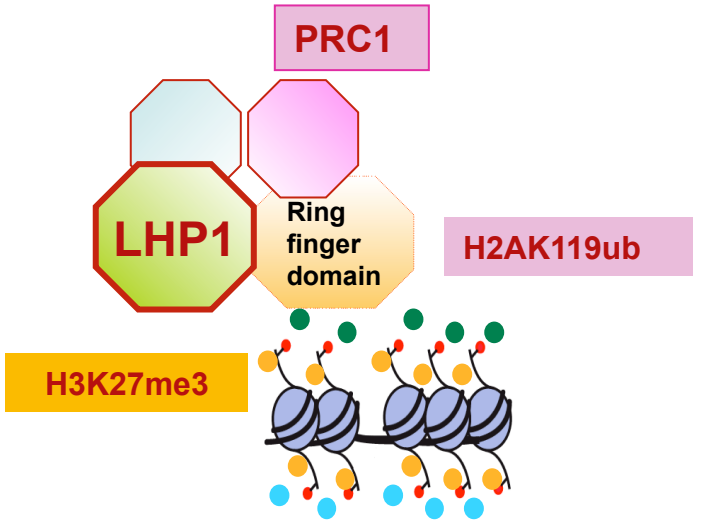


Genome-wide LHP1 chromatin profiling by DamID



Zang, Germann et al Nat. Struc. Biol. 2007

PRC1
POLYCOMB
REPRESSIVE
COMPLEX1



LHP1
LIKE HETEROCHROMATIN PROTEIN 1

A LIF2

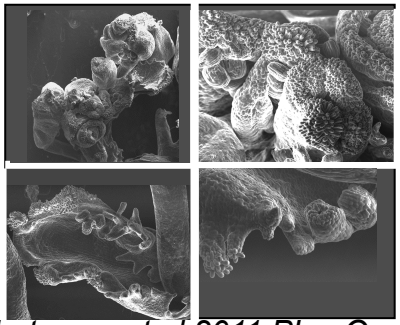
RNA

LHP1

complex

?

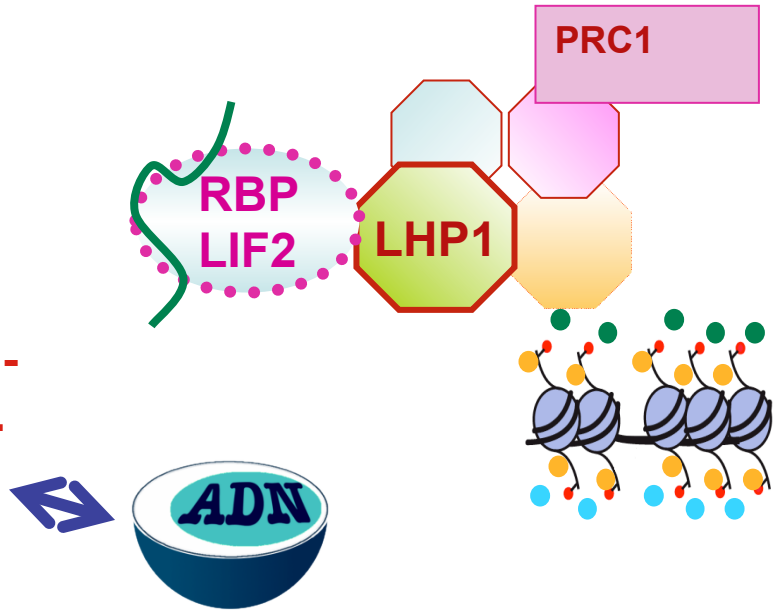
What kind of function?
Which mechanism?
What are the LIF2 RNA cofactors?



Latrasse et al 2011 PLosOne

Maintenance
of cell identity
Flowering time

Under progress
Chromatin & RNA
immunoprecipitation -
(ChIP-seq, RIP-seq)…



Modeling functional organization of the cell nucleus in Arabidopsis

Relations between nucleus organization and gene expression?

Rules governing structure/function in nucleus?

