



Advancing digital manufacturing with fluids

– **Dr Ronan Daly**

12th May 2016



Introduction



Distributed Information & Automation Laboratory



Fluids in Advanced Manufacturing



Design Management



Industrial Photonics



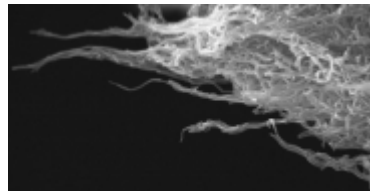
Industrial Sustainability



Inkjet Research



International Manufacturing



Nanomanufacturing



Strategy and Performance



Technology Enterprise



Technology Management



Science, Technology & Innovation Policy



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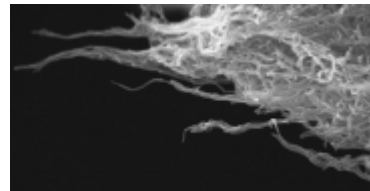
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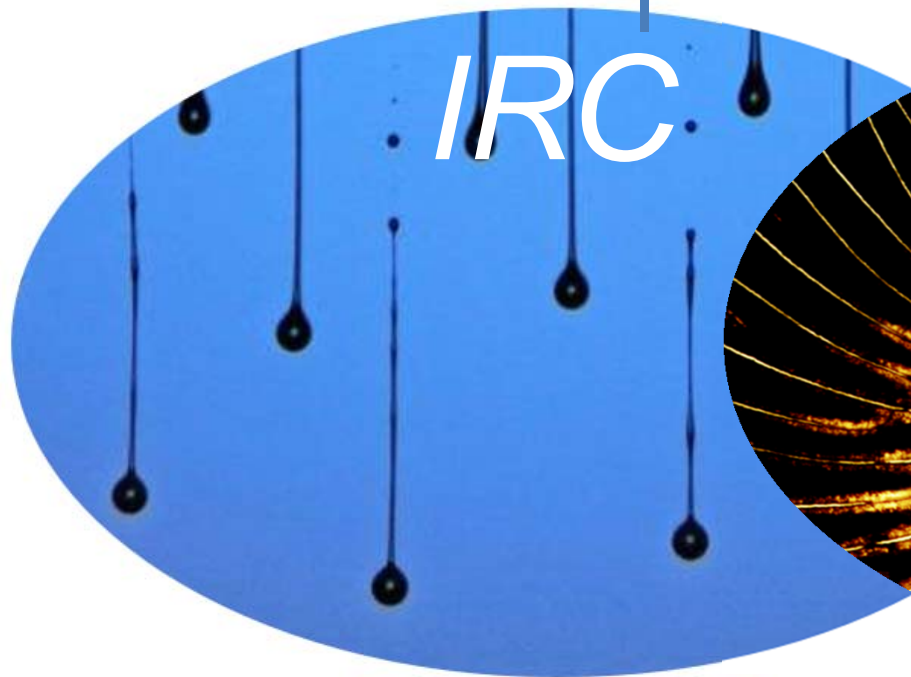
Science, Technology & Innovation Policy



