



ROBOTS MAKING PRECISION MEDICINES... AT SCALE!

Alice Melocchi^{1,2}

¹ Associate Professor, Università degli Studi di Milano, Milan, Italy;

² Co-founder & Chief Scientific Officer, Multiply Labs, Inc.,
San Francisco, US-CA.

RAYA 2024 Finalist Event





Multiply Labs



- Robotics-as-a-service company
- We design and build robotic clusters compliant with Current Good Manufacturing Practices (cGMP) for cost-effective production of personalized medicines at scale



ATTRACTIVNESS

Precision medicine



Efficacy & Safety

Sustainability

Oral Route

Customize drug strength, dosage form (composition in excipients and physical characteristics), mode as well as frequency of administration and performance

Cell Therapies

Production of autologous products starting from the patient's cells. They represent an ideal match for the subject, limiting rejection risks and asking for less intensive patients' screening

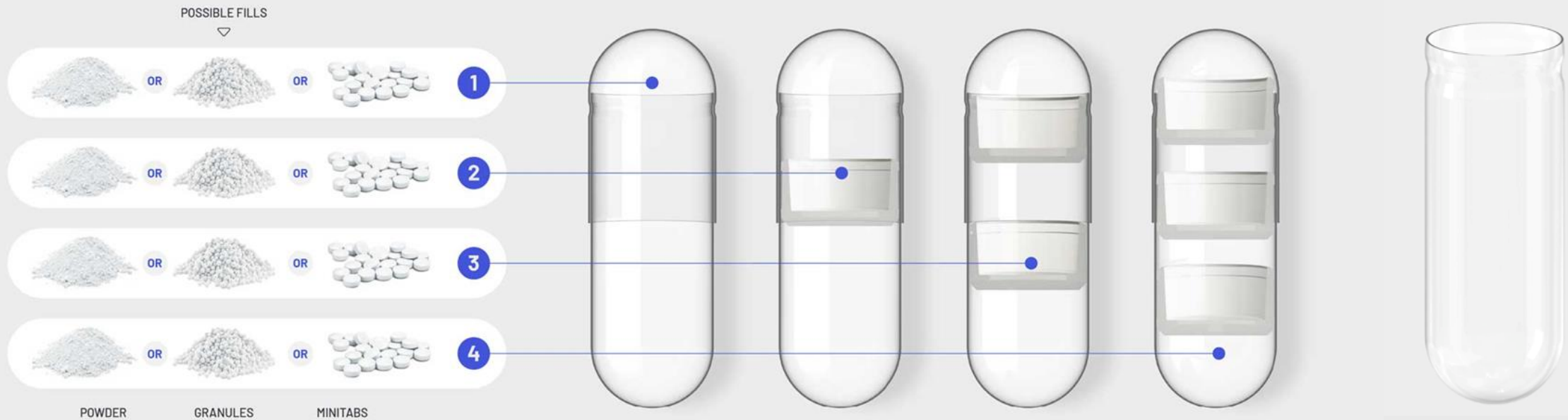
Robotic Clusters (RCs) *High-quality personalized medicines at scale & at contained costs!*

1. Personalized multi-compartment capsules

ATTRACTIVNESS

Robotic Clusters (RCs) *High-quality personalized medicines at scale & at contained costs!*

