Bayer's Lab of the Future approach

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**Lab of the Future Congress, Wellcome Genome Conference Centre, November 2019**

Agenda – Bayer's Lab of the Future approach

// Stakeholders and as-is situation

    // For whom are we working for?

    // What are current lab digitization obstacles?

// Bayer's LotF prototype

    // High level overview

    // IoT technology and tablet application

    // Outlook and results

// Summary / take home messages

Prolog – The secret code of chemists

The secret code of chemists
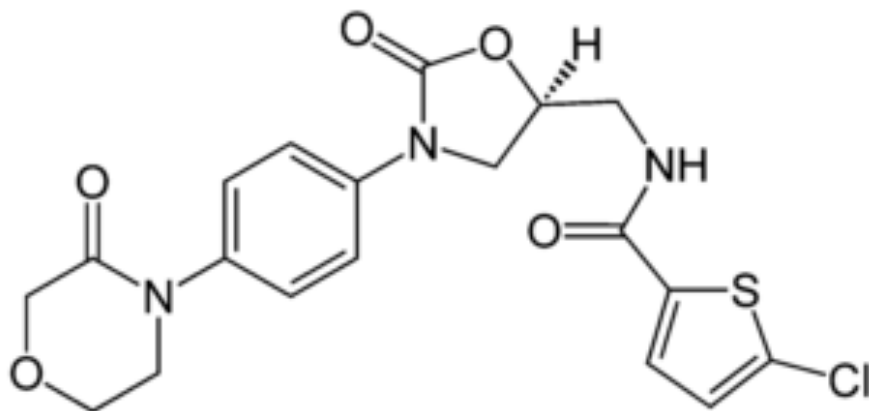
and the secret code of IT

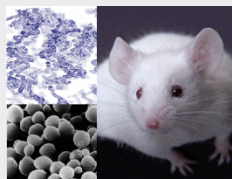A lot of things in common...

Stakeholders and as-is situation

The Bayer example

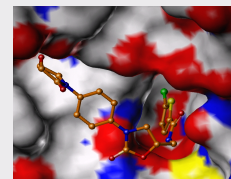# Research Value Chain – all about generating Data

High-Through-put Screening

Early ADME/PK

Medicinal Chemistry

Predictive Pharmacology

Computational Chemistry
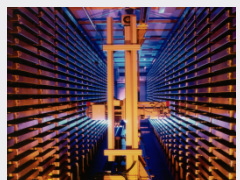
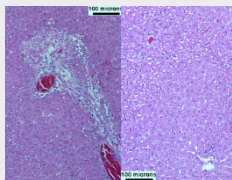Target Discovery → Compound Screening → Lead Generation → Lead Optimization → Preclinical Development → Clinic Phase I
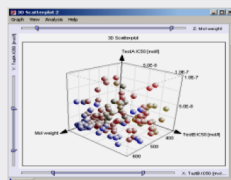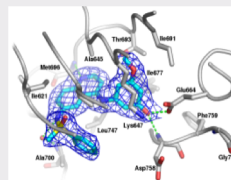
Compound Collection

Early Toxicology

Automated Synthesis

Pharmacophore Informatics

Structural Biology

Maximize patient benefit

Increase druggable target space

Leverage digital progress

Laboratory workflows to be improved

- ➢ Usage of paper notes in lab

- ➢ Real-time and automated documentation is not possible

- ➢ Lab devices offer RS-232 or USB-ports, but often it is not used

- ➢ Useful information has to be gathered manually

- ➢ Already high standard of lab safety, but still room for improvement

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Collaboration and journey

High level overview

Cooperation with

Fraunhofer FIT

labfolder

cubuslab

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Lab of the Future

The evolution of the initiative

- Visualization of lab device data
- Move from PoC to Production
- Establish interfaces to the ELN & chemical inventory system
- Rollout

Phase 3:
Digital Integrated Lab

- IoT integration of equipment
- Implementation of voice-to-text
- Refinement of smart documentation

Phase 2:
Digital support of technician

- Automatic documentation
- Accurate documentation
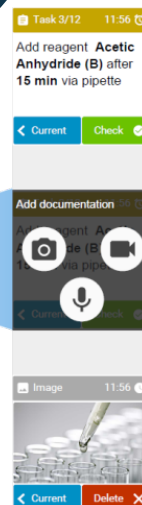- Task manager and IoT
- Independence of device

Phase 1:
Smart Glasses

- UAT in 2015
- Great potential
- Smart glasses not mature
- Support functions needed

