Connecting GHNE Hospital and Research Ecosystem : from the SHFJ experience to the PASREL project
Service Hospitalier
Frédéric Joliot

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1935: **Noble Prize** in Chemistry Frédéric Joliot & Irène Joliot-Curie “in recognition of their synthesis of new radioactive elements”

Strong promoter of medical application of radioactivity

1945: Creation of the french Atomic Energy Commission CEA Frédéric Joliot 1st high-commissioner
1958: Creation of SHFJ

2018: ~100 staff at SHFJ (permanent + non-permanent)
Missions

1. Routine Practice in Nuclear Medicine
   - SPECT unit: 2 gamma cameras
   - PET unit: 1 PET/CT + 1 PET/MR
   - ~4000 exams/year
   - Operating agreement with GHNE

2. Teaching
   - Medical physics
   - Paris-Saclay University

3. Research in medical imaging
   - Research unit: Development of imaging biomarkers
   - Radiotracers for personalised medicine
Research platforms

- Cyclotron, radiochemistry, radiopharmacy

- PET cameras
Research platforms

→ MRI and US

Research MRI 1.5T

→ Animal facilities and preclinical PET: rodents and primate

Inveon PET

Inveon PET/CT

HR+
Highlights

Neuroimaging

Elucidating the role of neuro-inflammation in Alzheimer’s disease with PETscan:

$[^{18}\text{F}]\text{DPA-714}$
$\rightarrow$ neuroinflammation

$[^{11}\text{C}]\text{PiB}$
$\rightarrow$ Amyloïd plaques

(collab. Pitié-Salpêtrière, Sainte-Anne)

Hamelin et al., Brain 2016
Hamelin et al., Brain 2018
Oncoimaging

Predicting individual response to targeted therapy in oncology:

- thyrosine kinase inhibitors: $^{11}$C-Erlotinib PET (collab. AP-HP)

![Image of PET scans](image1.png)

- mAb: $^{89}$Zr immunoPET (collab. CEA-DMTS / IGR)

![Image of immunoPET scan](image2.png)

Tournier et al., J Nuc Med 2017
Truillet et al., Clin Cancer Res. 2017
Instrumentation
Developing imaging systems of tomorrow: 1\textsuperscript{st} fully automatic and miniaturized system for on-demand radiopharmaceutical production (PMB/Lotus)
Partnership

Academic partnership
Partnership
SHFJ : Research center in **medical imaging** which connects:
- the research ecosystem in **imaging** (acad. & industrial)
- GHNE
PASREL: Research center in health technologies which connects:
- the research ecosystem in health tech (acad. & industrial)
- GHNE @Saclay
The PASREL Project
PAris Saclay REsearch & hospital

An open platform for collaboration between hospital - research - industry
A NEW HOSPITAL IN PLATEAU DE SACLAY: MERGING OF JUVISY, LONGJUMEAU AND ORSAY HOSPITALS

Validated by the French ministries on May 30, 2018
PARIS SACLAY: A SUBSTANTIAL POOL OF SKILLS IN HEALTHCARE

33% in the Ile de France
Among which, more than 60% are in « Paris-Saclay »

~20% of the people in Paris-Saclay
AN OUTSTANDING ENVIRONMENT FOR RESEARCH AND INNOVATION

- **Expertise** in physics, mathematics, chemistry, engineering, software, data sciences, life sciences

- Organized in **networks, infrastructures**

- **An industrial cluster**
  - Pharmaceutical leaders
  - 15 firms in biomedical engineering
  - 25 biotechnology firms

15% of French scientific research

Medical schools
Pharmacy faculty
Paris will be the sole department where population won’t increase between 2013 and 2050

<table>
<thead>
<tr>
<th></th>
<th>Population en 2013</th>
<th>Population en 2050</th>
<th>Taux de croissance annuel moyen entre 2013 et 2050 (en %)</th>
<th>Âge moyen en 2013</th>
<th>Âge moyen en 2050</th>
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</thead>
<tbody>
<tr>
<td>Paris</td>
<td>2 229 600</td>
<td>2 233 000</td>
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<td>39,2</td>
<td>42,2</td>
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<td>Petite couronne</td>
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<td>5 149 900</td>
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<td>40,8</td>
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<td>6 122 000</td>
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<tr>
<td>Île-de-France</td>
<td>11 959 800</td>
<td>13 504 900</td>
<td>0,33</td>
<td>37,4</td>
<td>41,1</td>
</tr>
</tbody>
</table>

Source: Insee, recensement de la population 2013 et modèle Omphale 2017 (scénario tendanciel).

