

## Fascinating World of Molecular Robotics

Note: an extended version of this post is on medium [here](#)

On September 21st 2018, I spent the entire day at 9th Annual Wyss International Symposium. The topic of this year was *Molecular Robotics*. I admit that this is not my area of expertise beyond a synthetic biology course I took couple years back, but I greatly enjoyed the talks. Coming from a computer science background, I was somewhat familiar with the majority of the main concepts except maybe some of the sophisticated bio-chemistry.

The Wyss Institute just released a [recap of the event](#), which is a must read.

The event booklet describes molecular robotics as "*encompassing the design of microscopic, self-assembly driven agents that sense, compute and actuate*". Furthermore they state that "*Nanoscale robots composed of nucleid acids, proteins or other molecules do not require power or batteries to operate, can be programmed to complete their tasks autonomously and collectively, and offer an unprecedented level of interaction with and control of biological systems*". They mention potential application areas as clinical diagnostics and therapeutics. They also state that it also extends "robotics" into the realm of nanoscale molecular systems with large numbers of individual agents collectively accomplishing tasks at microscopic scales.

The talks were divided into sessions covering the state of the art in sensing, computing and actuating aspects of the field. The final session titled "Translate" aimed to discuss how all this can be translated into applications in real life.

### A Bit of the History

Digging a bit deeper into the history of molecular robotics on the internet, it appears that the field started as [DNA Nanotechnology \(or DNA Nanoengineering\)](#). Wikipedia names [Dr. Nadrian Seeman of NYU](#) (Dept. of Chemistry) as the founding father of DNA Nanotechnology who laid out the main concepts back in the 80s. However, the field started to attract more attention only in mid-2000s. I realized this connection based on Japanese scientist Dr. Satoshi Murata's 2009 [grant proposal](#) titled "*Development of Molecular Robotics based on DNA Nanoengineering*". Furthermore, in this video interview (below), released by the NSF covering the 2010 Nature paper "*Molecular robots guided by prescriptive landscapes*" by Columbia University researchers, Dr. Milan N. Stojanovic is talking about brief history that led to their paper. And in there he mentions the work of Dr. Seeman of NYU. At that time NSF called molecular robotics as "[on the rise](#)":

The Japanese Government has [officially started supporting](#) this field back in 2012. Researchers from Japan published a [review](#) of the field at the time in 2013. Later, an initiative in molecular robotics was [established at Wyss Intitute in 2016](#).

Dr. Seeman has published [an article in Nature Reviews titled "DNA nanotechnology"](#) in 2017. Interestingly, in that article he does not use the term "Molecular Robotics" at all.

I also sensed little bit of "artificial life" flavor in all this. [Steven Levy's "Artificial Life"](#) and [John Holland's \(RIP\) "Hidden Order:How Adaptation Builds Complexity"](#) books come to mind.

I should dig deeper into this fascinating field sometime :-)