Cellen Bestuderen met behulp van een Gegevensbank Systeem
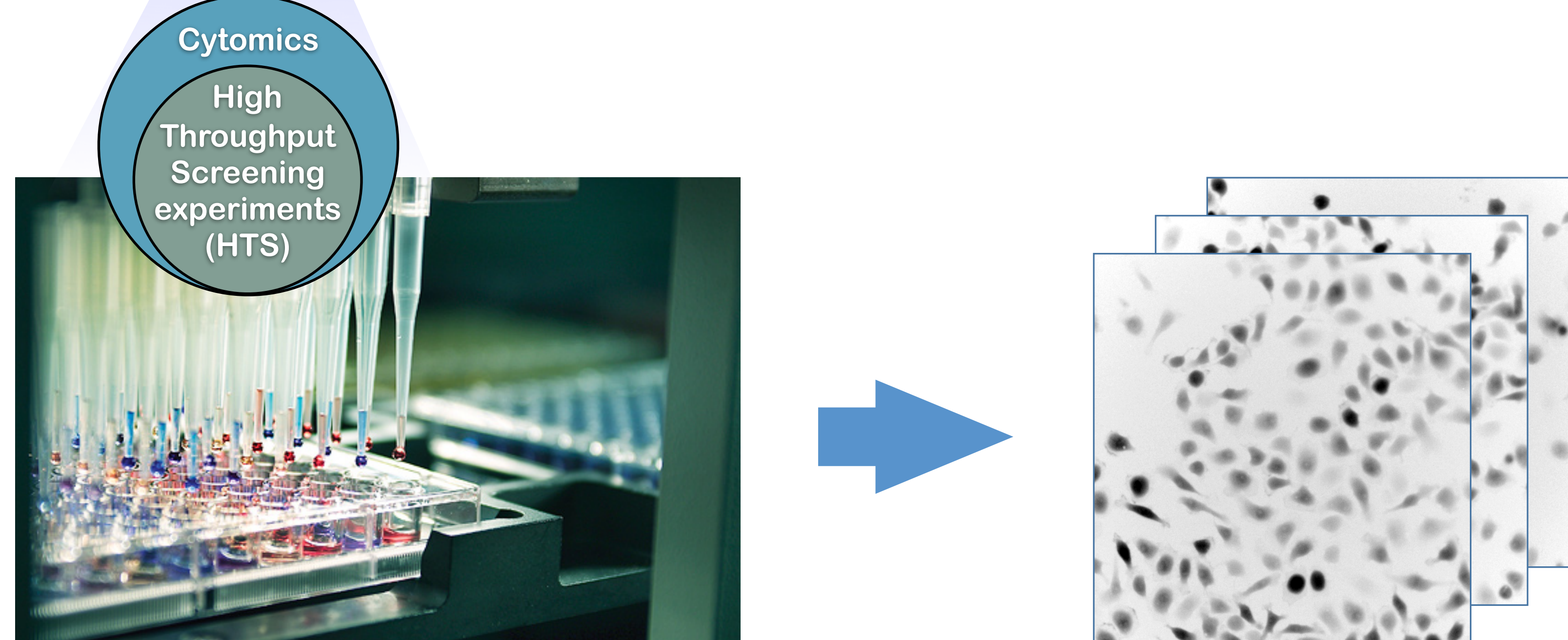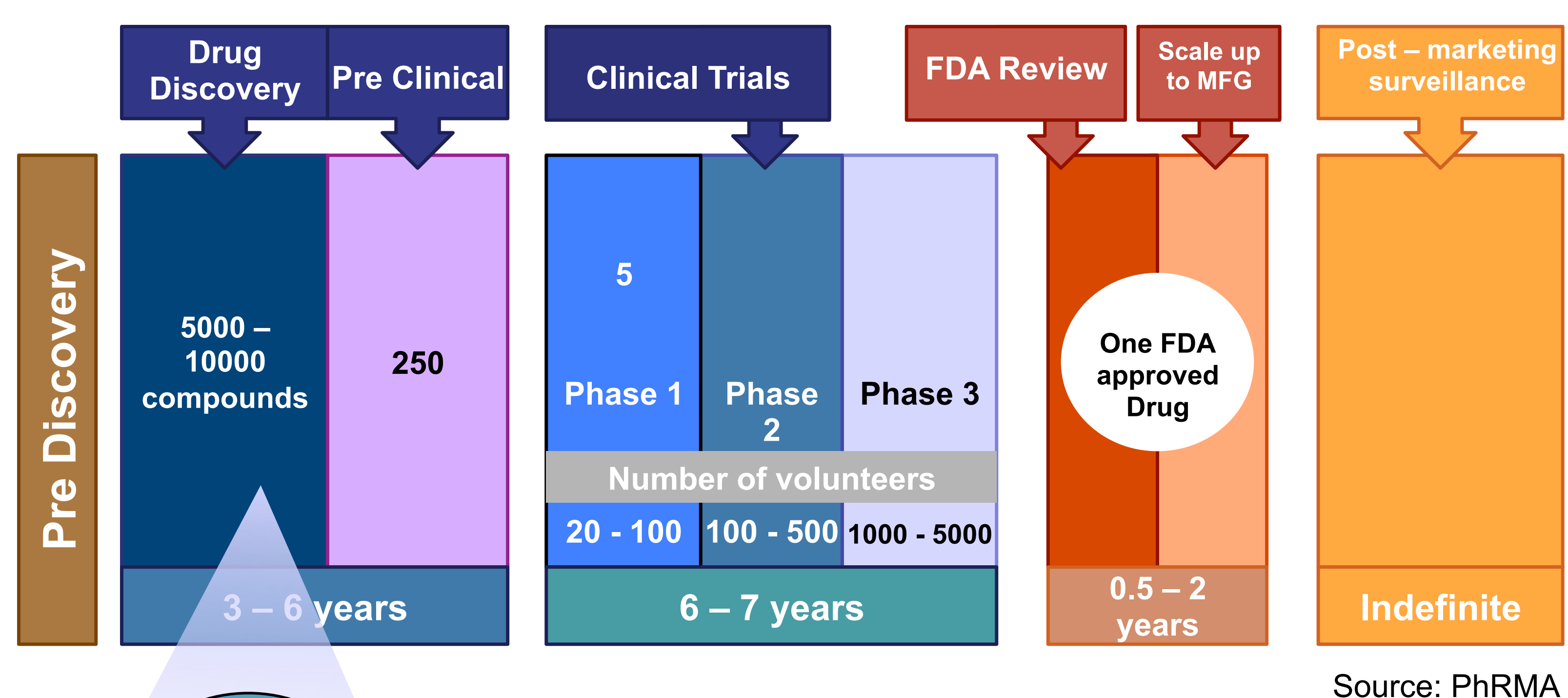
Life Sciences