Source: Khelladi I., Poncelet T., Trigano L., « En 2050, une population stable dont le poids au sein de la région déclinerait », Insee Flash Île-de-France n° 20, novembre 2017
MEDICINE OF THE FUTURE: FINDINGS AND ANALYSES

- Integration by the practitioners: approaches taking into account many factors
- Integration by the patients: well informed, very connected patient
- For the practitioners: decision-aids, tools for participatory decision-making
- For the patients: personalized medicine
HOSPITAL OF THE FUTURE

Hospitals will be major actors for the medicine of the future: collaborative technological platforms to integrate innovation

A collaborative platform
- Hospital
- Industrial research
- Academic research

A technological platform
- Gathering equipment and expertise
- Will enable evaluation in real-life conditions

A platform that integrates innovation
- Outward-looking
- Fully integrated in a gradual care pathway
- That can easily and rapidly adapt to healthcare evolution resulting from medical and therapeutic progresses
GHNE @Saclay is a one-of-a-kind opportunity to
- Develop Paris-Saclay position in healthcare technologies
- Boost research applications in the domain of healthcare technology

Taking advantage of the momentum created by the new hospital, we can develop a culture and an environment that will foster and support clinical proofs of concept / real-life use-cases

To orchestrate fruitful interactions between a research/innovation environment and the future hospital
WHAT WE PROPOSE

To back technological platforms to the future hospital

- Academic partnership
  PASREL
  Imaging, -Omics, Robotics, Connected Objects, AI, Virtual Reality

- Industrial partnership

- To foster and support innovations in healthcare; to assist their evaluation through clinical trials and use
  - Revolving around a cluster of key competencies, expertise, networks, equipment, data, samples, patients

GHNE @Saclay
How? A cluster of platforms and tailored services to foster the integration of innovations

Platforms / equipment
- Imaging center
- Biology and functional exploration
- Data access
- Sample access
- Rehabilitation center, support ???
- Equipped patient rooms

Forums
- Living Lab
- Meeting rooms
- Conference room

Resource area
- Residency of teams and projects
- Concept validation
- Value chains
- Partners and financing identification
- Gateway to resources

Clinical trials support
- Promotion
- Investigation
- Technical means
- Quality

Support, acculturation
A SHARED FIRST VISION, ENTHUSIASTICALLY RECEIVED

- To assess the interest of potential partners
- To share and build a first vision
- To build a momentum

Support

Favorable to a strong link
Land reserve and strengthened partnership

- An opportunity to develop original technological projects
- A distinguishing feature in regard to Paris

- A missing piece
- An opportunity for studies in pharmacokinetics, biodistribution, clinical trials…

- To create a university hospital specialized in physical activity (FSEF, health foundation of French students)
- Customized physical activity (rehabilitation / length of stay)
A SHARED FIRST VISION, ENTHUSIASTICALLY RECEIVED

- Software to optimize radiotherapy treatments
- Decision aids

DIGITAL HALL

- Data center hosting

- An opportunity regarding Garches’ evolution
- An opportunity to build a one-of-a-kind ecosystem combining research, innovation and medical care

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- Will increase the link between imaging and medical care
- Digital Innovation Hub for robotics in healthcare
- Cobotics: exoskeletons and healthcare assistance
- Chatbot: staff training and therapeutic education, patients’ quality of life
- Cybersecurity
- Machine Learning: fall detection, heart attack…
- Information and modeling systems: patient flow…
THANKS FOR YOUR ATTENTION

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Mathieu LEFEVRE, CEA

THANKS FOR YOUR ATTENTION