Lab of the Future – Usability Mockup

First concept with Hololens

Future Lab Hololens Mockup Test 08.12.2016

Lab of the Future

The evolution of the initiative

Phase 4:
Going Productive

- Visualization of lab device data
- Move from PoC to Production
- Establish interfaces to the ELN & chemical inventory system
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Phase 3:
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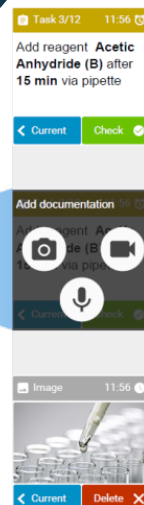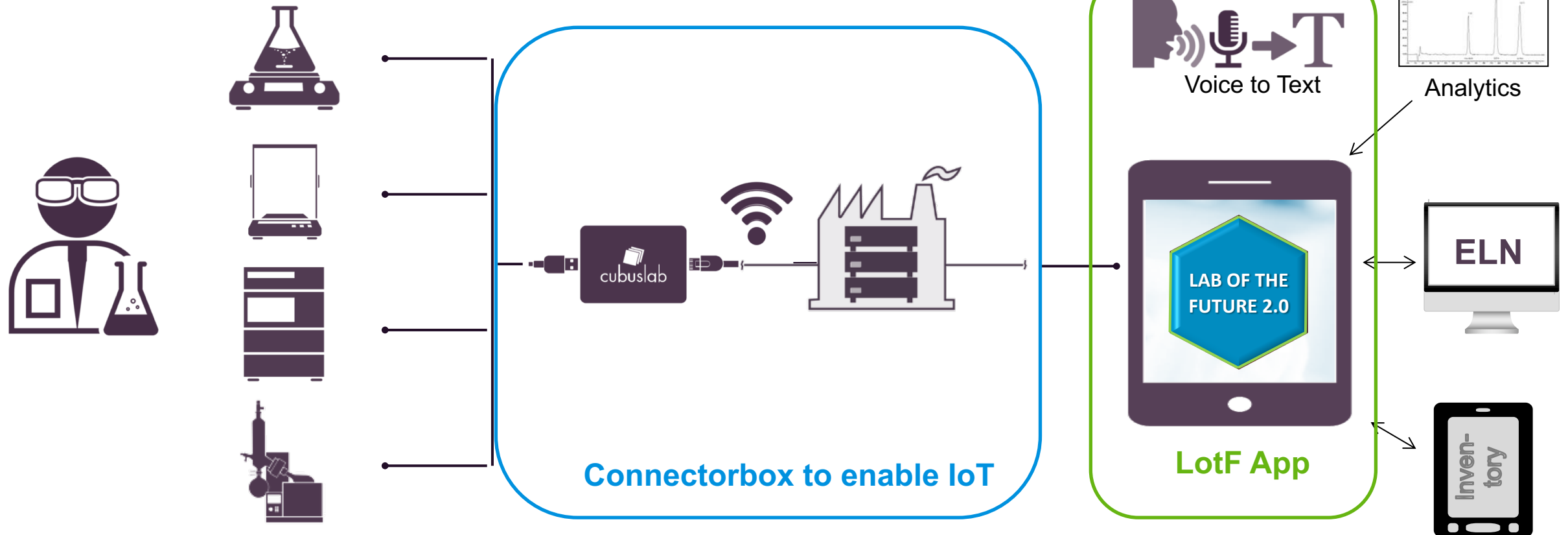- Support functions needed

General Setup – IoT platform and IT architecture

„IT should follow me & not vice versa"

(Lab Technician)

Voice to Text

Analytics

cubuslab

LAB OF THE FUTURE 2.0

ELN

Inven-tory

Connectorbox to enable IoT

LotF App

Redesigned workflows

Prototype application

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Paperless laboratory: mobile ELN

✓ Web-based application to display current experiments with:

  ✓ Structures / chemical equation

  ✓ Protocol text

  ✓ Reagents parameter (e.g. weighing amount)

✓ Strip down mobile solution to fit purpose

  ✓ Communication / synchronization through API to ELN

✓ Modern, intuitive UI that follows user (not vice versa)

Interactions with lab devices

✓ Read/write access to:

  ✓ Set temperature profile, transmit data, etc.

  ✓ Easy stoichiometry adjustment while weighing

  ✓ Protocol templates

✓ Interactions with lab devices through IoT

  ✓ One solution regardless of manufacturer or device type

  ✓ Requirement: RS232 or USB port

  ✓ Provision of structured data (SiLA / Allotrope)

What else?

✓ On-the-fly documentation / smart assistant:

    ✓ Voice-to-text already implemented

✓ Enhance lab safety:

    ✓ Instant validation of chemical identity
       upon weighing (scanning)

    ✓ Advance monitoring of your lab devices and
       visualization of important parameter

    ✓ Secure laboratory network through hardened
       connector boxes

Redesigned workflows

Outlook and results

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The Lab of the Future is a never ending story

- ✓ How to handle GxP requirements?