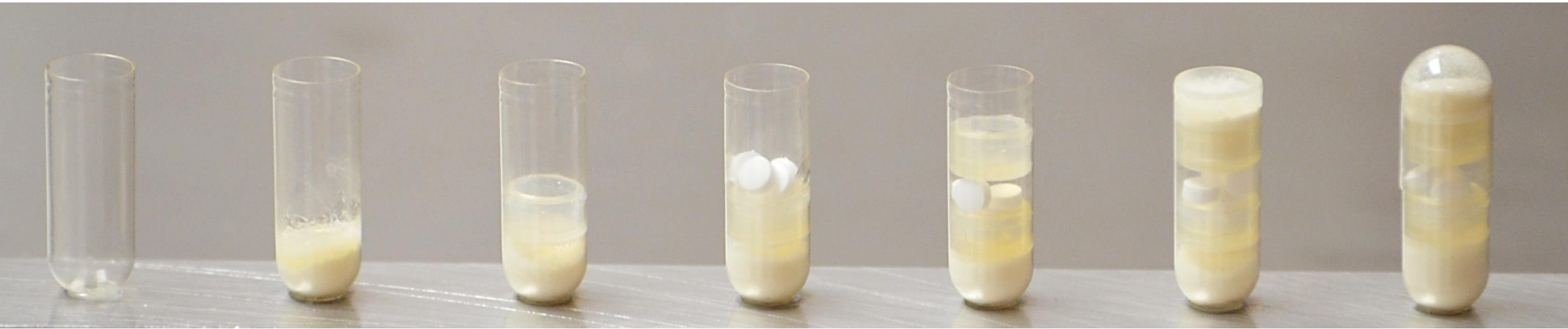
1. Personalized multi-compartment capsules



ATTRACTIVNESS

Robotic Clusters (RCs) *High-quality personalized medicines at scale & at contained costs!*

1. Personalized multi-compartment capsules



ATTRACTIVNESS

Robotic Clusters (RCs)

High-quality personalized medicines at scale & at contained costs!

2. Cell therapies



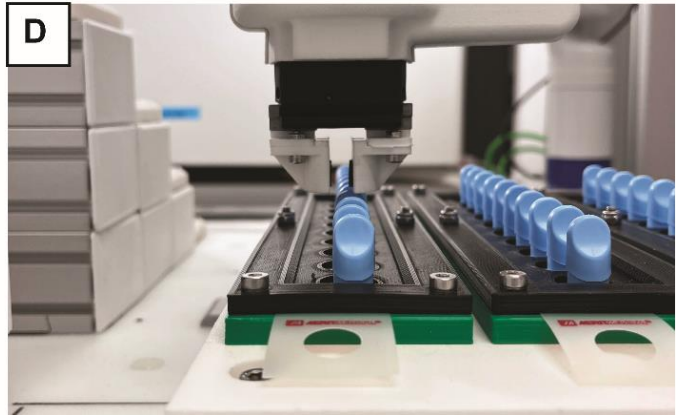
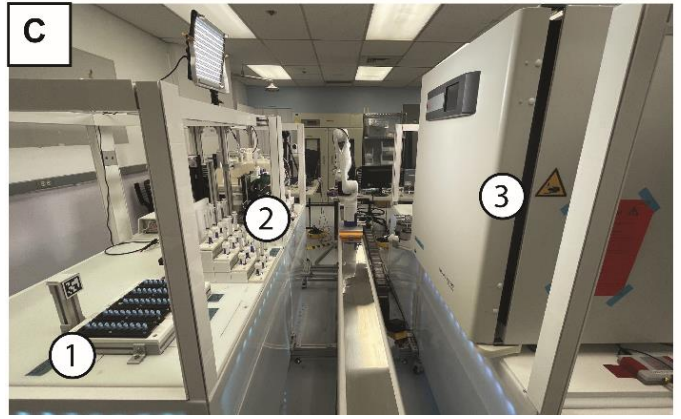
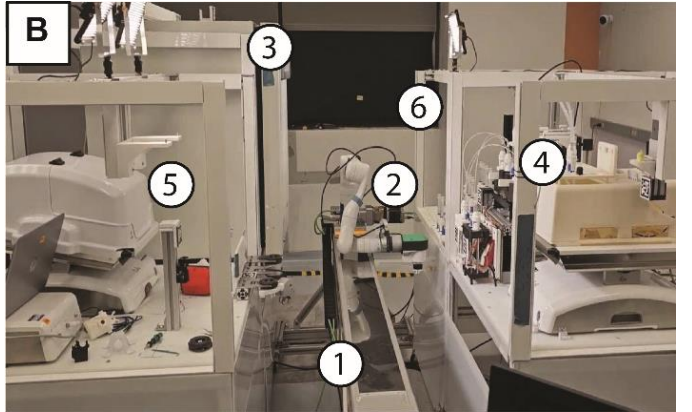
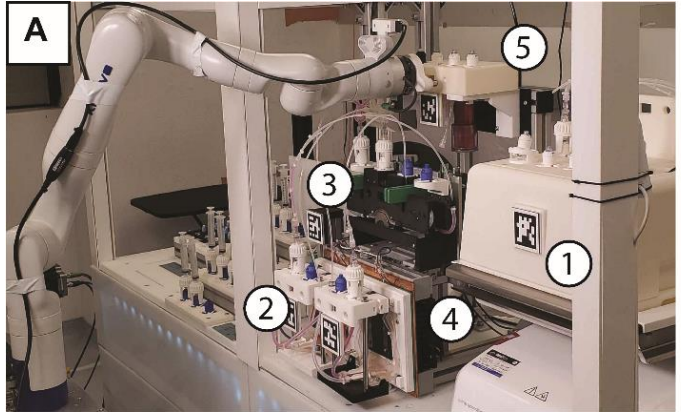
ATTRACTIVNESS

