



Microfluidics and Nanoparticles

Broad Definition

Microfluidics is an area of industry that involves the manipulation of fluids through micro-scale channels and pumps that can be additively manufactured. Cells can be inlaid in the channels of microfluidic chips, as can antibodies or other biological material.

Nanoparticles define an area of industry that works with nano-sized molecules (on the DNA and RNA scale) that act differently than larger molecules, like protein. They take unique shapes, and can therefore be used for packaging larger molecules, like drugs and DNA, for delivery.

The two industries/areas of research often overlap.

Behaviors

- Both industries are dominated by small companies that are few in number and still heavily academic; well-funded, not area of interest for large pharma and biotech yet
- Microfluidics industry is split into two areas: one for organ-on-chip, and one for diagnostics
 - Organ-on-chip has garnered a lot of attention from mid-size pharma companies for large-scale drug testing purposes
 - Each organ needs different system, most companies differentiate based on this
 - One or two large players in the field, and even these are not large companies
 - Microfluidics for diagnostics is relatively new and hasn't been picked up by any of the big diagnostics companies
- Nanoparticles are more widely-distributed and stretch beyond biology and into electronics, mechanics, etc.
 - Next biggest method of drug delivery, either through outside patches on the skin that release drugs slowly
 - Or through encasing of the drugs/antibodies/gene editing tools in nanoparticles for targeted drug delivery
 - A lot of small companies, but hasn't caught widespread interest from large companies yet
 - Next generation of cancer therapeutics
- Scientist positions are typically specialized in these industries and require 1-2 years of laboratory experience, even just after finishing a bachelor's -- *must prepare a couple of*

years beforehand

Types of Roles Available

- *Research Position:* research associate positions are entry-level; typically split into general platform, specific platform (i.e. brain, lung or a specific drug), and applied biosciences (internal research)
- *Business Development:* more of a prominent role due these companies being small; create collaborations with large pharma companies, look for new therapeutic opportunities
- *Field Scientist:* Works with companies to determine the best use of the technology
- *Production, Manufacturing, and Quality:* monitor the creation of the products, ensure that concentrations are correct, etc
- *Sales and Marketing:* interfaces with BD and field scientists for selling products
- *Mechanical Engineers/Product Designers:* for microfluidic diagnostics, often devices are included, designed and tested by mechanical engineers

Valued Skills

- For research positions, physicists, material scientists, and biomechanics, tissue engineers, and biomedical engineers are favored; PhD's or research with microfluidics/nanotech a must before working in these companies
- Knowledge of physiology/disease, as platform technologies need applications
- Precision and efficiency

Relevant Companies

<i>Microfluidics</i>	<i>Nanoparticles</i>
Emulate	January Therapeutics
Nortis Bio	Arcturus Therapeutics
BiomimX	Ligandal
Mimetas	Phosphorex
1Drop Diagnostics	Tarveda Therapeutics

To Follow/Join:

- *Emulate Biosciences:* The company runs a newsletter with organ-on-a-chip microfluidics workshops

- *Phys.org*: has both a nanoparticulate and a microfluidics news section
- *Nature Nanotechnology*: premier journal for nanotech improvements in medicine

Relevant Majors: BME, Chemistry, MechE