

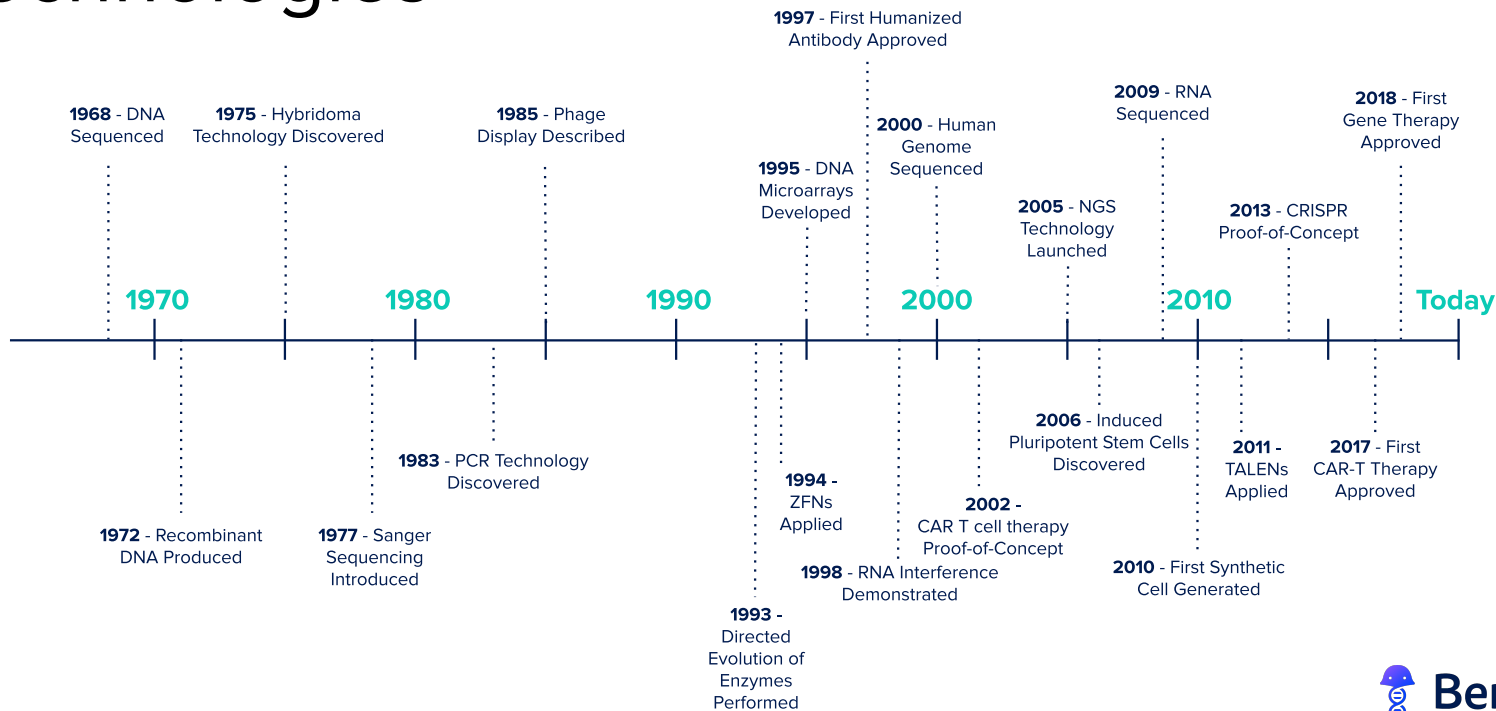
# Informatics Challenges in Synthetic Biology R&D

**Asa Oudes, PhD**

October 17, 2019



# We are entering a **new era** of molecular technologies



# Challenges facing synthetic biology R&D



Creation and management of  
DNA parts and constructs



Processes requiring complex  
data interpretation



Scale-up and processing  
challenges



Specialization of teams leading  
to more complex collaboration



Drive towards improving speed,  
productivity, and efficiency



Increased external  
partnering

# Need for a data management platform built to streamline synthetic biology R&D



## Unified cloud platform, not point solutions

- Centralized data repository and platform
- Standardized recordkeeping with more reliable data
- Open extensible platform that integrates with existing IT



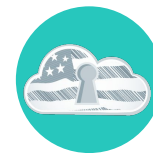
## Purpose-built for collaboration

- Web-based, simple, and intuitive user interface
- Real-time collaboration among authors / scientists
- Access controls for data sharing with external partners



## Made for modern science

- Handles the latest scientific workflows
- Traceability of samples and experimental records
- Built-in tools for automation and high-throughput analysis



## Meet stringent security & compliance standards

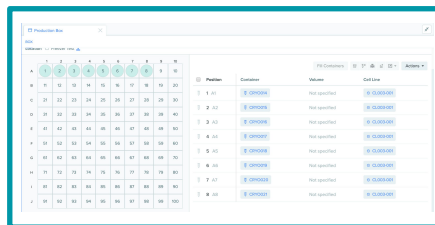
- Designed to host sensitive data
- Highest level of encryption and data security
- Compliance with data quality standards



