

Emerging Technologies and Innovation in Manufacturing Regenerative Medicine Therapies: A Workshop

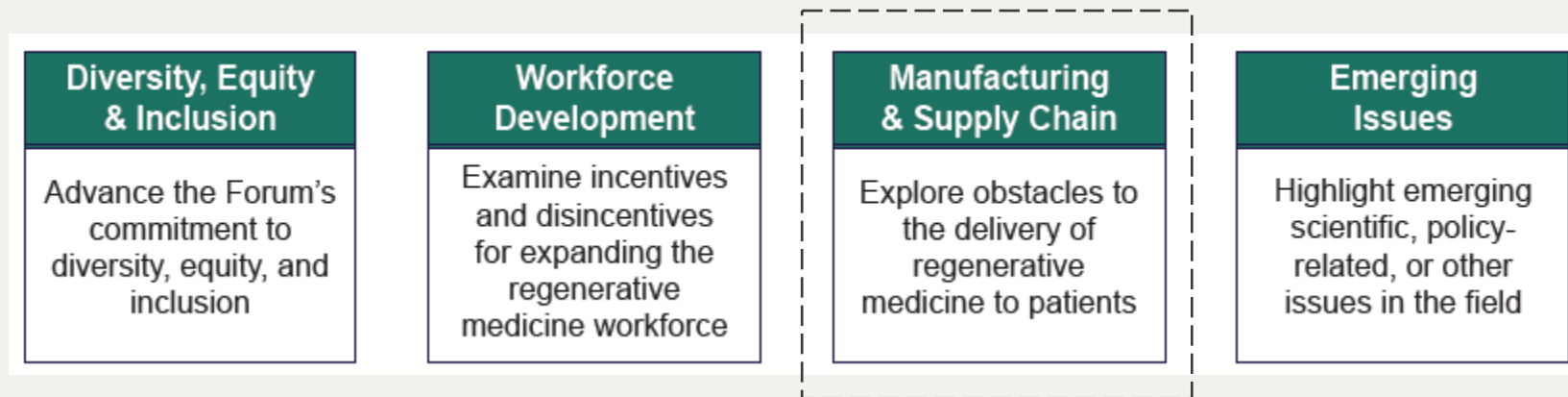
Scott Steele, Workshop Co-Chair

Claudia Zylberberg, Workshop Co-Chair

OCTOBER 17, 2023

Context – Priorities of the Forum's Work

The Forum on Regenerative Medicine adopted a new strategic plan in 2022



Primary focus of today's discussions

Purpose of Today's Workshop

- To examine challenges and opportunities in manufacturing regenerative medicine therapeutics as the field evolves to accommodate higher volume production and increased capacity for delivering regenerative medicine treatments to patients
- To discuss the interplay of different components in the context of manufacturing regenerative medicine therapies
 - Scientific and technological developments
 - Evolving manufacturing models
 - Regulatory considerations
 - Partnerships and models to implement new innovations

Planning Committee Members

Scott Steele (*workshop co-chair*), U.S. Food and Drug Administration

Claudia Zylberberg (*workshop co-chair*), *formerly* Akron Biotech

Thomas Greenwell, National Eye Institute

Kelvin Lee, University of Delaware

Anne Plant, National Institute of Standards and Technology

Rachel Salzman, American Society for Gene and Cell Therapy

Sohel Talib, California Institute for Regenerative Medicine

Phil Vanek, Gamma Biosciences

Context – 2017 NASEM Workshop on Manufacturing Regenerative Medicine Therapies

Goals

- To examine challenges, opportunities, and best practices associated with defining and measuring the quality of cell and tissue products and raw materials
- To learn from existing examples of manufacturing of early generation regenerative medicine products
- To discuss progress in identifying and measuring critical quality attributes

Topics

- Transitioning from discovery and development to manufacturing
- Critical quality attributes
- Technologies that meet manufacturing needs and regulatory standards