1. Capsule RC



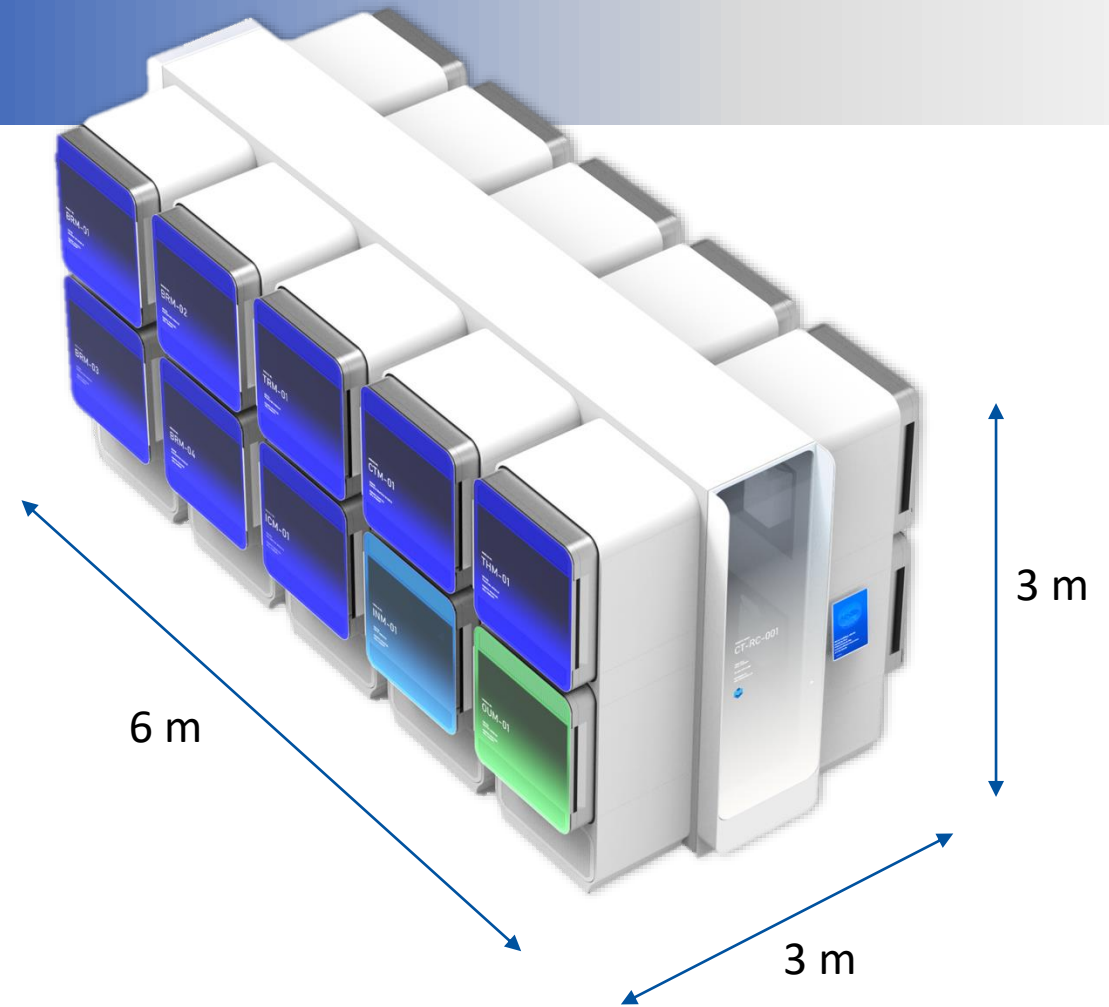
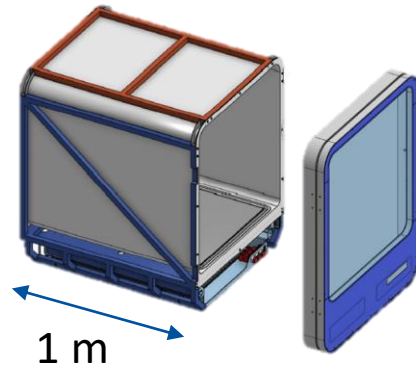
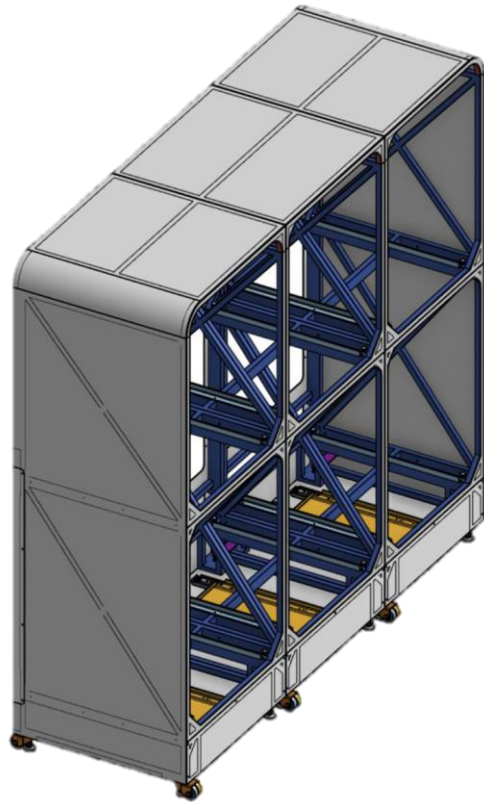
WuXi STA, subsidiary of WuXi AppTec, China

2. Cell therapy RC



University of California San Francisco & Stanford, USA

FLEXIBILITY



- the robotic arm shuffles items under processing between modules, each performing a specific action
- the modules work independently from the others and can be added, customized or replaced based on specific needs of the manufacturing process to be automated

FLEXIBILITY

Confidential-RL Digital MRB Template

DRAFT Master Batch Record		MRB No. MR_XXXX-X Version: 1	
Product No: 02XX x 10g Dmg 1 x 10g Dmg 2 x 10g Dmg 3		Effective Date: 11/1/2019	
Lot Number: MRB019164413-6-2019-09-12		MRB019164413-6-2019-09-12	

Transfer 0A				
Opcode	Description	Value	Robot Machine ID	Time
1.1	Robot pick	1	8a4527be-f700-4707-b060-9170f0e69696	2019-09-12 13:48:17.870000
1.2	Robot scan	307a9775-8457-4236-80a1-873883ca0086	8a4527be-f700-4707-b060-9170f0e69696	2019-09-12 13:48:18.360000
1.3	Robot place	6	8a4527be-f700-4707-b060-9170f0e69696	2019-09-12 22:46:11.000000