CWI

Centrum Wiskunde & Informatica

Enrique Larios[1], Kuan Yan[1], Fons J. Verbeek[1], Ying Zhang[2], Fabian Groffen[2], Zi Di[3], Sylvia LeDévédec[3]

1 LIACS, Leiden University, The Netherlands; 2 CWI, Amsterdam, The Netherlands; 3 Department of Toxicology, Leiden University, The Netherlands
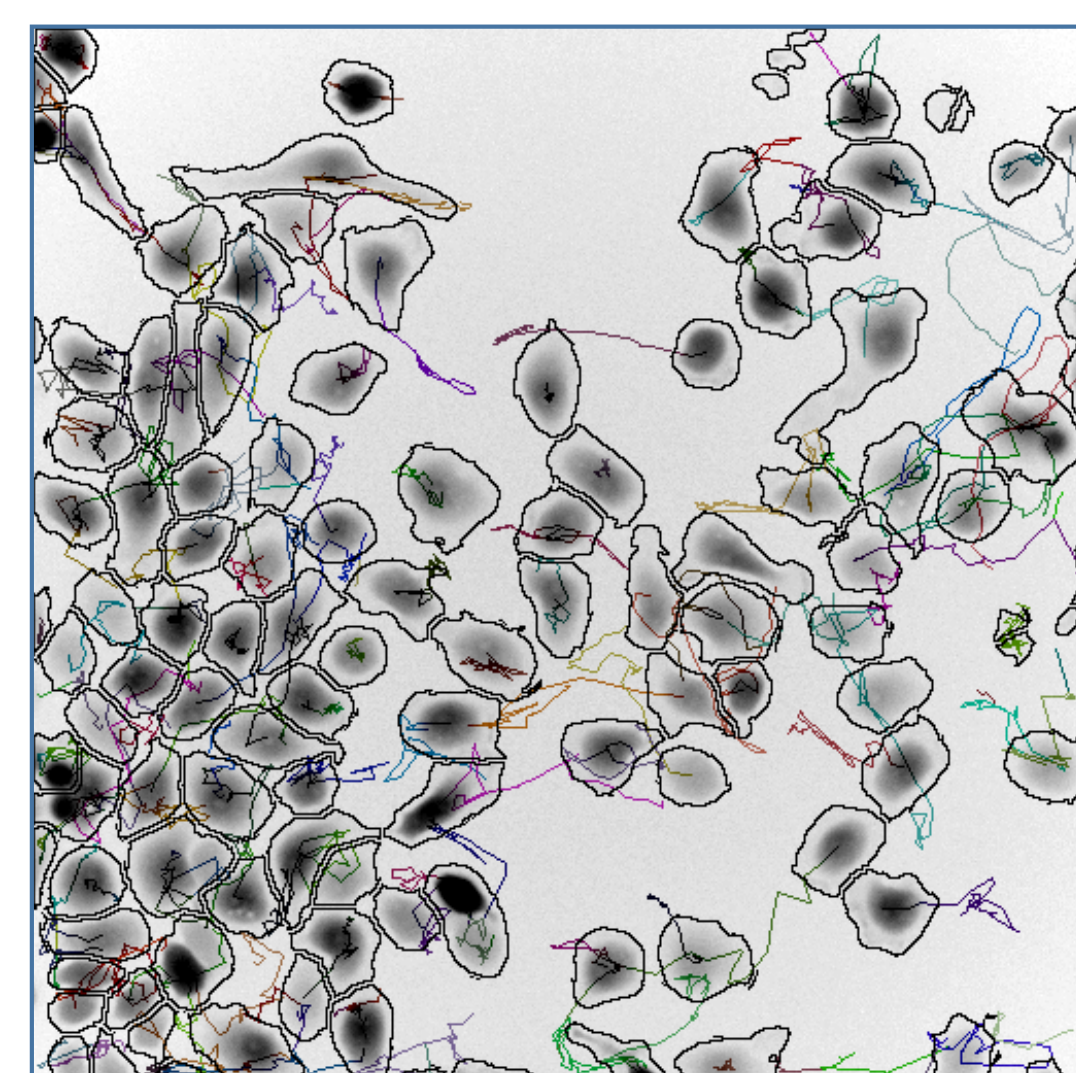
Development of New Drugs

Drug Discovery — Pre Clinical — Clinical Trials — FDA Review — Scale up to MFG — Post – marketing surveillance