From Workshop 2017- Bruce Levine Remarks

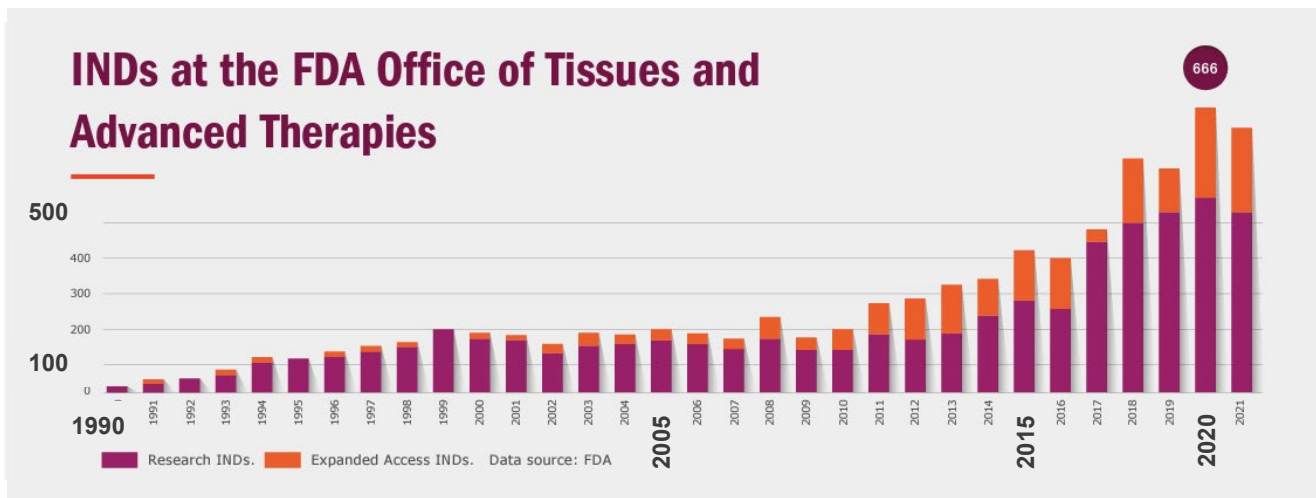
- *Ensuring that there is a consistent supply chain for complex reagents and materials*
- *Near-term out-scaling and the mid-to-long-term automation of manufacturing processes.*
- *Developing rapid and modified-release tests to assess product quality.*
- ***Increasing the consistency and comparability of regenerative medicine products and managing complex manufacturing processes.***
- *Reducing the cost of goods, labor, and services.*
- *Recruiting, training and retaining workforce,*

Context – What has changed since 2017?

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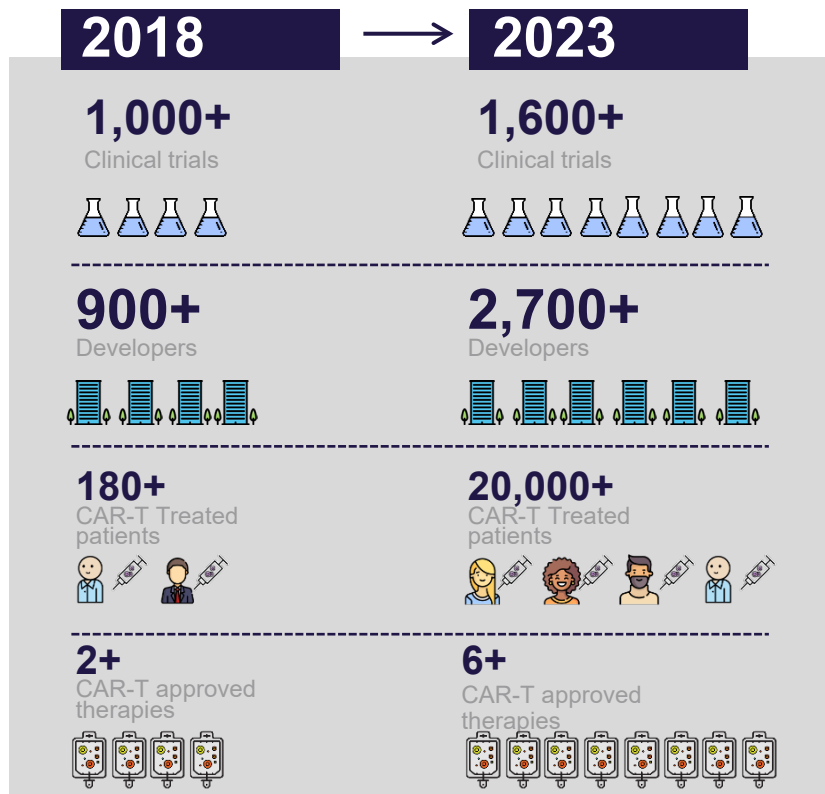
Current FDA-
approved Cell and
Gene Therapies

- More FDA-approved therapies, with more approvals anticipated
- Some of this growth is associated with manufacturing developments
- Realizing the potential of machine learning and AI capabilities
- Concerns about access, cost, and supply chain challenges



Source: Alliance for Regenerative Medicine, Aug 2023 Sector Report

How can we bridge current approved Advance Therapies for more global access?