# That's why we built **Benchling**

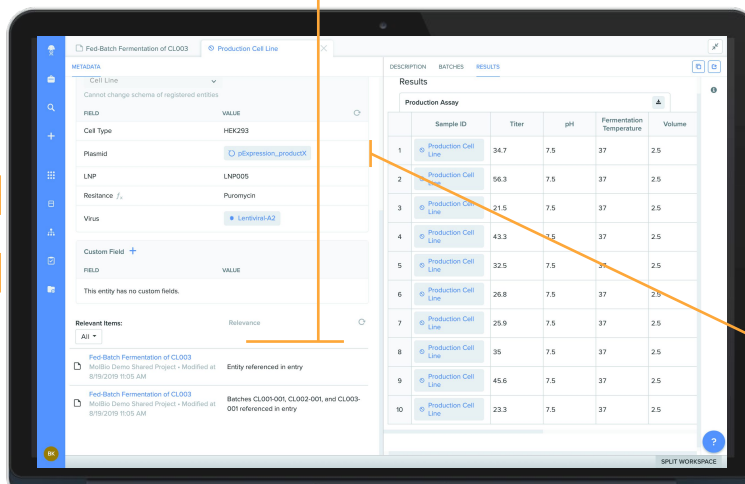
a unified, biointelligent platform to drive the creation of higher quality data

## INVENTORY



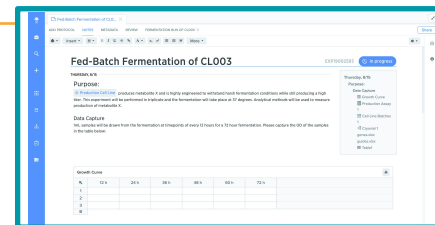
Lot	Position	Duration	Values	Cell Line
1	1	1	1	HEK293
2	2	2	2	HEK293
3	3	3	3	HEK293
4	4	4	4	HEK293
5	5	5	5	HEK293
6	6	6	6	HEK293
7	7	7	7	HEK293
8	8	8	8	HEK293
9	9	9	9	HEK293
10	10	10	10	HEK293

## REGISTRY



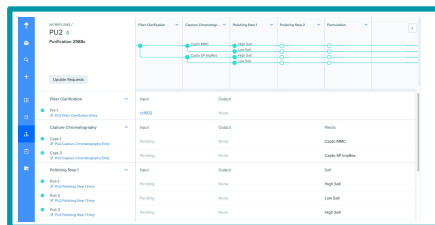
Sample ID	Titer	pH	Fermentation Temperature	Volume
1	34.7	7.5	37	2.5
2	56.3	7.5	37	2.5
3	21.5	7.5	37	2.5
4	43.3	7.5	37	2.5
5	32.5	7.5	37	2.5
6	26.8	7.5	37	2.5
7	25.9	7.5	37	2.5
8	35	7.5	37	2.5
9	45.6	7.5	37	2.5
10	23.3	7.5	37	2.5

## NOTEBOOK



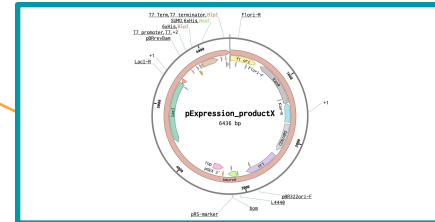
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## REQUESTS & WORKFLOWS