Pre Discovery

5000 – 10000 compounds | 250

5

Phase 1 | Phase 2 | Phase 3

Number of volunteers

20 - 100 | 100 - 500 | 1000 - 5000

One FDA approved Drug

3 – 6 years | 6 – 7 years | 0.5 – 2 years | Indefinite

Source: PhRMA

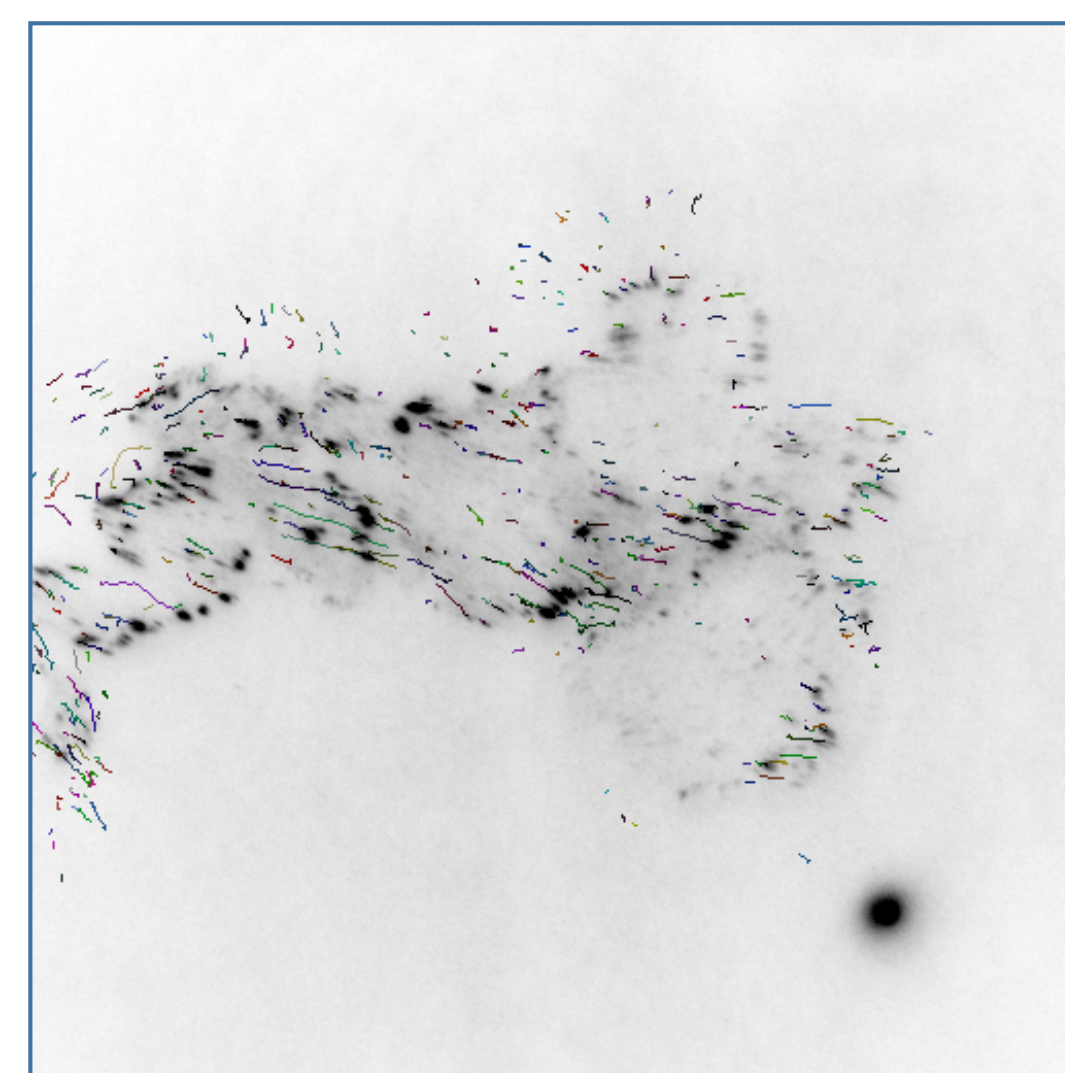Cytomics
High Throughput Screening experiments (HTS)

The current approach in cytomics is to conduct High Throughput Screening (HTS) experiments so that cells can be tested under different experimental conditions.