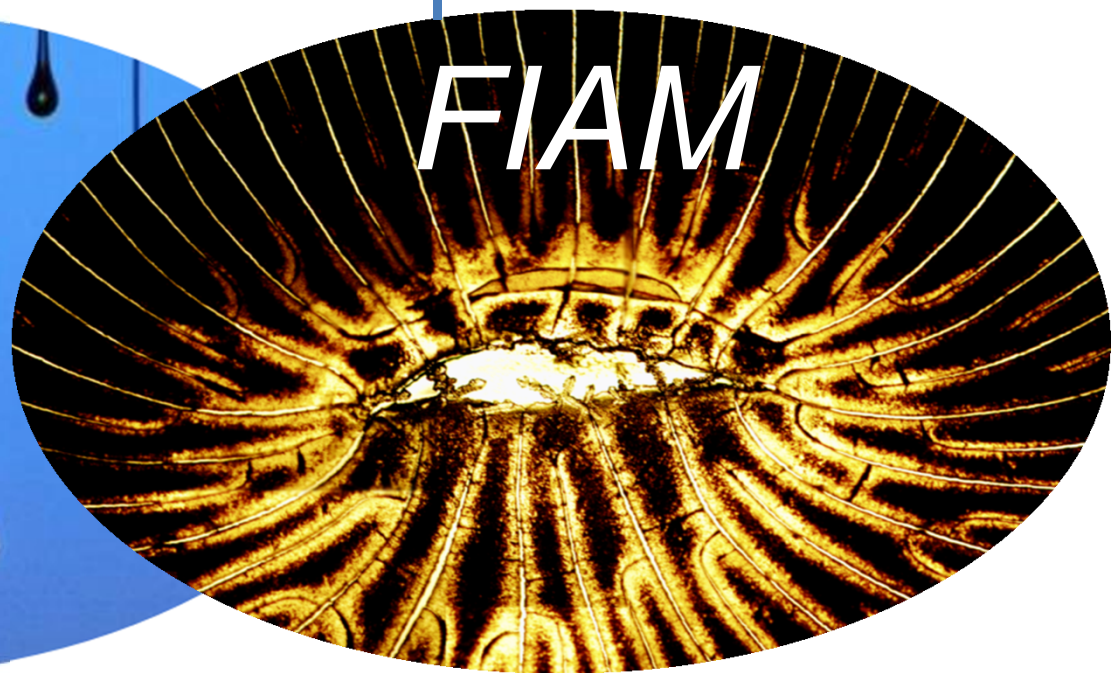
Introduction



“Brings together expertise in management, economics and technology to address the **full spectrum of manufacturing issues**”