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## MOLECULAR BIOLOGY



Seamless, flexible  
integration



Cloud

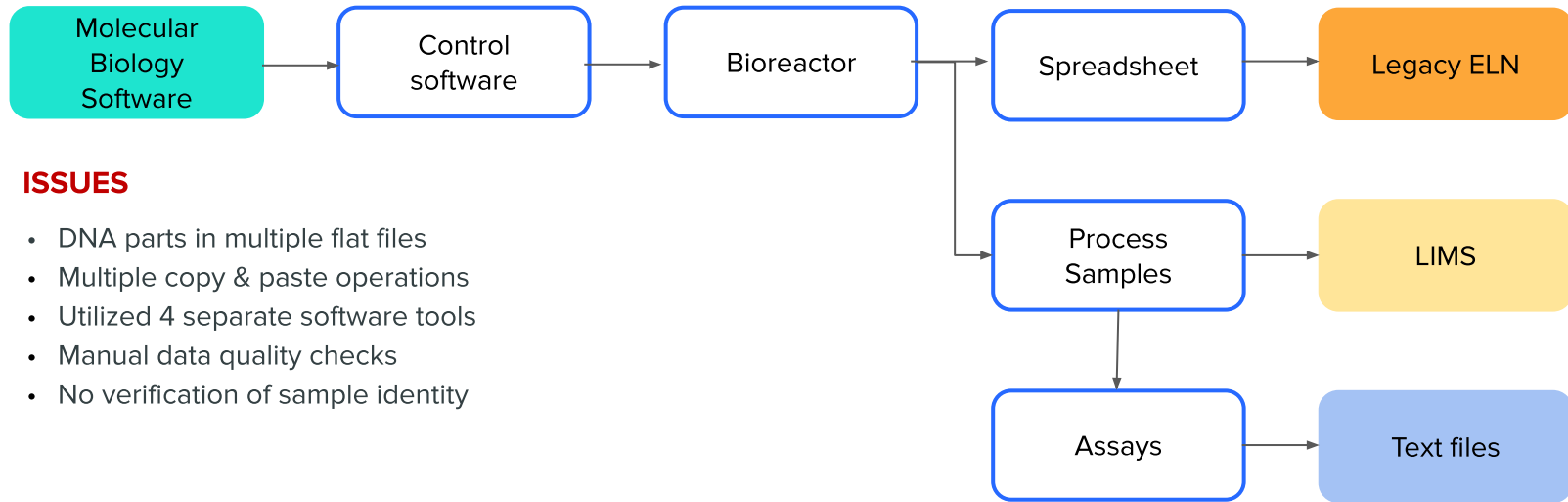


Analytics / business  
intelligence



**Benchling**

# Use Case: Unification of data on a single software platform

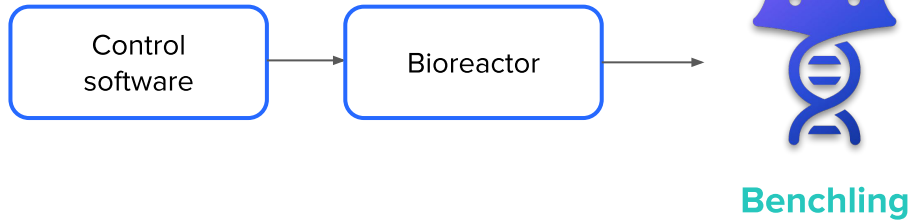


## ISSUES

- DNA parts in multiple flat files
- Multiple copy & paste operations
- Utilized 4 separate software tools
- Manual data quality checks
- No verification of sample identity

# Use Case: Unification of data on a single software platform

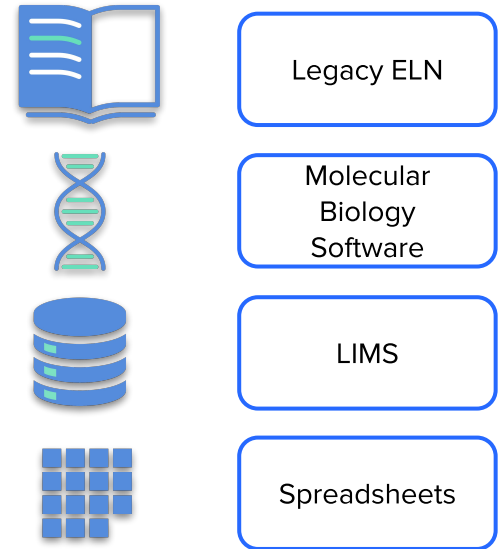
## AFTER BENCHLING



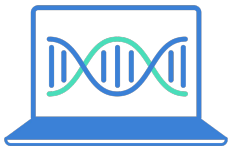
## SOLUTION

- Efficient data collection
- Database of DNA parts
- Zero copy & paste operations
- Data integrity is assured with validation and audit logs
- Replaced legacy ELN, LIMS, and molecular biology software

## BENCHLING REPLACED



# Software Example



DNA part library

DNA part autofill

Vector assembly

Sequence search

The screenshot displays the 'Enzyme design' software interface. The left sidebar contains a 'Projects / Enzyme design' section with a search bar and filters. Below this is a 'NOTEBOOK' tab with a list of items: 'Assembled integration cassettes', 'Ensembl genes', 'Expression cassettes', 'Gene fragments', 'Homology', 'Instrument output', 'Linkers', 'Primers', 'Promoters', 'Terminators', and 'Test'. The main workspace is titled 'Vector backbone for homology cloning - EXPCAS001'. It features a 'SEQUENCE MAP' section with a 'Create' button and a 'Copy' button. The sequence map shows a DNA sequence with various restriction enzyme sites (BsoBI, AvaI, BbvCI, BssSbI, BssSI, NheAIII, BsiHKAI, TaqI, PaeR7I, BsoBI, XhoI, TiiI, AvaI) and a '5' homology' region. The sequence is displayed in a table format with columns for 'BASES', 'START', 'END', 'LENGTH', 'GC', and 'MELTING TEMP'. The right sidebar shows the 'METADATA' tab with a 'Schema' section containing 'Expression Cassette', 'Date', 'Sequence verified', 'Promoter', 'Gene A', 'Linker', 'Gene B', 'Terminator', and 'Synthetic Fragments'. Each field has a dropdown menu with a selection (e.g., 'PRO005', 'GOIA001', 'LINK003', 'GOIB001', 'TERM008'). A 'Custom Field' section is also visible at the bottom right.



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