<table>
<thead>
<tr>
<th>Year</th>
<th>Product</th>
<th>Duration</th>
<th>Genes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957</td>
<td>Glutamate (Ajinomoto)</td>
<td>50 yrs</td>
<td>0 genes</td>
</tr>
<tr>
<td>2006</td>
<td>PDO (Dupont / Tate &amp; Lyle)</td>
<td>15 yrs</td>
<td>6 genes</td>
</tr>
<tr>
<td>2011</td>
<td>Farnesene (Amyris)</td>
<td>6 yrs</td>
<td>22 genes</td>
</tr>
</tbody>
</table>
1957
Glutamate (Ajinomoto)
$1s millions

2006
PDO (Tate & Lyle)
$10s millions

2011
Farnesene (Amyris)
$100s millions
Escalating costs mean fewer world-changing biotech products will reach market
Process quality

Aggregated data
Example: troubles with scale-up due to noisy R&D processes
Process variation obscured understanding of true process behavior & capability

Typical PD Batch early in development

Scale-up outcome

XX% yield drop
12 months transfer time
**Solution: data integration & analytics delivered process quality**

Improved data then uncovered root-causes of scaling problems

**Typical PD Batch after quality campaign**

- Yield vs. Time (h)
- Process CV

**LOW NOISE / CONTROLLED PROCESS**

**Scale-up outcome**

- Exact performance match
- 3 months transfer time

- **YIELD**
  - PD
  - MFG

- **Scale-up**
  - 0.5 L
  - 2 L
  - 200,000 L
Quality data is a building block for machine learning
Data aggregation revealed latent correlations that delivered cost-free gains in manufacturing output

Mining of 500 aggregated experiments delivered a cost-free 5-10% gain in productivity

See JMP Forward for JMP 16 for the story of “Just add water” (also posted online at jmp.com)
Traditional data systems and practices are failing us
They don’t deliver the **process context** or **data integration** needed for machine learning

“It often takes us 2-3 months to assemble the data from a single development batch”

- senior scientist global pharmaceutical company

“We change what we know not what matters”
Riffyn Nexus: a process-centric approach to R&D
Built to support process development in biopharma & industrial biotech
Analysis-ready data in real-time
Data is contextualized on collection into a flexible, versioned process model for aggregate analysis
Automated & instant data integration delivers insight

- Material traceability & process context
- Always structured & integrated data
- Dramatic time savings
- Novel insights from correlated data
How customers are using Nexus to accelerate R&D innovation

- **Biofuels strain development**: 2X faster project
- **Translational medicine / molecular assays**: 25% less effort
- **Fermentation**: 20X faster data prep
- **Clinical assays**: 9 weeks to clinic
- **Solid dose formulations development**: 16h saved / batch
- **Veterinary health**: 80% fewer animals