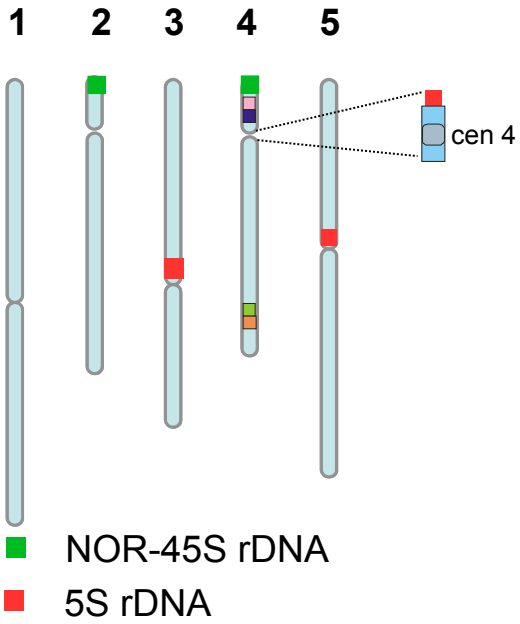
Dynamique de la chromatine
IJPB Versailles

3D FISH protocols
Confocal microscopy

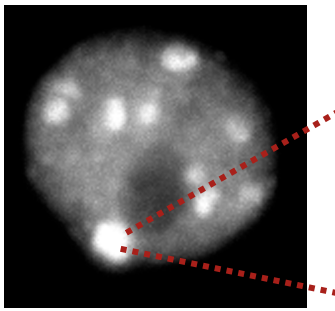
Modélisation et
Imagerie numérique
IJPB Versailles

