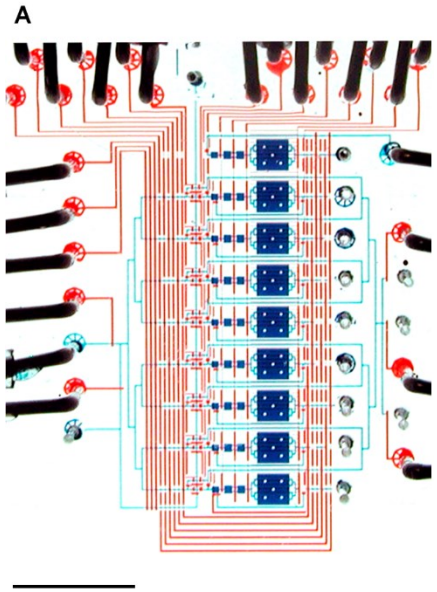
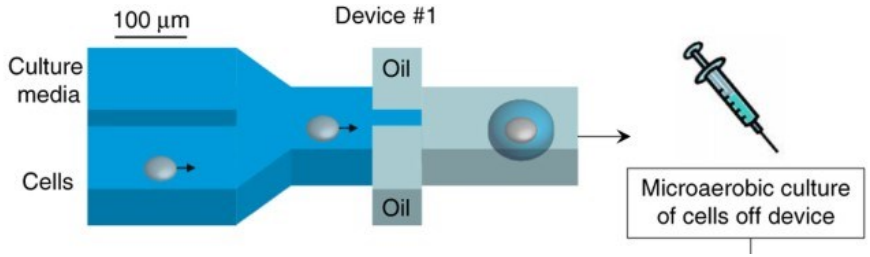
PSIS WORKSHOP MICROFLUIDICS