- ✓ How can we automate our inventory?
  - ✓ Keep track of your substances and stock amounts

- ✓ How to extend to non-chemistry labs?

- ✓ How to support automation / robotics?

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Lab of the Future shows overall benefit in the long run

For the company:

- How can we generate **more data** in the labs?

- How can we increase the **quality** of the data?

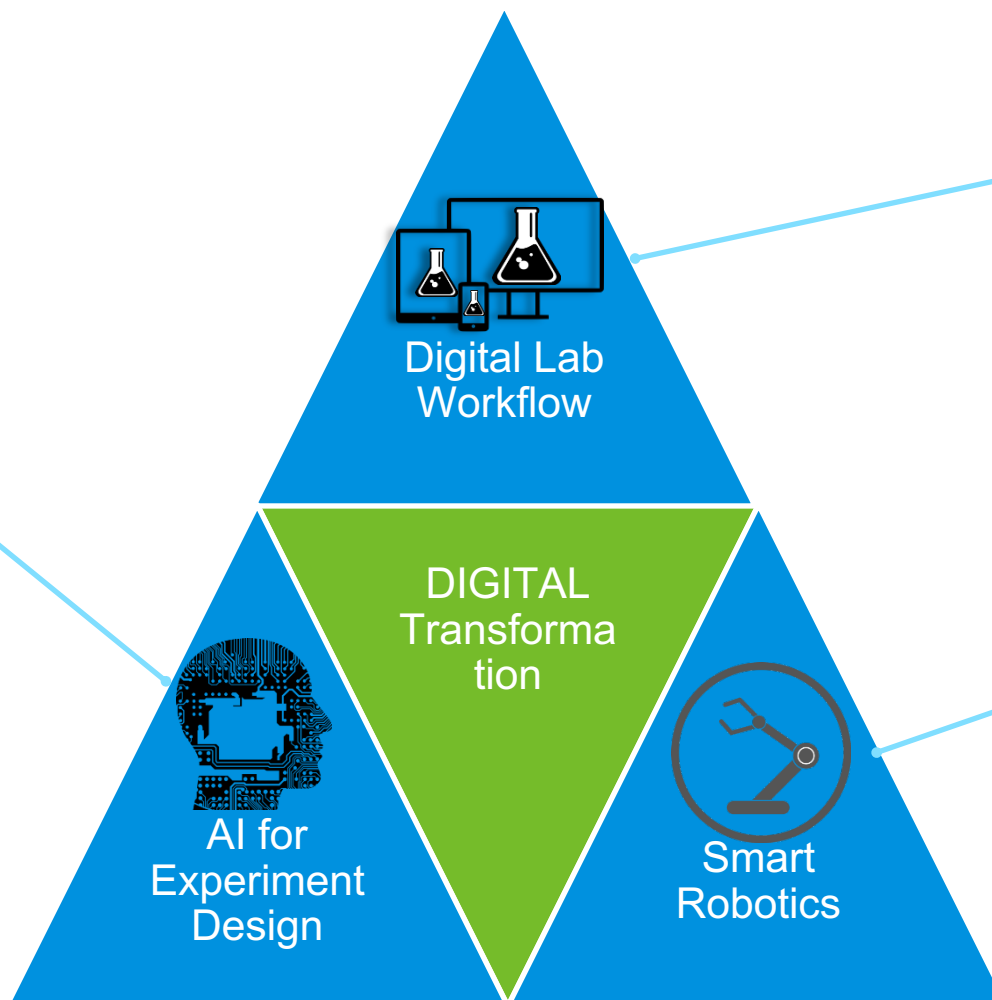- How can we make the data machine readable?

For the lab technician:

- What will **my workplace** look like?

- How can „digital" **make my life easier** ?

- What **„boring"** tasks can be automated for me?

Data Quality ⬆

Time Used Documenting ⬇

User Satisfaction ⬆

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Digital Transformation fuses emerging technologies into tangible changes

Lab of the Future

- Reduce the effort needed for experiment documentation by 50%
- Improve the quality of the experiment documentation

Quality

- Reduce the number of wet lab experiments through in silico predictions

Automation

- Automate standardized activities

Digital Lab Workflow

DIGITAL Transformation

AI for Experiment Design

Smart Robotics

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Take home messages

➢ IoT in the lab can be a major leverage to improve data quality

➢ Through balance of user needs and business goals we developed a modular solution fitting in our IT landscape

➢ IoT needs long term commitment over short term goals

➢ Adapt the new standards for open and FAIR data

➢ Automate routines, empower people for value-adding activities

➢ Never rest - think big in terms of lab digitization!

Thank you
for your attention!