Weighing 0				
Capcuse Well	Weight	Time of Pick (2.1)	Time of Weigh (2.2)	Time of Place (2.3)
"Well F2"	0	2019-09-12 13:48:19.250000	13:48:33.680000	2019-09-12 13:48:37.700000

Transfer 0B				
Opcode	Description	Value	Robot Machine ID	Time
1.1	Robot pick			
1.2	Robot scan			
1.4	Robot place and push			

Filling 1				
Opcode	Description	Value	Machine ID	Time
3.1	Issuance			
3.2	Deposition			
3.3	Remainder			

Transfer 1A				
Opcode	Description	Value	Robot Machine ID	Time
1.5	Robot pull and pick			
1.2	Robot scan			
1.3	Robot place			

Weighing 1				
Capcuse Well	Weight	Time of Pick (2.1)	Time of Weigh (2.2)	Time of Place (2.3)

Transfer 1B				
Opcode	Description	Value	Robot Machine ID	Time
1.1	Robot pick			
1.2	Robot scan			
1.4	Robot place and push			

Filling 2				
Opcode	Description	Value	Machine ID	Time
3.1	Issuance			
3.2	Deposition			
3.3	Remainder			

Transfer 2A				
Opcode	Description	Value	Robot Machine ID	Time
1.5	Robot pull and pick			
1.2	Robot scan			
1.3	Robot place			

Weighing 2				
Capcuse Well	Weight	Time of Pick (2.1)	Time of Weigh (2.2)	Time of Place (2.3)

Transfer 2B				
Opcode	Description	Value	Robot Machine ID	Time
1.1	Robot pick			
1.2	Robot scan			
1.4	Robot place and push			

Filling 3				
Opcode	Description	Value	Machine ID	Time
3.1	Issuance			
3.2	Deposition			
3.3	Remainder			

Transfer 3A				
Opcode	Description	Value	Robot Machine ID	Time
1.5	Robot pull and pick			
1.2	Robot scan			
1.3	Robot place			

Weighing 3				
Capcuse Well	Weight	Time of Pick (2.1)	Time of Weigh (2.2)	Time of Place (2.3)

Transfer 3B				
Opcode	Description	Value	Robot Machine ID	Time
1.1	Robot pick			
1.2	Robot scan			
1.3	Robot place			