Most examples from: Chem 2, 201–223, 2017

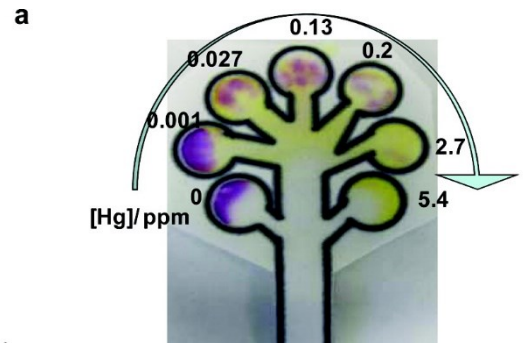
The diversity of Microfluidics



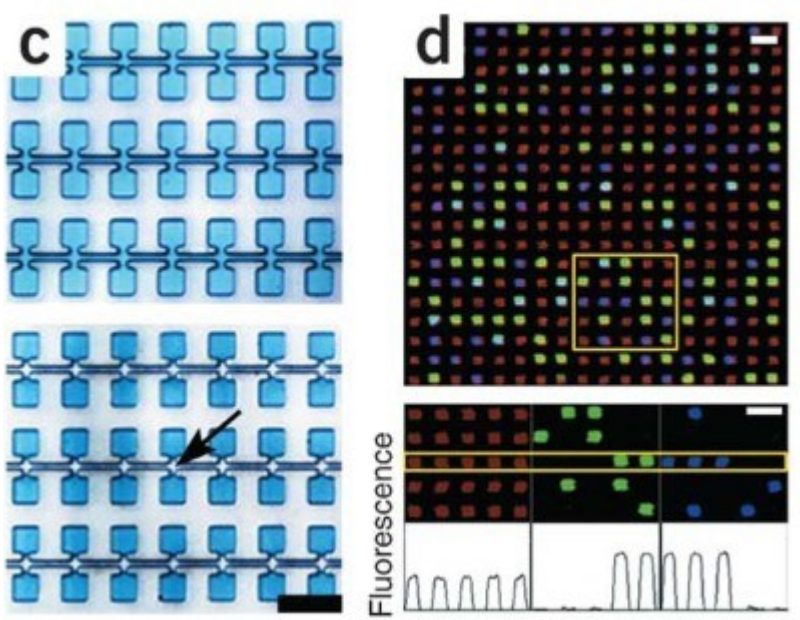
DOI: 10.1371/journal.pgen.0030155



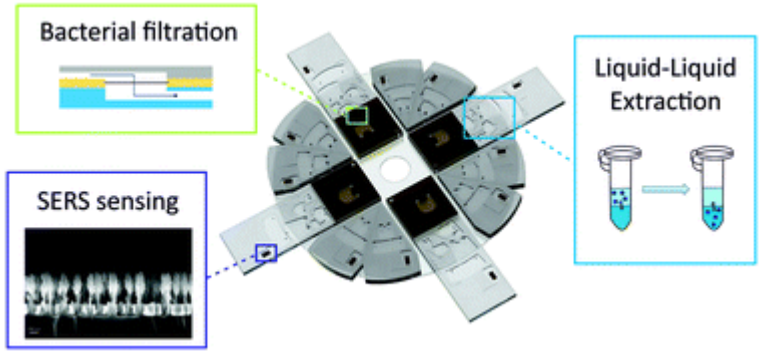
Nature Biotechnology **32**, 473–478 (2014)



Anal. Chem. 2011, 83, 22, 8772−8778



Nature Methods **8**, 649–651 (2011)



DOI: 10.1039/C7LC01217A

Challenges

Large volume (DNA, PoC, etc)

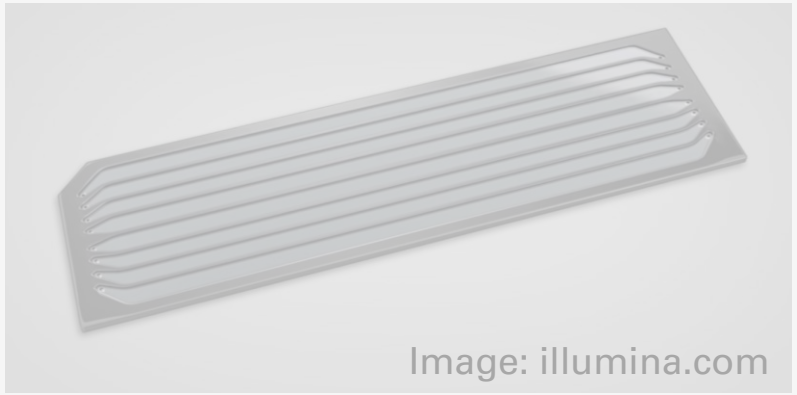


Image: illumina.com

- Monolithic approach

Small volume, start-ups

- Bridging Valley of Death
- Re-inventing the wheel
- Cost of development
- Certification

HOW TO MOVE THE FIELD FORWARD?

STANDARDIZATION HISTORY

2010-2013

- MFConsortium creation
- 2 whitepapers
- 1 article in Lab on Chip

2014-2017

- MFManufacturing project
  - *21 partners*
  - *5 surveys*
  - *3 whitepapers*
  - *5 demonstrators*
  - *1 website : makefluidics.com*
- ISO IWA23 (International Workshop Agreement)
- ISO NWIP (New Work Item Proposal)
  - *Project leader : N. Verplanck, CEA*
- 2 International workshops
  - *NIST, June'17*
  - *IMEC, Oct'17*
- Charta of the future International Microfluidics Association (MFA), based on MFManufacturing experience

Since 2018

- Standardization led by MFA
- New ISO TC48/WG3
  - *N. Verplanck, CEA*
- New CEN TC332/WG7 convenor :
  - *N. Verplanck, CEA*
- 2 international workshops
  - *CEA, March'18*
  - *METAS, July'18*
- Invited speaker to conferences (NanoBioTech, Montreux)
- Interaction with major conference boards for talks

ISO / CEN ONGOING PROJECTS

Standardization work is conducted at the ISO level.

CEN TC332/WG7 is the mirror committee of ISO TC48/WG3.

These WGs have be renamed Microfluidic devices in 2019.