Image processing
Spatial statistics
Modelisation

Heterochromatin compartment

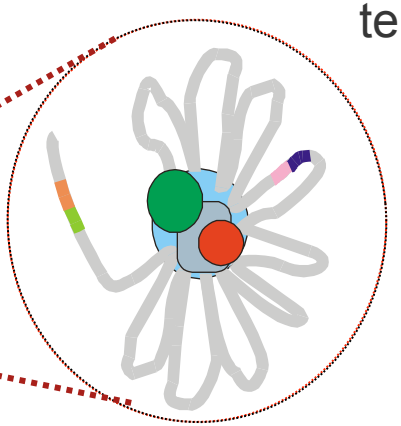


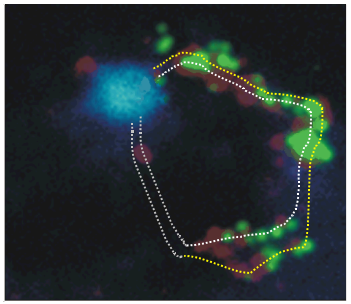
DAPI



5-10 chromocentres

Chromosome territory





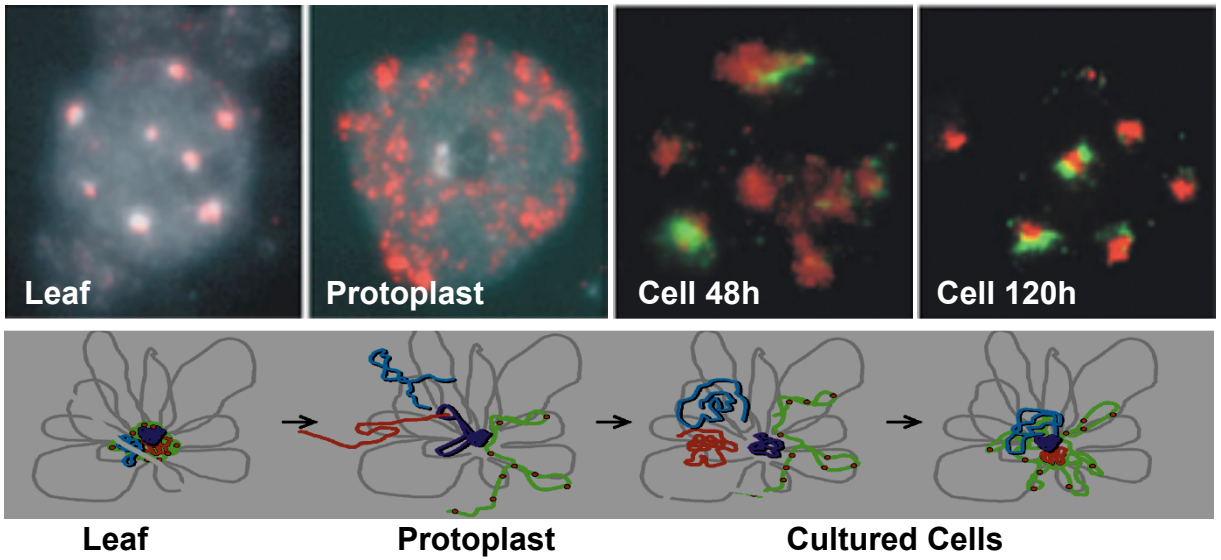
Chromocentre-loop model

Fransz *et al* 2002

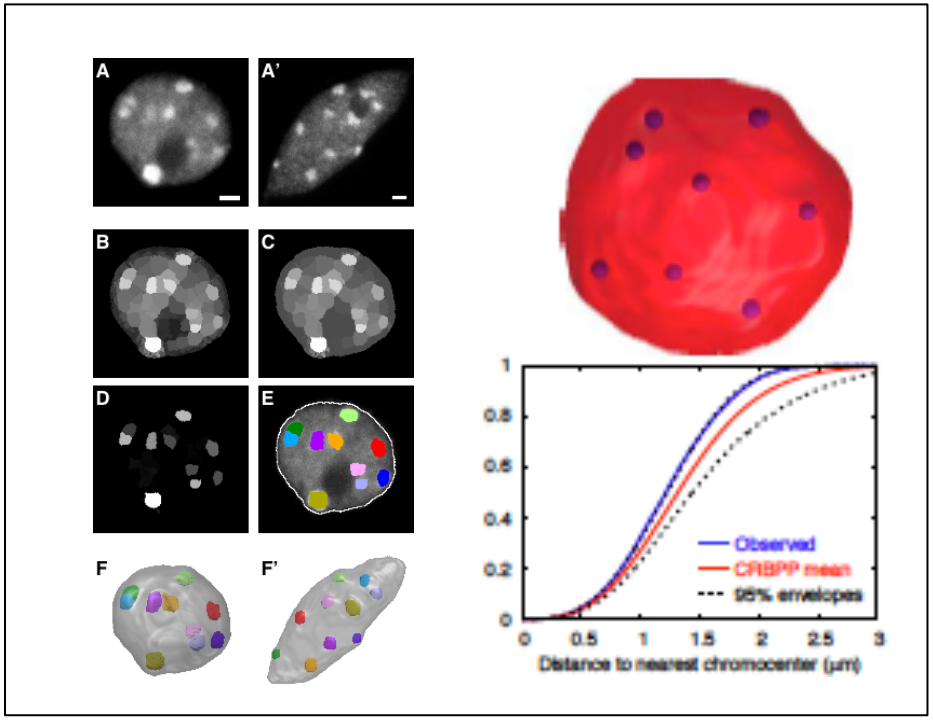
Dynamic chromocentres during cell de/redifferentiation

- Large-scale chromatin reorganization during nuclear reprogramming in Arabidopsis
- Loss of cohesion of chromocentres during dedifferentiation
- Dispersion of tandem repeats and pericentromeric regions
- Reversibility
- Kinetic of reassociation suggests a hierarchical structuration of chromocentres

Tessadori *et al* J Cell Science 2007



A non random distribution of chromocentres with a repulsion tendency in eukaryotes?



Andrey et al (2010) PLos Comput Biol

In animal systems
INRA- AgroBI program

Under progress…

• Better description and modeling of plant nuclear organization

different compartments (nucleole, nuclear envelope…)

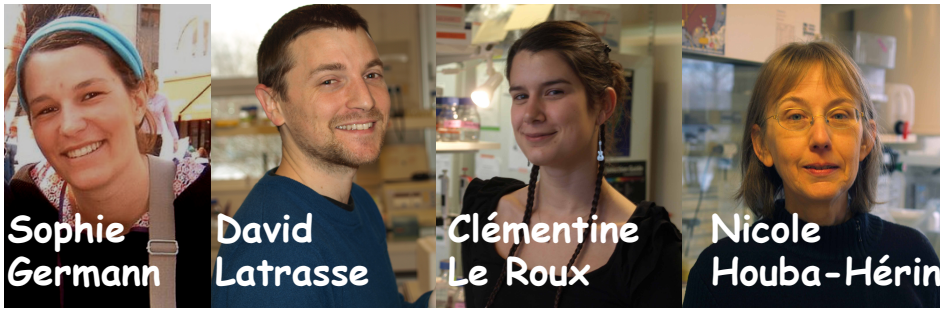
various cell types

• Understand the mechanism underlying the chromocentre repulsion

• Identify genetic determinants of nuclear organization

• Evaluate the implication of nuclear organization in the control of gene expression

Acknowledgments



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Greenhouse (IJPB)
Bruno Letarnec
Hervé Ferry

Modeling (IJPB)
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Eric Biot

Bioinformatics (IJPB)
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Collaborators
In France
Jean-Pierre Renou
Patrick England
Wen-Hui Shen
Dao Zhou

In USA
S. Jacobsen / X. Zhang
S. Khorasanizadeh

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