Open PHACTS, an example of a public-private partnership delivering for industry

Session: “How to succeed in public-private partnerships“

Linking Life Science Data: Design to Implementation, and Beyond

University of Vienna, February 18-19th, 2016, Vienna, Austria

Prof Theo Meert, PhD. PhD., Head G3O
(EFPIA InnoMedS Group)
Summary

- There is a huge opportunity for collaborations and public private partnerships for pharmaceutical development
  - But note that different types of grants/funds/contracts come with different requirements related to IP, governance / steering / decision making, reporting obligations, ownership, commercial rights, ….  
    - IMI is an unique tool for Pharma to collaborate with its environment

- Open PHACTS created an unique & integrated data resource for Pharma allowing answering complex questions during the drug discovery process in a timely and cost effective way.

- The Open PHACTS Foundation can help to safeguard this unique toolset for Pharma and its partners.
“CATALYZING INNOVATION AT JOHNSON & JOHNSON IS ABOUT CREATING STRONG NETWORKS OF PEOPLE WHO CAN COMBINE RESOURCES, IDEAS AND TECHNOLOGIES IN A NEW WAY.

PAUL STOFFELS
CHIEF SCIENTIFIC OFFICER
Why do we collaborate?

$ / €’s

Support for our R&D

External know-how

Collaborations with key experts in the field; access to resources not readily available - Increases the Probability of Success for our projects

Making our R&D $ / €’s go further

We can use the same amount of internal spend to progress more projects

External collaboration is endorsed and actively encouraged by the R&D SLT
Why Public-Private Partnerships?

- For key challenges a single entity is unable to do everything by itself
- Pooling expertise, knowledge and resources; cross-fertilization (even amongst various industries)
- Developing incentives to address major unmet medical needs
- Providing a neutral trusted platform to align public and private interests
Competitive Collaborative Funding Landscape

Huge opportunities ...

Global Health Innovation and Technology Fund, Japan
NIH
BARDA
CPI
FDA
DoD
JTIs - IMI
ERA-NET
EUREKA
COST – R&I networks
EU-backed loans
National Funding
National PPPs
NGOs
IWT
H2020
MOF - MST
A-STAR
Combining Internal Strength and External Innovation: An Elegant Balance

**INTERNAL RESEARCH**
- Discovery
- Biomarkers
- Development
- Research Capability Units

**EXTERNAL INNOVATION**
- Innovation Centers
- Business Development
- Academics
- Biotechs
- Consortia
## Projects along entire R&D development chain

<table>
<thead>
<tr>
<th>Stage</th>
<th>Project Details</th>
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<tbody>
<tr>
<td>PreClin FORMULATION</td>
<td>LAI Nanosuspension (IWT)</td>
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<tr>
<td>PreClin UPSCALING</td>
<td>EBOMAN (IM12)</td>
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<tr>
<td>HTS/HTL</td>
<td>ELF (IM11)</td>
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<td></td>
<td>BACE1 (IWT_O&amp;O)</td>
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<tr>
<td>Projects along entire R&amp;D development chain</td>
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<tr>
<td>CLINICAL PHASE 1 &amp; 2</td>
<td>NO438 – COMBACTE (IM1)</td>
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<tr>
<td></td>
<td>VX-787 (JN872) (BARDA)</td>
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<td></td>
<td>Ebola monovalent (BARDA)</td>
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<tr>
<td>CLINICAL PHASE 2</td>
<td>MAYFLOWER: HIV vaccine development program (NGO)</td>
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<td>CSIRNUM: HIV vaccine development program (NGO)</td>
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<td></td>
<td>RVDBEK: HIV vaccine development program (NGO)</td>
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<tr>
<td>BIOMARKER</td>
<td>U-BIOPRED (IM1)</td>
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<tr>
<td>NEW DIAGNOSTIC METHODS</td>
<td>HTcTcell (IM1)</td>
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<td></td>
<td>HTcTcell (Jansen)</td>
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<tr>
<td>TRAINING PROGRAM</td>
<td>PHARMATRAIN (IM1)</td>
</tr>
<tr>
<td>PLATFORM</td>
<td>EXASCIENCE (IWT_O&amp;O)</td>
</tr>
</tbody>
</table>