Inkjet Research
Centre



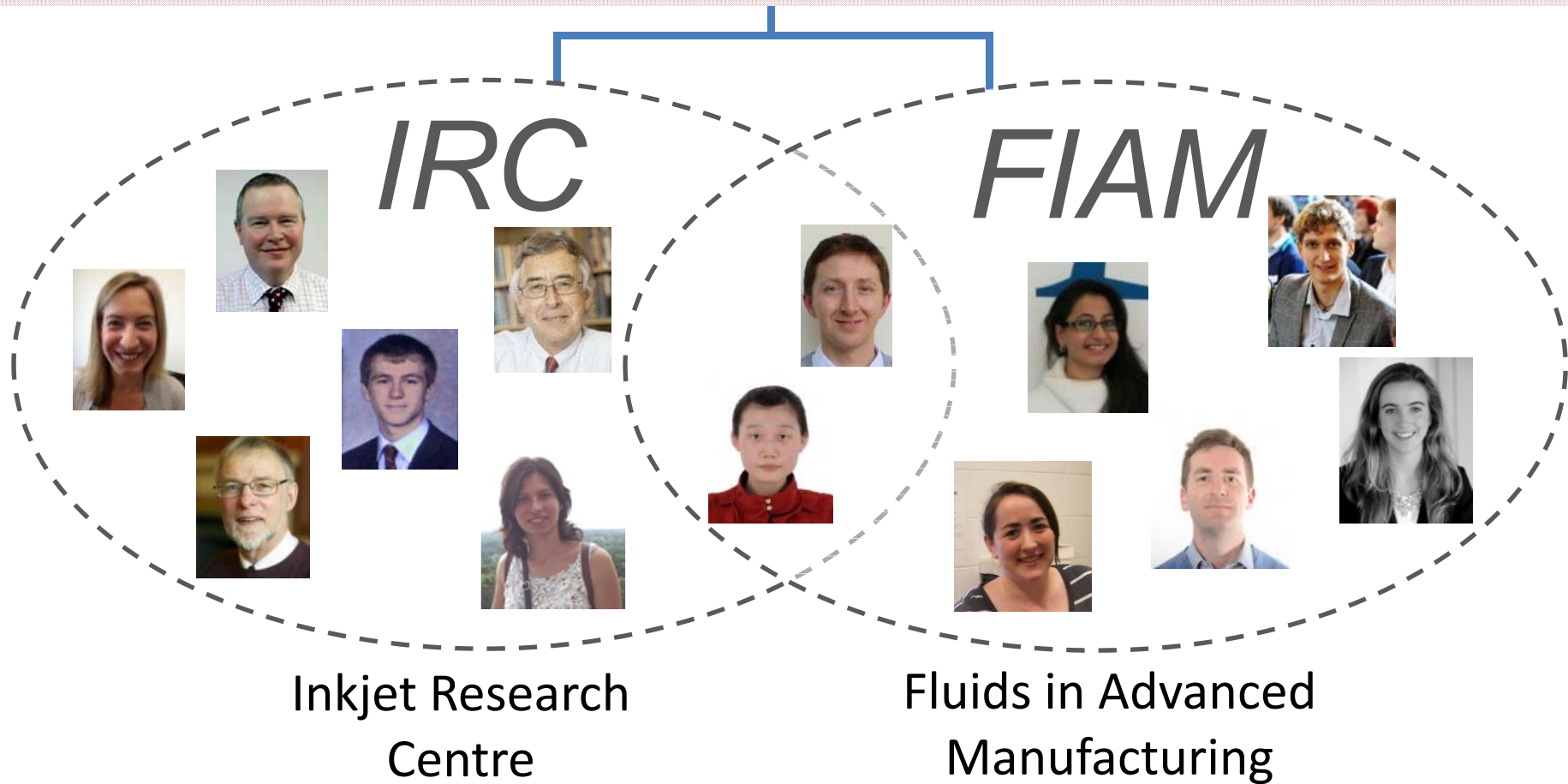
Fluids in Advanced
Manufacturing



Introduction



“Brings together expertise in management, economics and technology to address the **full spectrum of manufacturing issues**”





Goals



Drive new understanding of established industrial technologies



Explore and develop new applications

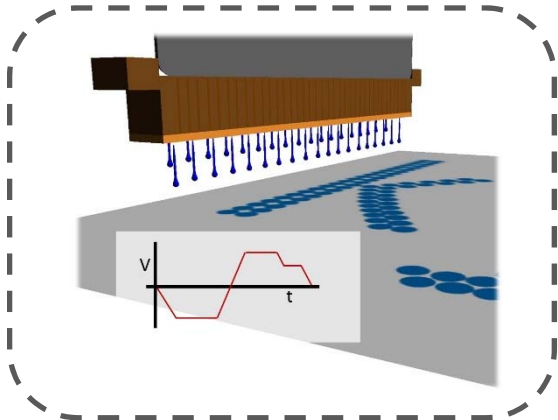


Build the science of manufacturing and scale-up into lab research

Credit: zlikovec/Shutterstock



Drive new understanding



Industrial inkjet printing

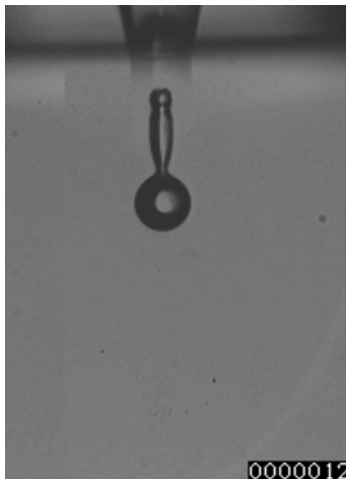
- Drop **formation, impact and stability**
- Print **functional** materials
- Characterise and **validate** drops

Example 1

A **visualization and velocimetric technique** developed to study **airflows** beneath commercial printheads.



Dr. Cristina Rodriguez Rivero
(mcr51@cam.ac.uk)



Example 2

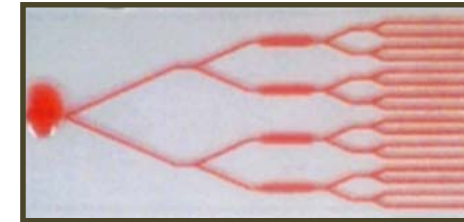
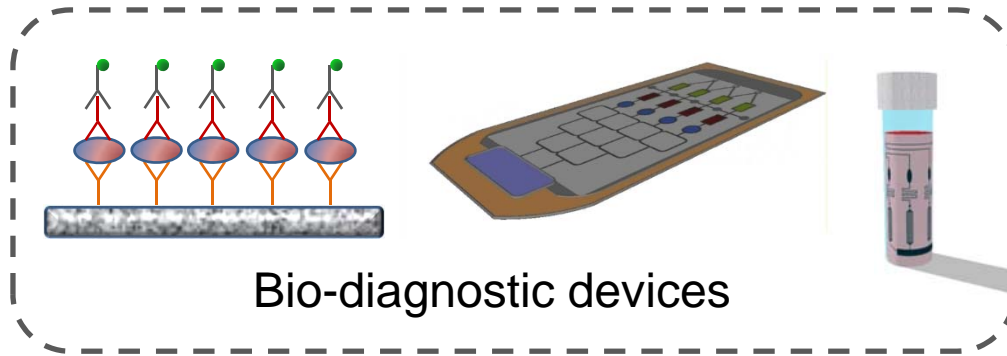
Measurement of inkjet drop volume
– the role of image processing