FLEXIBILITY

Instruments

the leading cGMP tools

● *Multiply Labs' Partner*



cytiva



ThermoFisher
SCIENTIFIC



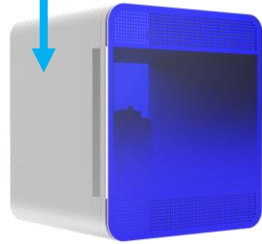
cytiva



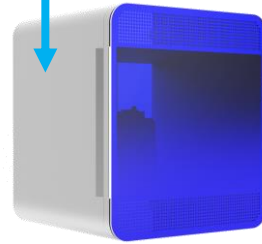
charles river



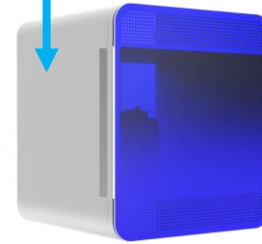
ThermoFisher
SCIENTIFIC



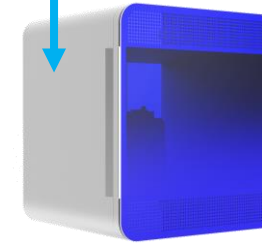
isolation
module



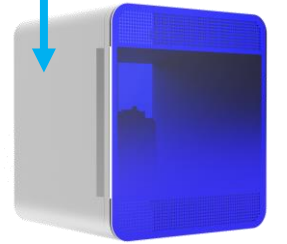
gene editing
module



expansion
module



Quality Control
module



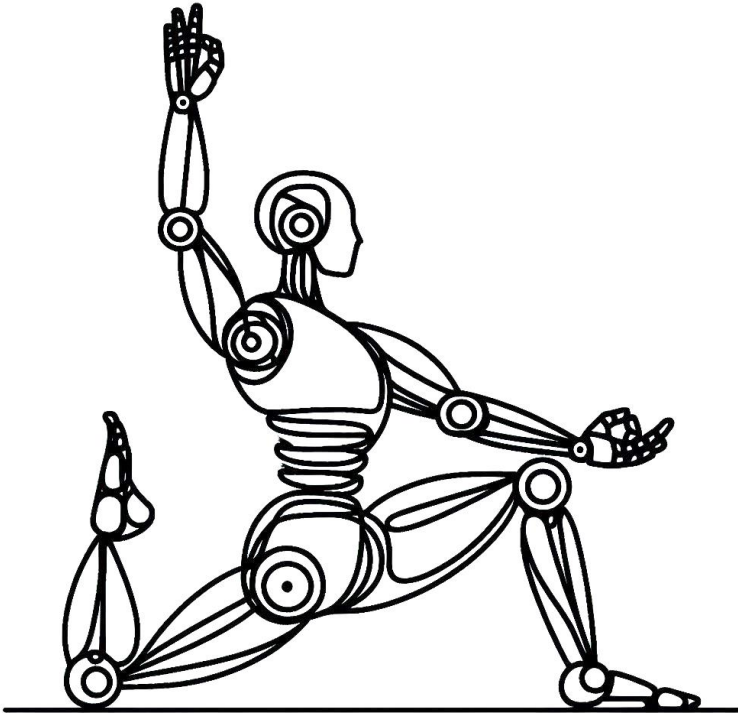
formulation
module

FLEXIBILITY



Melocchi et al., Cytotherapy, 2024, 26: 1095, <https://doi.org/10.1016/j.jcyt.2024.03.010>

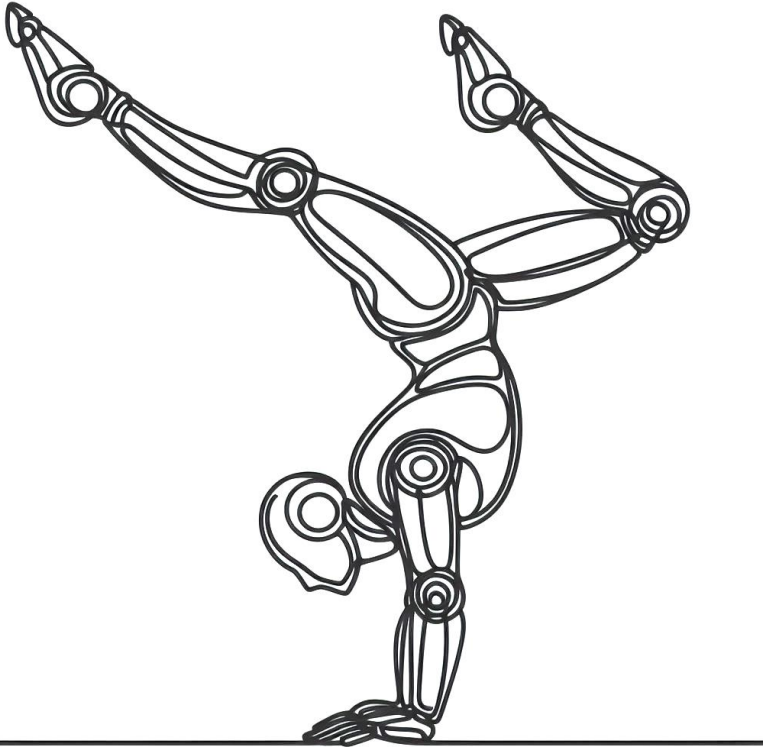
FLEXIBILITY



- Wide range of **production volumes**
- Applications entailing
 - actions requiring **increasing accuracy**
 - diverse **environmental conditions**
 - different **quantities** and **types** of starting materials
- Process involving **volumetric dosing, precision filling, repeatable operations**