[Open PHACTS](#)
The importance of Public Private Partnerships

Regional breakdown of companies and institutes in public-private partnerships, 2011–2013
(SciBX, FEBRUARY 20, 2014 • VOLUME 7 / NUMBER 7)
Horizon 2020
The EU Framework Programme for Research and Innovation
2014-2020

$ 80 billion
The EU pharma funding landscape

EU PHARMA FUNDING LANDSCAPE

Regional Policy
- European Structural and Investment Funds
- European Regional and Development Fund (£3-8M)

Research Policy
- HORIZON 2020
  - European Research Infrastructures (£5-15M)
  - Leadership in Industrial Technology (£1-15M)
  - Access to risk finance (InnovFin)
  - SCI Health, demographic change and wellbeing (£2-10M)
  - Fast Track to Innovation Pilot (£3M)
  - Infectious Diseases (£7.5-75M)

Health Policy
- 3rd Health Programme (£100k-1M)

Public-Public and Public-Private Partnerships and Joint programming initiatives
- Innovative Medicines Initiative
- Joint Programming Initiative on Anti-microbial resistance
- Joint Programming on Neurodegenerative Diseases
- Large Projects (£25-300M)
- Developing countries Clinical Trials Partnership

Legend
- Potential for Janssen
- Type of Action Financed
  - R&D
  - Tech
  - Manufacturing
  - Human Capital
- Type of Funding
  - Direct loans
  - Calls for proposal
  - Prizes

Janssen
PHarmaceutical Companies of Johnson & Johnson
Strategic Initiatives

Innovative Medicines Initiative 2
www.imi.europa.eu

European Innovation Partnership on Active and Healthy Ageing
https://webgate.ec.europa.eu/eipaha

Active and Assisted Living 2
www.aal-europe.eu

European & Developing Countries Clinical Trials Partnership (EDCTP2)
www.edctp.org
IMI 1/2 – Janssen: Facts & Figures

- ~81m€ committed in total ~8% of total EFPIA commitment
- Participate in 56% (n=34) of all IMI1 projects
- J&J/Janssen is global coordinator (overall project lead) in 3 projects (WP lead in various other programs)

(Total IMI 1 Project Value with J&J participation ~530MMC)

IMI 2

- 21 projects
  - 5 signed
  - 16 launched
- ~170m€ committed in total
  - 100m€ signed
  - 70m€ to be signed
- J&J/Janssen is global coordinator (overall project lead) in 5 projects (WP lead in various other programs)
Examples IMI’s drug discovery platforms

**European Lead Factory Focus:** identification of new hits

**ELF Budget:**
- €92.0m EFPIA in-kind
- €80.0m IMI JU

**ENABLE Focus:** to move promising hits into early clinical development

**EPAD**
POC trials in prevention AD

**RADAR**
Open PHACTS
Open PHACTS: Pharma Needs Data Integration

Pharma are accessing, processing, storing and re-processing public data.

We are all doing this many times......
Open PHACTS: Deliverables to Pharma Data Integration

- 10+ databases were integrated semantically
- Never done before at this scale and with this quality
Open PHACTS: Deliverables to Pharma Data Access

- Access to the integrated data via common interface (API)
- Direct access for Pharma tools such as Pipeline Pilot
Open PHACTS: Deliverables to Pharma Data Implementation

Want to run Open PHACTS within your environment?

Want to load your data into Open PHACTS?