Dr. Graham Martin
(gdm31@cam.ac.uk)



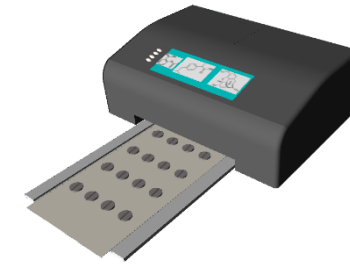
Explore new applications - 1



- Sensing platforms for **re-configuration at point of manufacture**
- Sample **preparation**, delivery to the device
- Sample **transport**, filtration, splitting, mixing, heating
- Analyte **capture** in the reaction zone, signal generation.
- Collection of **waste** by absorption



Explore new applications - 2

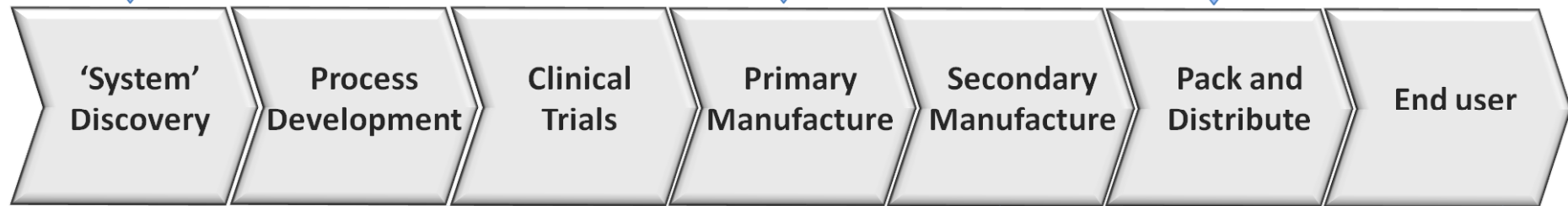


Pharma printing

- Combinatorial chemistry
- Genomics
- High throughput screening

- Continuous manufacturing
- Particle freeze-drying

- Security features
- Functional / smart packaging



- Scalable technology (1 – 1000 nozzle / head)
- Flexible production scale

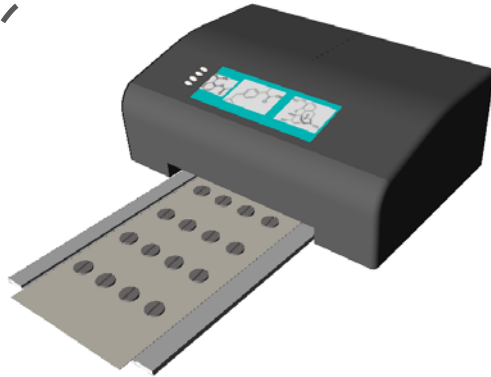
- Direct fabrication of tablets, capsules, etc.
- Functional medical device coating
- Controlled time-release films

- Needle-free injection
- Inhaler design

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Explore new applications - 2

