International Symposium on
Continuous Manufacturing of Pharmaceuticals
MIT May 20-21, 2014

White Paper # 4

Continuous Bioprocessing

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Session #4 structure

Panelists: Jeff Baker (FDA), Joanne Beck (Shire), Karol Lacki (GE)

Agenda:

• Opening:	C. Cooney	5min	(4:00-4:05pm)
• Introduction:	K. Konstantinov	15min	(4:05-4:20pm)
• Panelists comments:		10min	(4:20-4:30pm)
	J. Baker – regulatory view		
	J. Beck – industry view		
	K. Lacki – vendor view		
• Open discussion:	All	40 min	(4:30-5:10pm)
• Closing remarks:	C. Cooney	5min	(5:10-5:15pm)

White Paper #4: Continuous Bioprocessing (CB)

Authors and first reviewers:

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Feedback from a growing number of colleagues received

We will continue to revise the document. PLEASE, SUBMIT YOUR COMMENTS

Thank You!

White Paper #4: Contents

Abstract

Introduction

Definitions

Challenges of current biomanufacturing technology and the opportunities offered by continuous processing

- *Cost*
- *Flexibility*
- *Standardization*
- *Speed of scaling*
- *Quality*

Technology needs

- *Different requirements for up and downstream*
- *Standardization of downstream architecture*
- *Further optimization of cell culture media*
- *Global process control*
- *Process Analytical Technology (PAT)*

Issues to be addressed

- *Regulatory roadmap*
- *Challenges to adoption*
- *Supply chain considerations*
- *Impact on business strategy*
- *Impact on organizational structure*

Examples: 3 hybrid architectures and 1 integrated

- *Continuous upstream, batch downstream*
- *Batch upstream, continuous downstream*
- *Continuous bioreactor-capture, batch post-capture*
- *Fully integrated continuous process*