Virtual Machine install of Open PHACTS behind company firewall, using docker image
- Beta testing with a Pharma partner
- Allows you to customise and load your own data
Open PHACTS: Pharma Needs Scientific Questions

### TABLE 1

The top 20 research questions

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clusters</td>
<td>Question</td>
</tr>
<tr>
<td>Q1</td>
<td>Determine the ADMET profile of active compounds</td>
</tr>
<tr>
<td>Q2</td>
<td>Given a target, find me all actives against that target. Find/predict polypharmacology of actives. Determine ADMET profile of actives</td>
</tr>
<tr>
<td>Q3</td>
<td>For a given interaction profile, give me similar compounds</td>
</tr>
<tr>
<td>Q4</td>
<td>The current factor 3a lead series is characterized by structures X. Retreive all bioactivity data in serine protease assays for molecules that contain substructure X</td>
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<tr>
<td>Q5</td>
<td>A project is considering protein kinase C alpha (PRKCA) as a target. What are all the compounds known to modulate the target directly? What are the compounds that could modulate the target directly? I.e. return all compounds active in assays where the resolution is at least at the level of the target family (i.e. PKC) from structured assay databases and the literature</td>
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<tr>
<td>Q6</td>
<td>Give me all active compounds on a given target with the relevant assay data</td>
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<tr>
<td>Q7</td>
<td>Identify all known protein-protein interaction inhibitors</td>
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<tr>
<td>Q8</td>
<td>For a given compound, give me the interaction profile with targets</td>
</tr>
<tr>
<td>Q9</td>
<td>For a given compound, summarize all 'similar compounds' and their activities</td>
</tr>
<tr>
<td>Q10</td>
<td>Retrieve all experimental and clinical data for a given list of compounds defined by their chemical structure (with options to match stereochemistry or not)</td>
</tr>
<tr>
<td>Q11</td>
<td>For my given compound, which targets have been patented in the context of Alzheimer's disease?</td>
</tr>
<tr>
<td>Q12</td>
<td>Which ligands have been described for a particular target associated with transthyretin-related amyloidosis, what is their affinity for that target and how far are they advanced into preclinical/clinical phases, with links to publications/patents describing these interactions?</td>
</tr>
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<td>Q13</td>
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</tr>
<tr>
<td>Q14</td>
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Scientific competency questions as the basis for semantically enriched open pharmacological space development

Kamal Azaaou, Edgar Jacoby, Stefan Senger, Emiliano Cuadrado Rodríguez, Mabel Loza, Barbara Zdrazil, Marta Pinto, Antony J. Williams, Víctor de la Torre, Jordi Mestres, Manuel Pastor, Olivier Taboureau, Matthias Rarey, Christine Chichester, Steve Pettifer, Niklas Blomberg, Lee Harland, Bryn Williams-Jones and Gerhard F. Ecker
Open PHACTS: Deliverables to Pharma
From research questions to solutions

The list of relevant research questions

Table 1

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Q01</th>
<th>Q02</th>
<th>Q03</th>
<th>Q04</th>
<th>Q05</th>
<th>Q06</th>
<th>Q07</th>
<th>Q08</th>
<th>Q09</th>
<th>Q10</th>
<th>Q11</th>
<th>Q12</th>
<th>Q13</th>
<th>Q14</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Given compound X, what is its predicted secondary pharmacology? What are the on- and off-target safety concerns for a compound? Is the evidence and handleable in that evidence for a reason X? For findings associated with a compound?</td>
<td>Given a target, find me all active against that target. Find/predict polypharmacology of a target. Determine ADMET profile of a target. For a given interaction profile - give me similar compounds.</td>
<td>A protein X is a target, list protein inhibitors for structure X. For a compound, list all nonactive inhibitors in the same structure as X.</td>
<td>For a given compound, where are the intersections of the compound with the relevant assay data?</td>
<td>Identify all known protein-protein interaction inhibitors.</td>
<td>For a given compound, give the interaction profile with targets.</td>
<td>For a given compound, summarize all similar compounds and their activities.</td>
<td>For a given compound, list all relevant and clinical data for a given list of compounds defined by their chemical structure (with options to match stereochemistry or not).</td>
<td>For a given compound, which targets have been patented in the context of Alzheimer’s disease? Which targets have been described for a particular target associated with neurotransmitter-riodulators, what is their safety for that target and how far are they advanced into preclinical/clinical phases, with links to publications/patents describing these interactions?</td>
<td>Target druggability of compounds directed against target X have been tested in which indications? Which new targets have emerged recently in the patent literature for a disease? Has the target been screened against all A2 before?</td>
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The solutions to answer them
Open PHACTS: Impact in multiple ways