Total Quality System

- Non-destructive controls of 100% of products under processing
- The proprietary software automatically collects and saves the critical operating parameters multiple times throughout the process
 - All the data are securely stored in compliance with CFR Part 11 requirements so they can only be accessed by quality personnel with the appropriate security authorizations
 - Full traceability as each component, intermediate and final product has unique barcodes that are scanned and saved to track any movement during the process



ECONOMIC POTENTIAL

1. Capsules RC

- 100 to 250 capsules/h (3.6 min for quality-control on 30 capsules)
 - 5,000 one-compartment capsules in 5 h
 - 5,000 three-compartment capsules in 21 h
 - **3.25x** increase in the number of batches produced in 50 days
- Reduce
 - manufacturing space (2000 versus 200 m²) with **90% savings**
 - time equivalents (up to **6.5x**)

2. Cell therapies RC

Per Therapy Costs	Current Manual Process	Robotic Process
Fixed cost per therapy	Traditional Suite	Baseline Case
Labor	\$ 58,500	\$ 492
Facility	\$ 10,000	\$ 126
Amortized hardware	\$ 17,000	\$ 1,515
Consumables cost per therapy	\$ 15,084	\$ 23,716
Total cost per therapy	\$ 100,584	\$ 25,850
Saving per therapy with the Robotic Process	\$ 74,734	
	74%	

INTEGRATION EASINESS

1. Capsules RC

2. Cell therapies RC

Plug & Play in the current configuration	Applicable with relevant customization
Collaboration with various industrial partners to develop and validate the already available for purchase RCs	Co-development partner

THANK YOU!



Multiply Labs

Federico Parietti
Brigitte Schmittlein
Yasmine Ainane
Ali Rizvi
Kelsey Pool
Nadia Kreciglowa
Allison Hunter
.... and all the engineers



PhormulaMi
Formulation and technology frontiers in pharmaceuticals



Lucia Zema
Alice Melocchi
Marco Uboldi
Erasmus Ragucci
Veronica Pengo

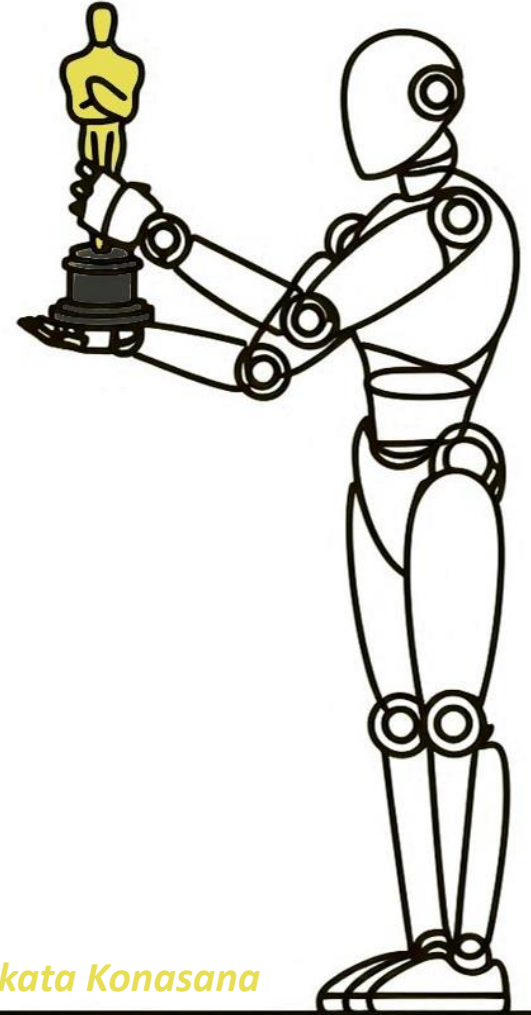


Benedetta di Robilant



University of California
San Francisco

Jonathan H. Esensten



Utkata Konasana