Gaps and Opportunities

- Consolidation of the supply chain to reduce costs. Centralized raw material purchasing, qualification, and validation
- Decentralized Quality Management Systems and advancements in analytical tools and techniques
- Standards to support the advancement of novel manufacturing and analytical strategies
- Integration of automation in as many unit operations as is practical to drive throughput safely
- Secure IT infrastructure to support increased data collection capacity and drive predictive analytics
- Industry involvement in workforce development and training to close the skill gap
- Point-of-care model development (i.e., Central CDMO with satellite regional centers, hospital exemptions, others)
- International Harmonization of on-site inspections to increase and globalize commercial manufacturing capacity
- Strengthen collaborations and tech transfer activities across sites and countries (i.e., PAHO/WHO Technology Transfer Program)



Today's Discussion Topics

- Opportunities for new biomanufacturing technologies to change the future of cell and gene therapies
- Available models of decentralized or distributed manufacturing for regenerative medicine
- The role of automation and AI or machine learning in biomanufacturing
- How to ensure quality control and improve manufacturing reliability
- Strategies to build partnerships and promote technology transfer

Today's Agenda

- **SESSION I: Opening Remarks & Keynote**
- SESSION II: Decentralized Manufacturing as a Strategy to Address Production and Supply Chain Challenges
- SESSION III: Automation and Algorithms in Regenerative Medicine Manufacturing
- SESSION IV: Quality Control and Regulatory Considerations
- SESSION V: Implementing New Manufacturing Strategies through Partnerships and Innovative Technology Transfer

How to Engage with Us Today

Asking Questions

- **In-Person:** Speak into a microphone, stating your name and affiliation, before asking a question
- **Remote:** Use the Slido box beneath the webcast to share your questions for the panelists

Other

- Speaker bios can be found in the briefing book located on the workshop webpage.
- A survey will be shared with you after the workshop to collect your feedback.
- A proceedings—in brief will be published based on the day's discussions.

Thank you for joining us!

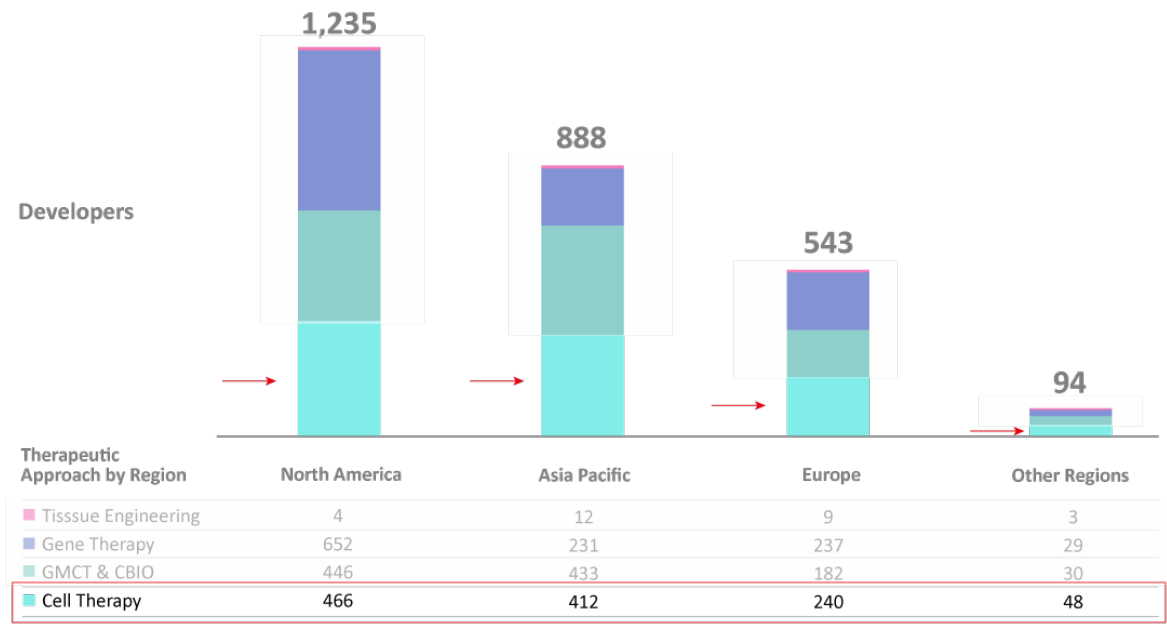
Background slide

Global Decentralized Manufacturing- Patient Access is in the critical path



ARM Data as 2023

Therapeutic Approach by Region



ARM Snapshot 2023

Phase 3 Cell Therapy Clau aca completa el texto

Approved CAR-T Globally Deployed*

Annual Estimate of Patients Treated with Approved CAR-T Therapies								
Therapy Name	2017	2018	2019	2020	2021	2022	2023 (through 2nd Quarter)	Cumulative Patients Treated by Therapy
KYMRIA [®]	13 (Aug 2017)	160	586	998	1,236	1,129	556	4,678
YESCARTA [®]	19 (Oct 2017)	708	1,223	1,510	1,864	3,110	1,982	10,416*
TECARTUS [®]	-	-	-	118 (Jul 2020)	472	802	475	1,867*
ABECMA [®]	-	-	-	-	391 (Mar 2021)	925	666	1,982
BREYANZI [®]	-	-	-	-	213 (Feb 2021)	444	417	1,074
CARVYKTI [®]	-	-	-	-	-	289 (Feb 2022)	407	696
Total Patients Treated per Year	32	868	1,809	2,626	4,176	6,699	4,503	20,713