- Access to integrated biomedical and chemical databases
  - Create information workflows that were very difficult before, such as:
    - Searching for compounds across protein families, pathways, diseases
    - Target validation
    - Phenotypic screen analysis
  - Maximising the value of internal data by integration with public data

- Changing the mindset of scientists
  - Semantic querying opens up new ways of using existing data
  - Sky is the limit, especially when additional domains are added, such as ADME, (pre)-clinical data

- Changing the mindset of Pharma IT
  - At start of project Relational Databases was the only game in town
  - Now a strong realisation of the value of semantic databases, and actual efforts to integrate internal databases. This would not have been done in the pre Open PHACTS situation. Value for the pharma scientists!

- Changing the mindset of public and commercial databases
  - Public database providers such as EBI, ELIXIR, NCBI and commercial providers such as GVK and Thomson Reuters have made database interoperability a key requirement. This benefits us all!
Time and €€ savings

- Certain queries were possible before but were tedious work and took a lot of time (days). These can now be done in less than an hour
- Semantically integrated databases allow for completely new ways of analysing the data
- Integration of different databases is difficult, costly, and time consuming, and probably would not have been done at this level of quality without Open PHACTS

Conclusion: Without Open PHACTS, pharma companies would not have access to this valuable resource
  - Sharing the cost and effort in precompetitive project saved millions
  - Accelerated research using integrated data
  - Involvement in the project sparked internal innovation in this area
Outlook and future support from Industry

- With help and inspiration from the success of Open PHACTS, the database environment has evolved
  - Large public data providers (EBI, ELIXIR, NCBI, etc) and commercial providers (Thomson Reuters, Elsevier, GVK, etc) put database interoperability as high priority
  - Commercial analysis tools for semantic biomedical data are rapidly developing (Euretos, Cambridge Semantics, OntoForce, etc)

- The Open PHACTS Foundation will continue to deliver and develop semantic data solutions for pharma.

- Unique opportunity to continue the value of precompetitive collaboration
Additional Info on the utility of Open PHACTS For Janssen Pharmaceutical (J&J)

14:30 – 16:00  **Using Open PHACTS**
A series of presentations will demonstrate different ways of integrating the Open PHACTS Discovery Platform into real research workflows.

Speakers:
- Daniela Digle
  *University of Vienna*
  Using Open PHACTS with KNIME
- Luca Bartek
  *University of Strathclyde*
  Drug-related information on Wikipedia
- Edgar Jacoby
  *Janssen Pharmaceutica*
  Open PHACTS computational protocols for *in silico* target validation of cellular phenotypic screens: Knowing the knowns
- Jean-Marc Neefs
  *Janssen Pharmaceutica*
  Chem³ to search SAR space... and much more
- George Papadatos
  *EMBL-EBI*
  Leveraging annotated SureChEMBL patent data with the Open PHACTS API

11:00 – 12:00  **How big pharma is using linked data**
Representatives of pharmaceutical companies will explain how linked data is becoming crucial to their drug discovery workflows in this global industry.

Speakers:
- Jeremy Yang
  *Indiana University*
  Linking the Open Phenotypic Drug Discovery Resource (OPDDR)
- Derek Marren
  *Eli Lilly and Company*
- Stefan Senger
  *GlaxoSmithKline*
- Herman van Vlijmen
  *Janssen Pharmaceutica*
  How big pharma is using linked data
Global Government Grant Office (G3O)