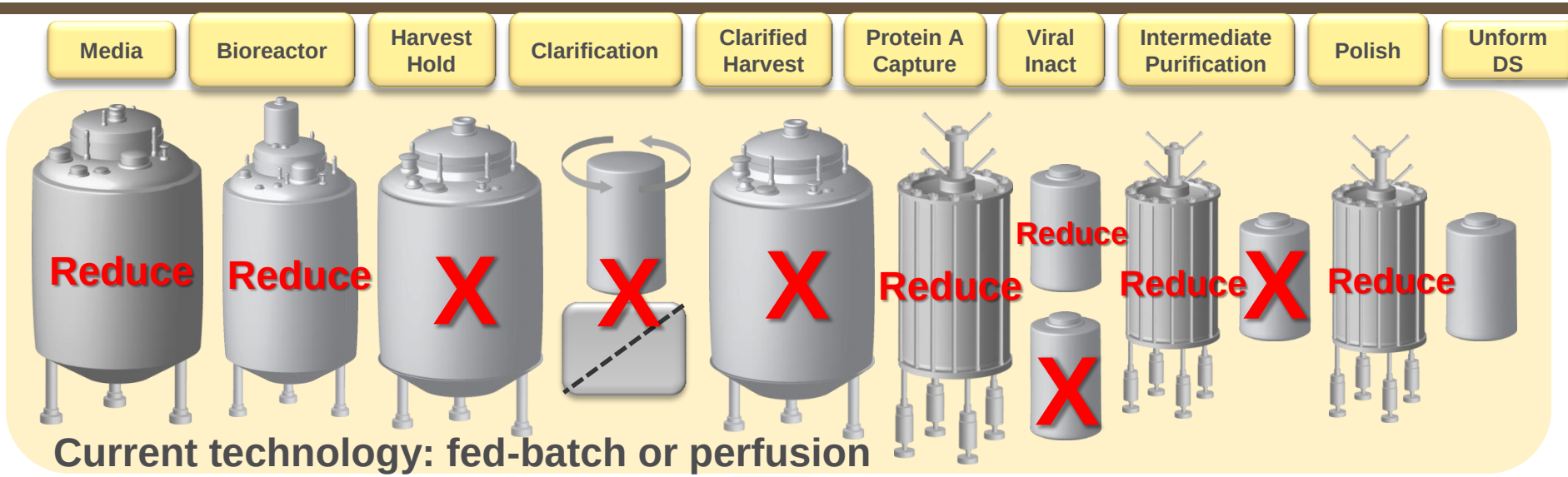
Recommendations

References

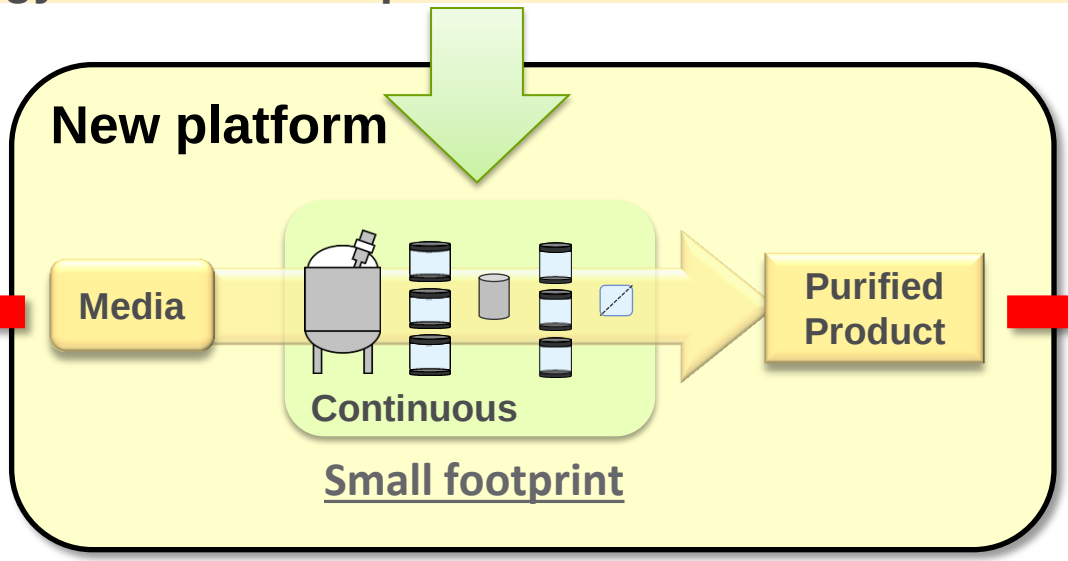
CB: Current status and key messages

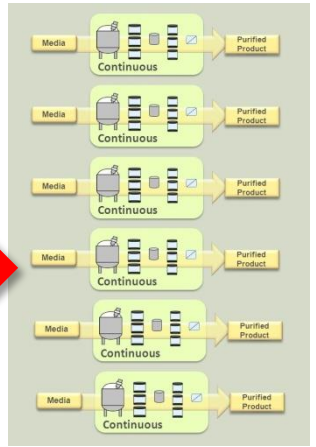
- Upstream perfusions technology well established for the last >25 years
- Downstream continuous purification missing at commercial scale
- Transformative potential of CB is increasingly apparent
- Significant resistance and insufficient understanding persist
- Key challenges are not only technical but also ORGANIZATIONAL
- CB under development by several companies, but “dominant design” has not emerged
- International “CB community” is emerging
- Regulatory guidance needs to be operationalized

Transition from traditional to CB



- Efficiency
- Simplicity
- Flexibility
- Quality
- Cost
- Facility
- Mobility
- Standardization





Small, flexible, portable multi-product facility

Key questions and points for discussion

- **Science & technology**
  - *What are the standards for performance and control?*
  - *What are the analytical (PAT) to support CB?*
  - *Where are the critical science & technology gaps?*
- **Facilities Design and Operation**
  - *What are the operational barriers to CB?*
  - *Cleaning and robustness*
  - *What is the preferred facility design?*
- **Cooperation with Regulatory agencies**
  - *What kind of guidance is needed from FDA and EMA to accelerate CB implementation?*
  - *What are the challenges of QbD and validation?*
- **Addressing organizational challenges**
  - *Who is the internal champion and why?*
  - *What organizational and cultural changes are needed for the implementation of CB?*
  - *How to justify CB while production capacity on the old technology exists?*
- **Knowledge & learning**
  - *How do we learn from other industries?*
  - *How to bring together the academic, industrial and regulatory community?*