HTS Image Analysis

HTS image analysis provides an automated quantification of dynamic cell behavior in both cellular level and structural level
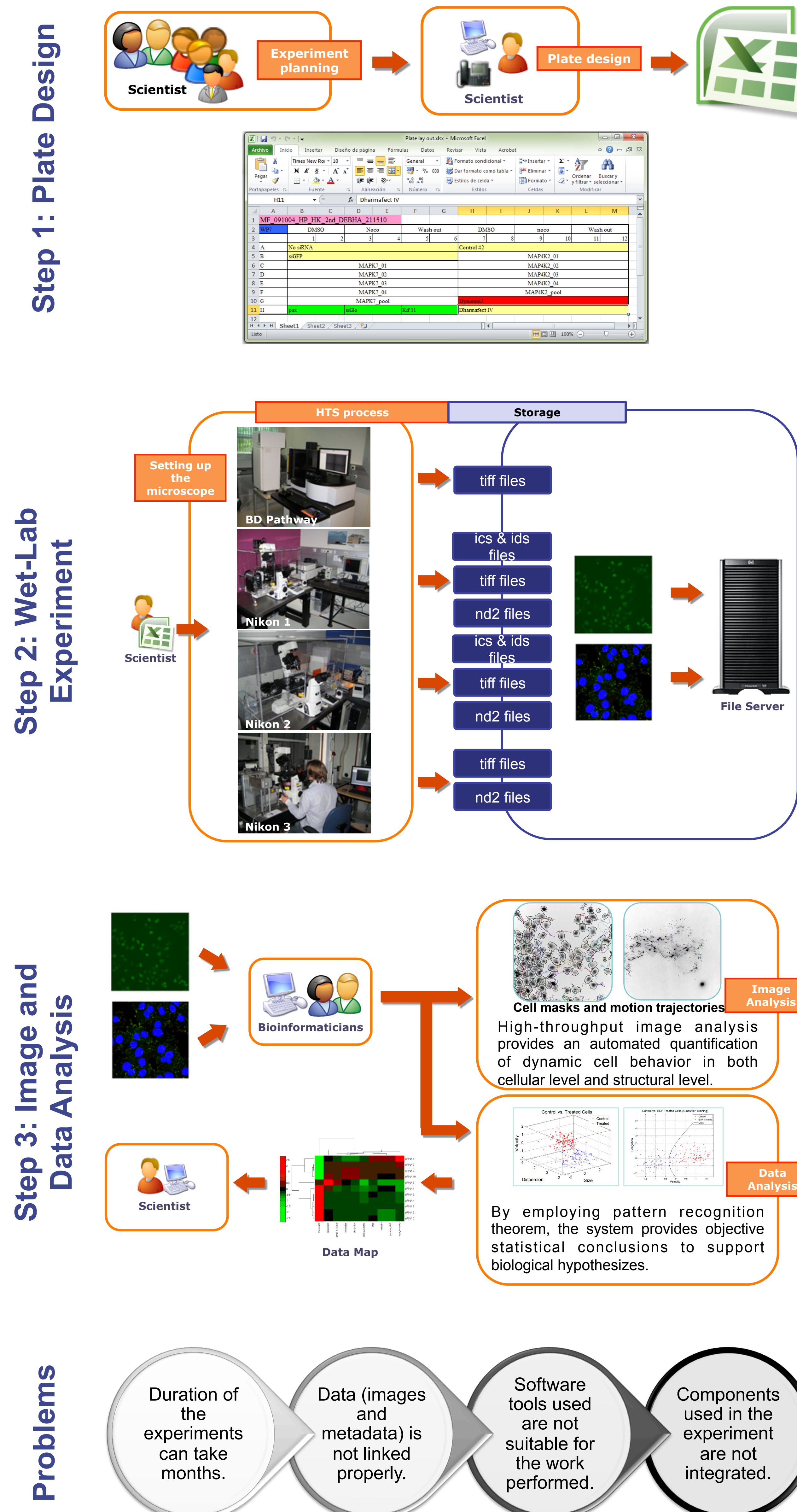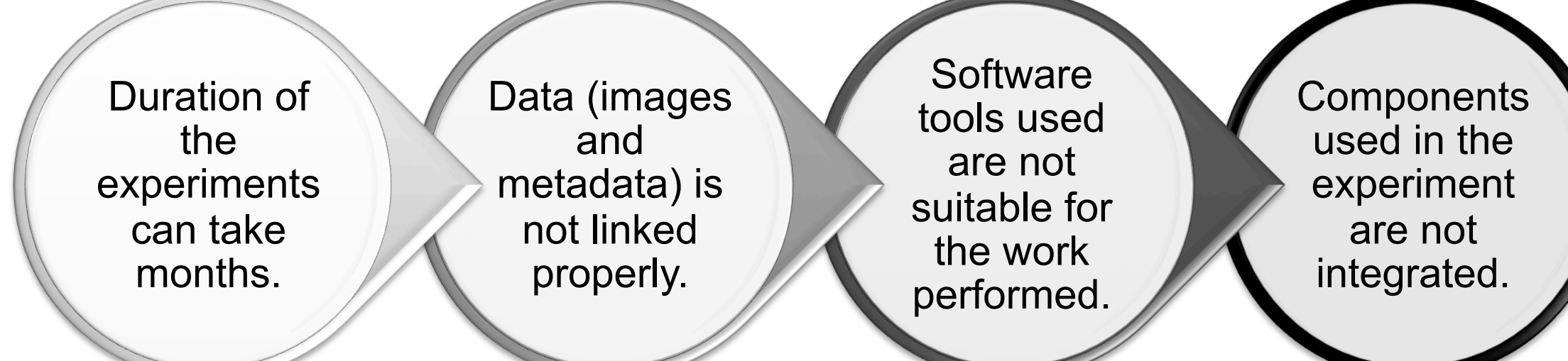
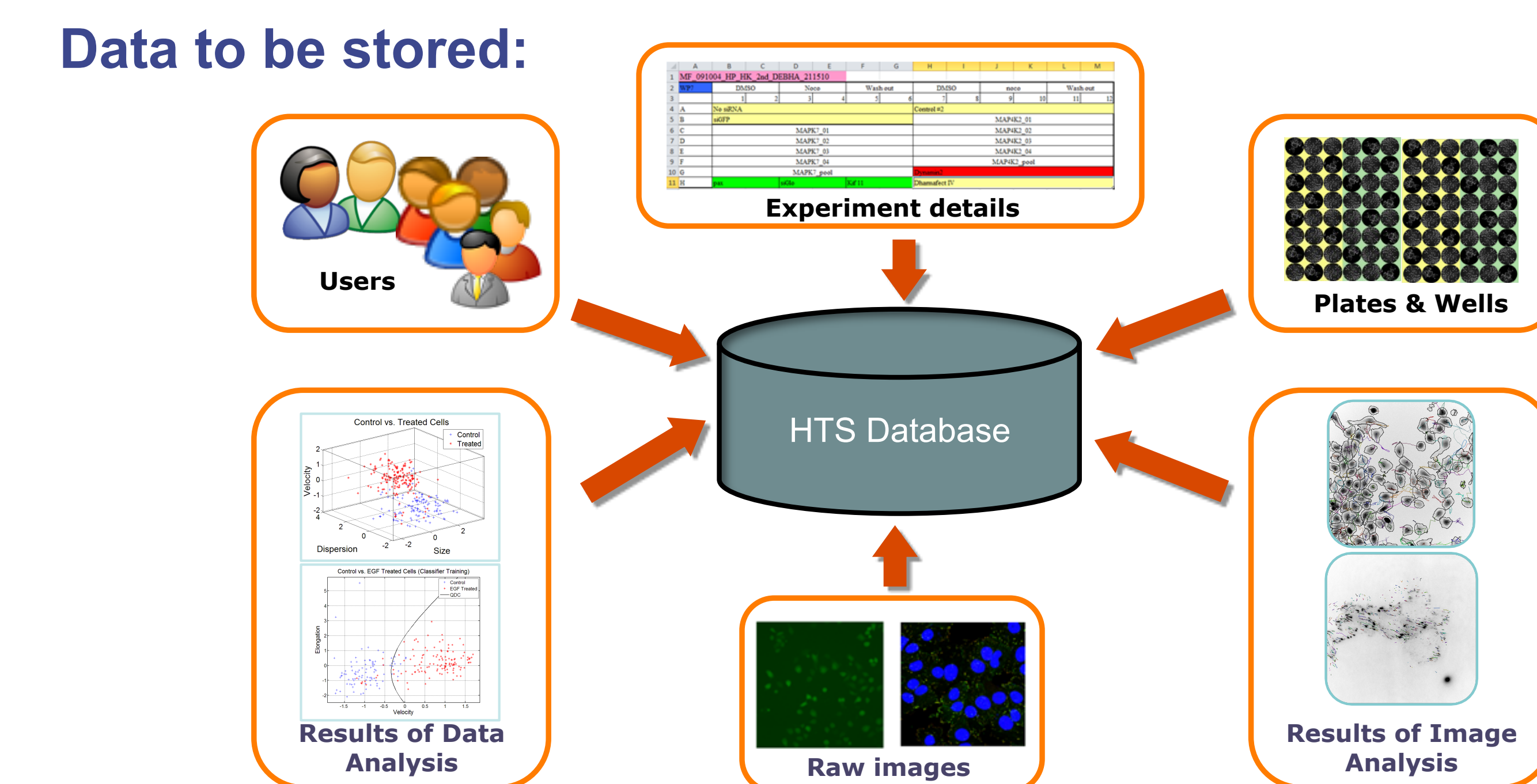Cell Migration Analysis | Structure Dynamics Analysis