ISO/DIS 22916 - Microfluidic devices — Interoperability requirements for dimensions, connections and initial device classification

- Final stage, on-going ballot until the 7th of May 2021

ISO 10991 – Microfluidic devices - Vocabulary

- NWIP approved in 2021

ISO 6417 - Microfluidic pumps — Symbols and performance communication

- This document wont be a standard but a TS document (Technical Specification)
- NWIP approved in 2021

DIS : Draft International Standard

NWIP : New Work Item Proposal

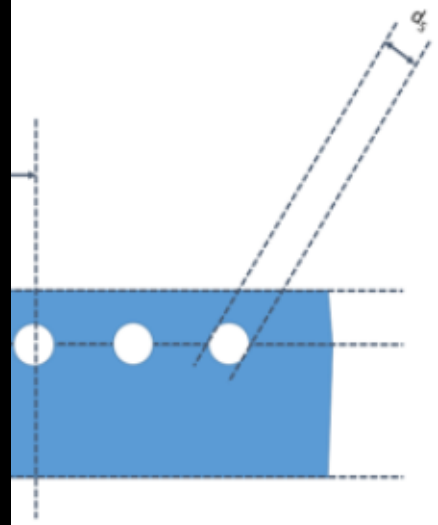
STANDARDISATION EXAMPLE

of 2016

15

Port designator	Function
A1	Pressure port 1
A7	Pressure port 2
G1	Future use (electrical)
G3	Future use (electrical)
G5	Future use (electrical)
G7	Future use (electrical)

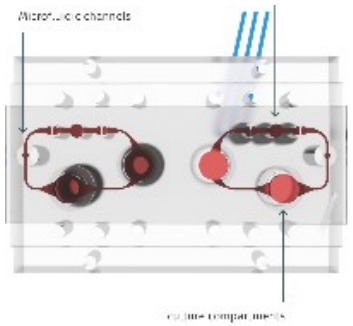
tandard microfluidic



r microfluidic edge-

Organ on Chip

chip

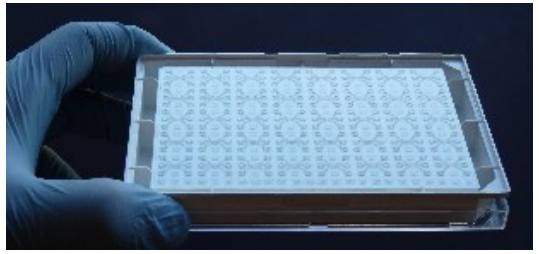


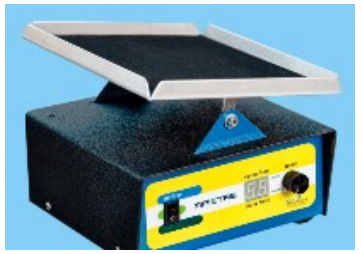
holder

system

emulate

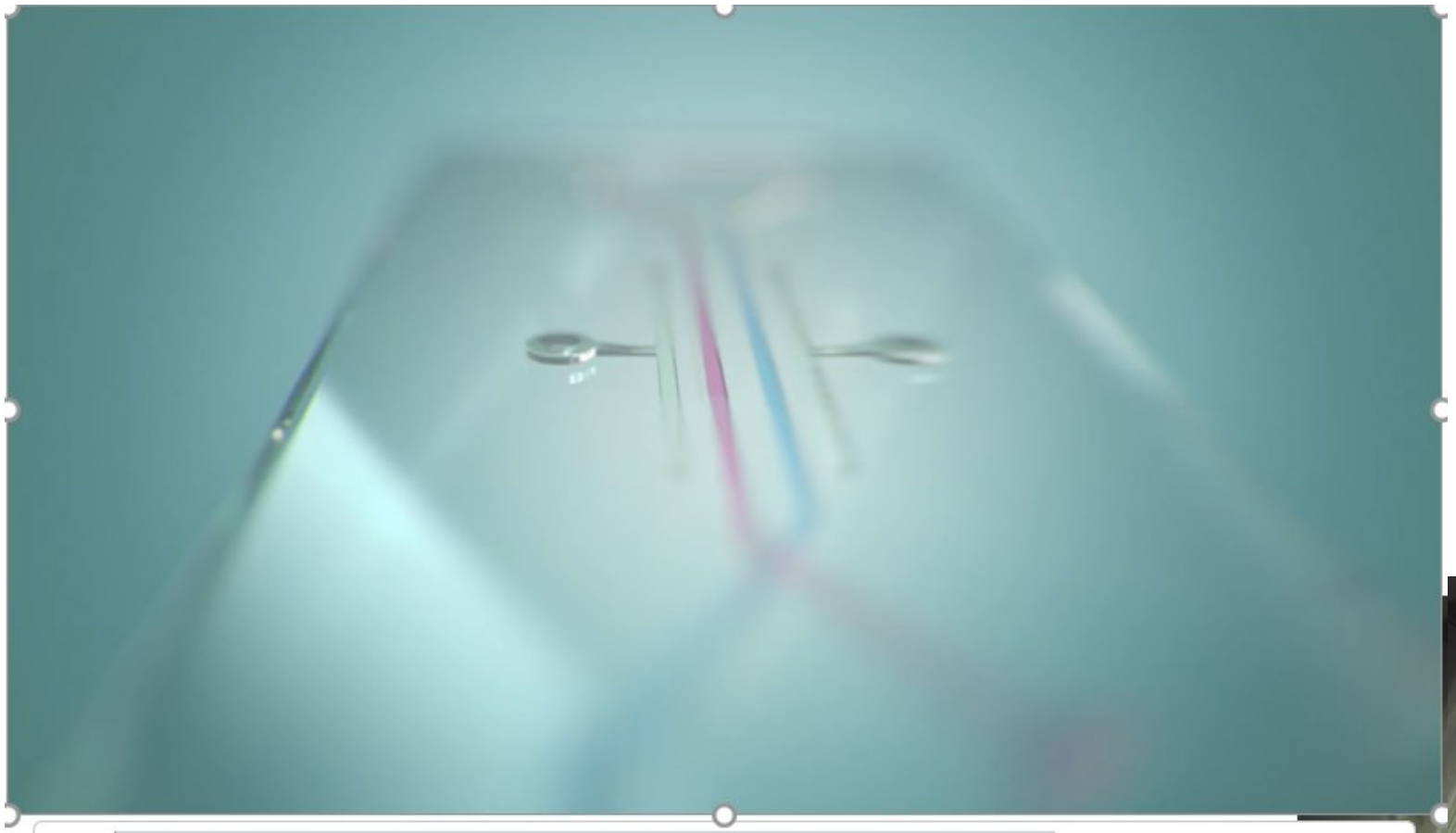
TISSUSE
Emulating Human Biology





MIMETAS
the organ-on-a-chip company

TRANSLATIONAL ORGAN PLATFORM (TOP)



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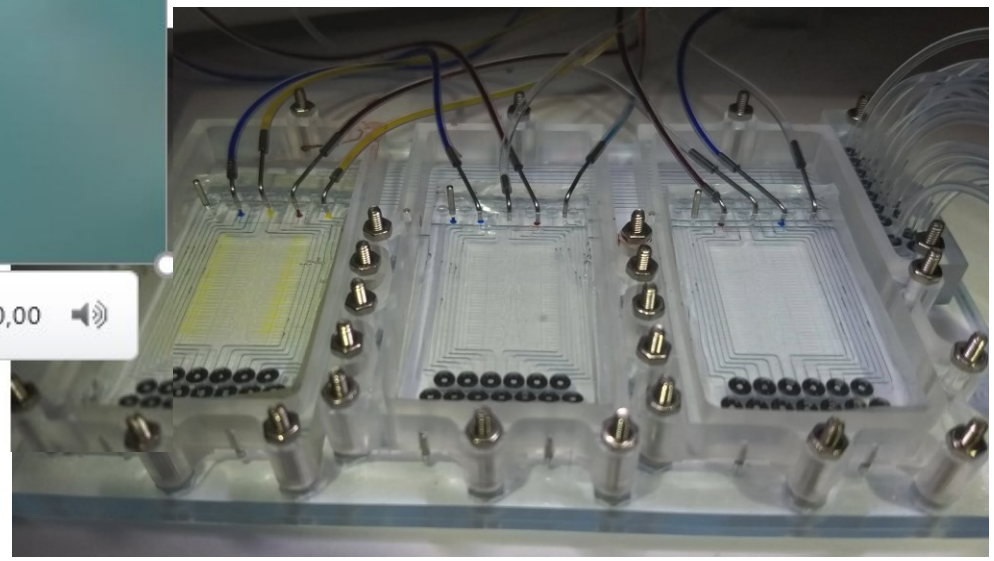
https://doi.org/10.1038/s41378-020-00216-z



END OF INTRODUCTION

CATEGORIZING - CHALLENGES 4 USERS?

A - Cell viability
- a) how to keep your cells happy (surface coating / roughness, etc)
- b) gas/media composition
- c) biocompatibility (do existing standards help?), etc

B - Biomimetics
- a) thickness of membrane
- b) Shear
- c) Flex, etc.

C - Suitable materials
- a) gas permeable
- b) non-absorbent
- c) Elastic?

D - Reproducibility/throughput:
- a) variations in flow
- b) Geometry
- c) statistics (n = …)
- d) read-out (TEER!), etc.

E - Valley-of-Death
TRL 4 -> 7

F - Volume production issue:
- a) Not MI of monolithic chips
- b) integrated/modular approach?

A

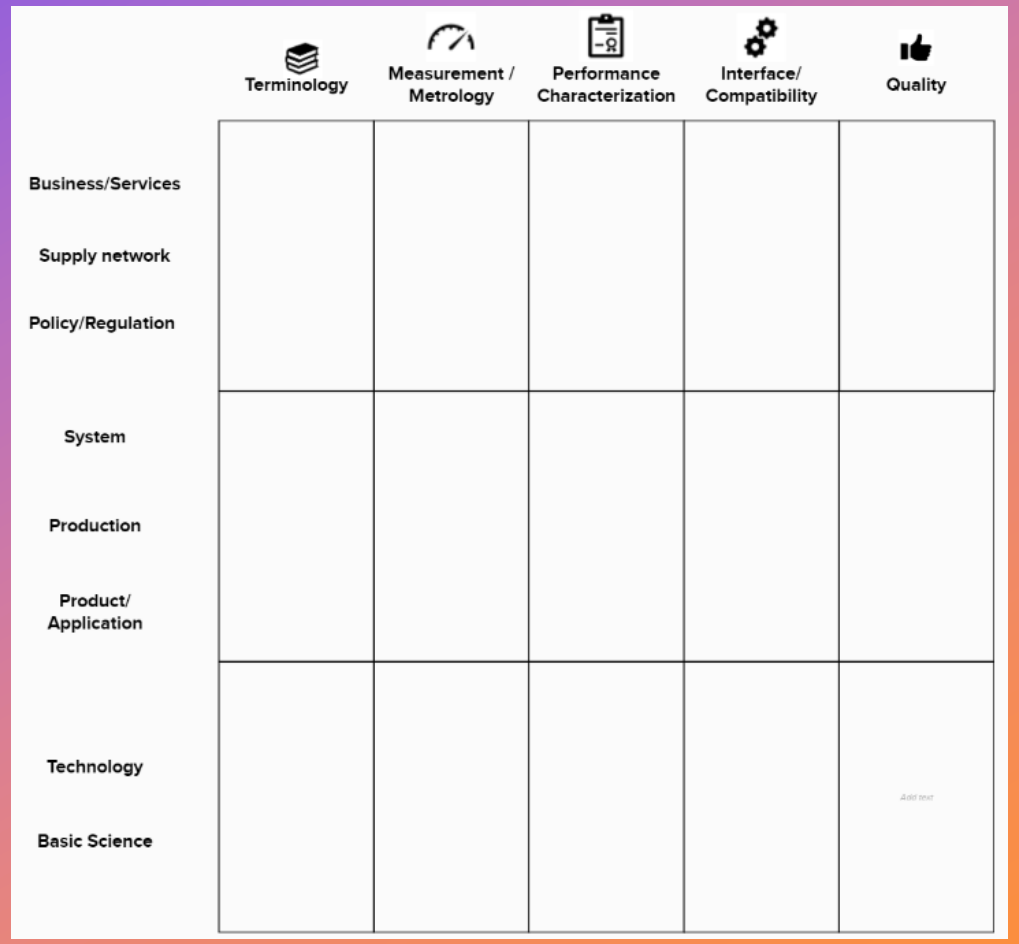
B

C

D

E

F



PRIORITIZATION – HOW CAN STANDARDS HELP?

(1) Metrology: Flow, TEER, etc.

(2) Exp. methods reproducibility

(3) Materials: PDMS, COC, -> manufacturability

(4) Design: Standards like ISO, etc

(5) Open platform: Speed-up development

1 2 3 4 5