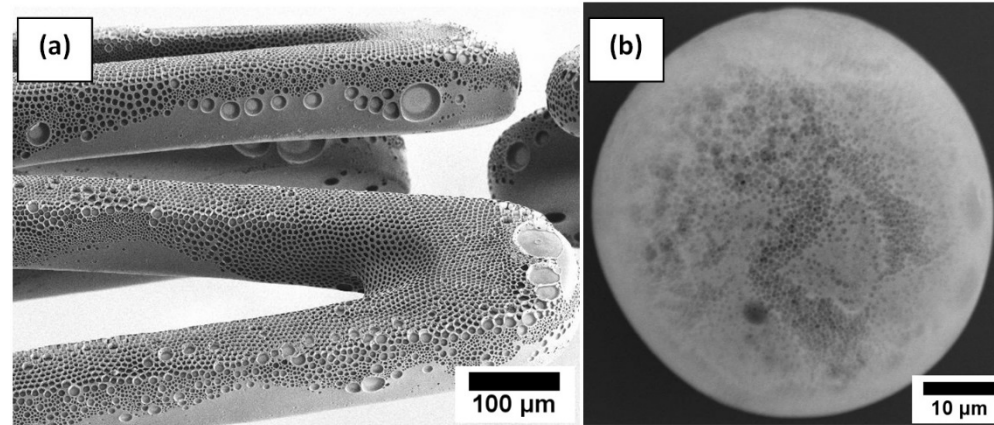


Pharma printing

- Start coherent approach to understanding **printability of molecule families**
- Use right **research equipment** for each challenge
- Vast array of analytical techniques used in the literature. **What is needed during manufacturing?**

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Explore new applications - 2

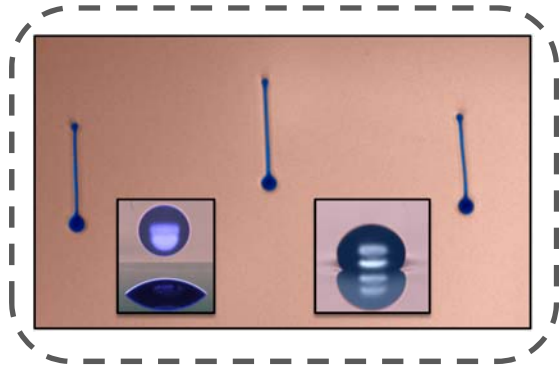


Pharma printing

- (a) Coating of vascular stent
- (b) Fabrication of porous particles

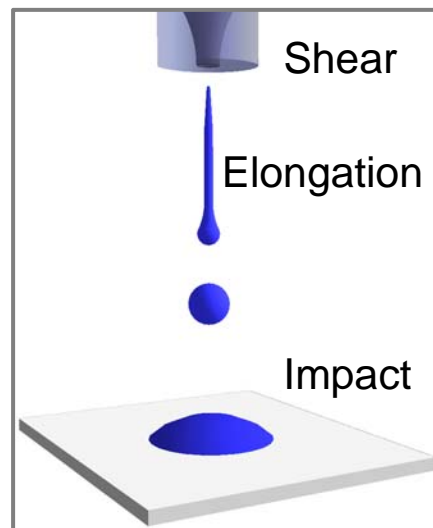


Science of manufacturing



Drop-on-demand inkjet

- Examining the functional changes due to mechanical energy
- Understanding influence of forces