Workflow in HTS Experiments

Step 1: Plate Design

Scientist — Experiment planning — Scientist — Plate design — (Excel)

Step 2: Wet-Lab Experiment

HTS process | Storage

Setting up the microscope

BD Pathway — tiff files
Nikon 1 — ics & ids files / tiff files / nd2 files
Nikon 2 — ics & ids files / tiff files / nd2 files
Nikon 3 — tiff files / nd2 files

Scientist

File Server

Step 3: Image and Data Analysis

Bioinformaticians

Cell masks and motion trajectories — Image Analysis

High-throughput image analysis provides an automated quantification of dynamic cell behavior in both cellular level and structural level.

Data Analysis

By employing pattern recognition theorem, the system provides objective statistical conclusions to support biological hypothesizes.

Scientist

Data Map

Problems

Duration of the experiments can take months. — Data (images and metadata) is not linked properly. — Software tools used are not suitable for the work performed. — Components used in the experiment are not integrated.
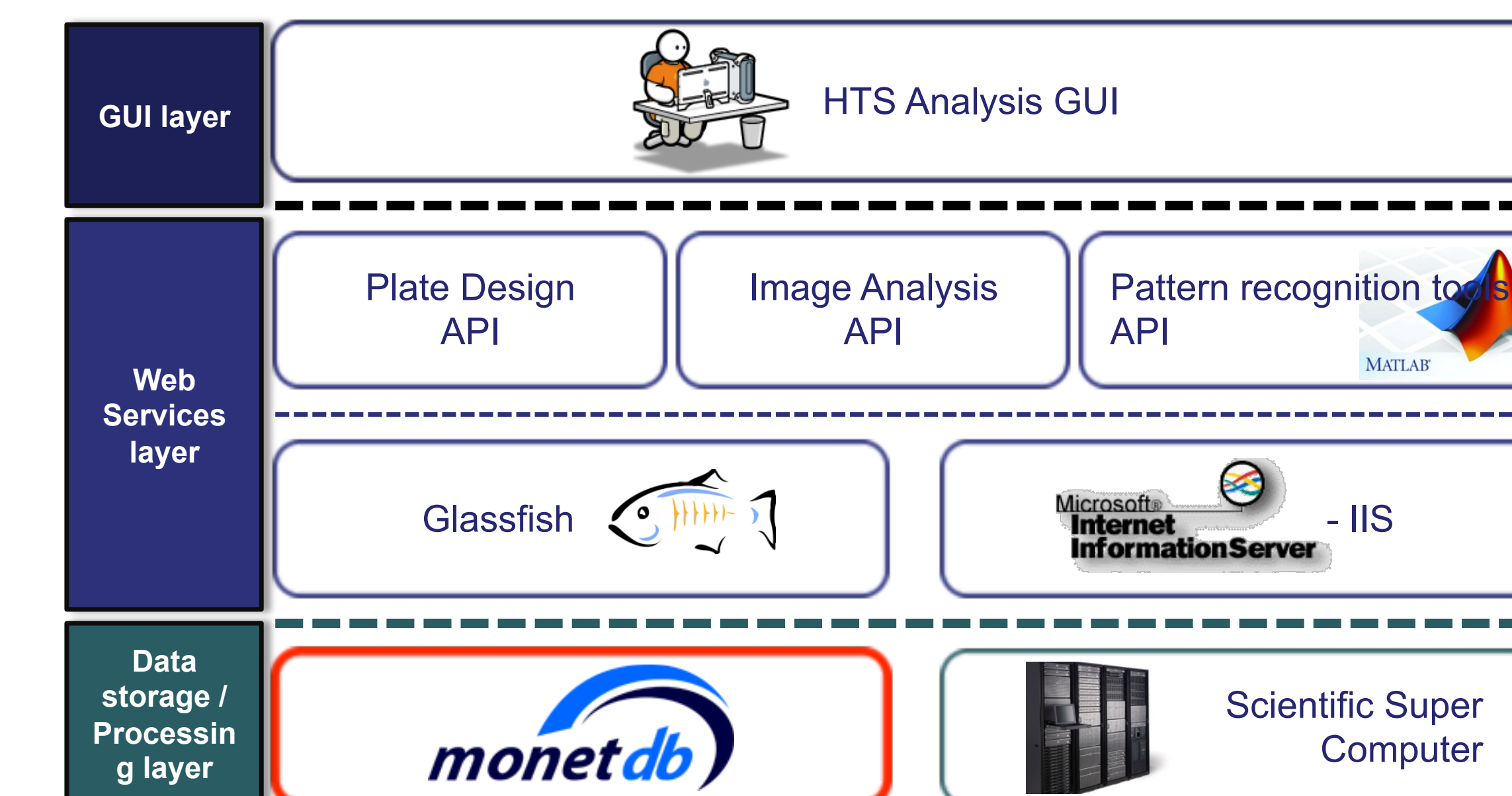
Lack of a Knowledge Discovery System: there is no platform that can facilitate scientists to learn from the experience.

Automated HTS Experiments Platform

Data to be stored:

Users — Experiment details — Plates & Wells

HTS Database

Results of Data Analysis — Raw images — Results of Image Analysis

System Architecture:

GUI layer — HTS Analysis GUI

Web Services layer — Plate Design API | Image Analysis API | Pattern recognition tool API

Glassfish | Microsoft Internet Information Server - IIS

Data storage / Processing layer — monetdb | Scientific Super Computer

Web User Interface:

Netherlands Toxicogenomics CENTRE

Welcome user elarios
Close Session

HOME | ADMINISTRATION | PROJECTS | EXPERIMENTS | CONDITIONS | PLATES | REPORTS | ANALYSIS

HTS System

- Create/Edit/Delete users
- Assign Roles to a user

- Create/Edit/Delete Projects
- Visualize Project's metadata

- Create/Edit/Delete Experiments
- Visualize Experiment's metadata

- Create/Edit/Delete/ Import existing parameters, cell line tissues, compounds, siRNA, antibodies/ regents

- Create/Edit/Delete Plates
- Visualize Plate's metadata

- Perform custom queries through different datasets.
- Visualize predefined reports about projects/ experiments/ plates/ well metadata

- Invoke the Data and Image Analysis APIs.
- Visualize the results of the data and image analysis.

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