مدينة الملك عبدالعزيز
للعلوم والتقنية KACST

KACST-CAMM

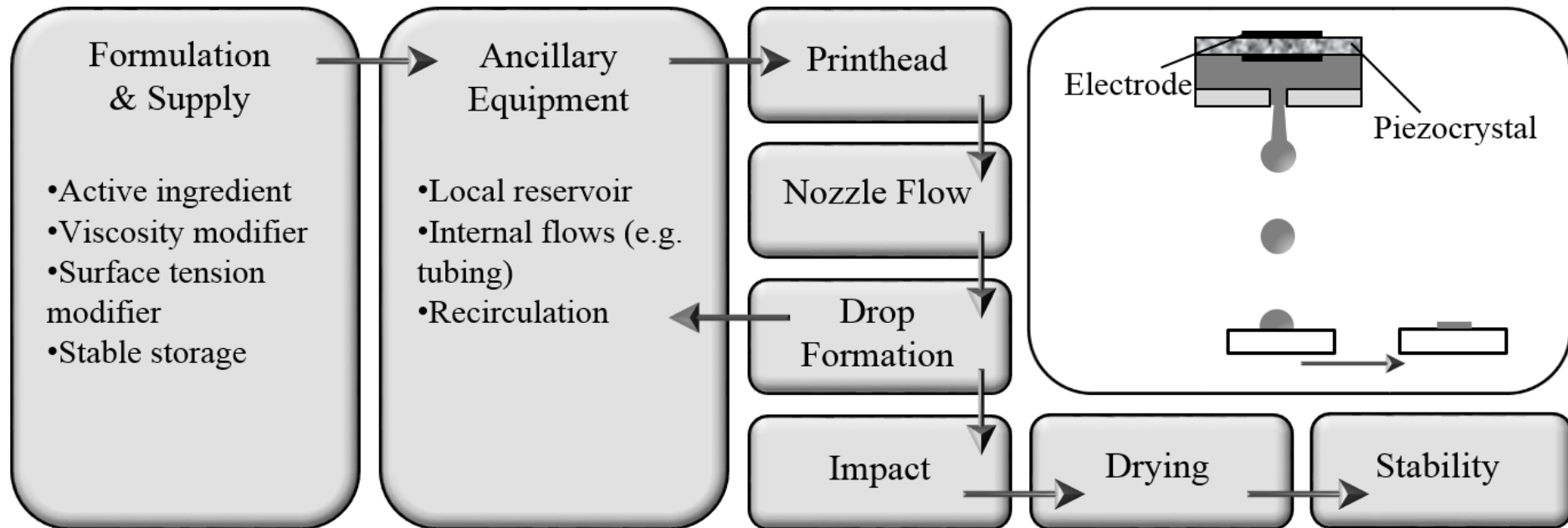


Dr Etienne
Rognin



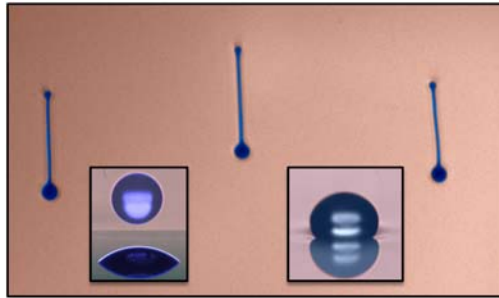
Dr Niamh
Fox

Science of manufacturing

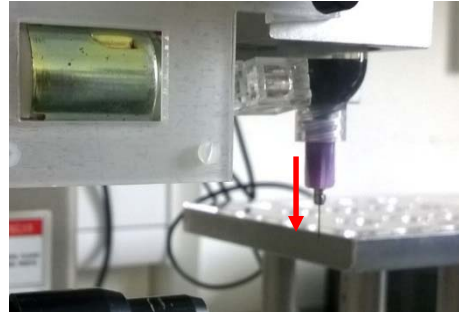




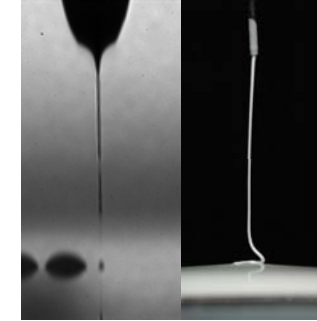
Science of manufacturing



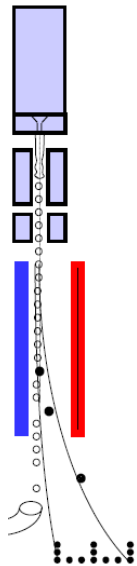
Drop-on-demand inkjet



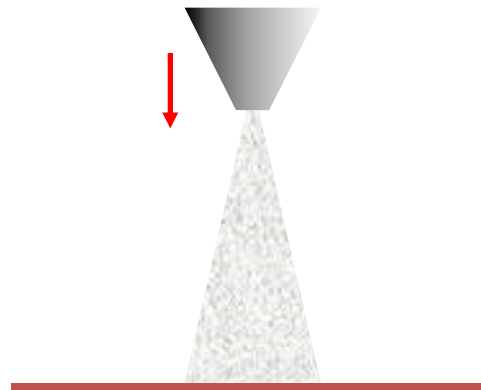
Valve-jet & extrusion



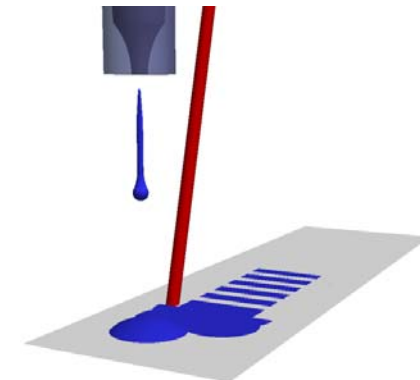
Electrohydrodynamic



Continuous inkjet



Spray deposition



Hybrid Inkjet/Laser

Thank you for listening

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Funding:

