NANOROBOTICS

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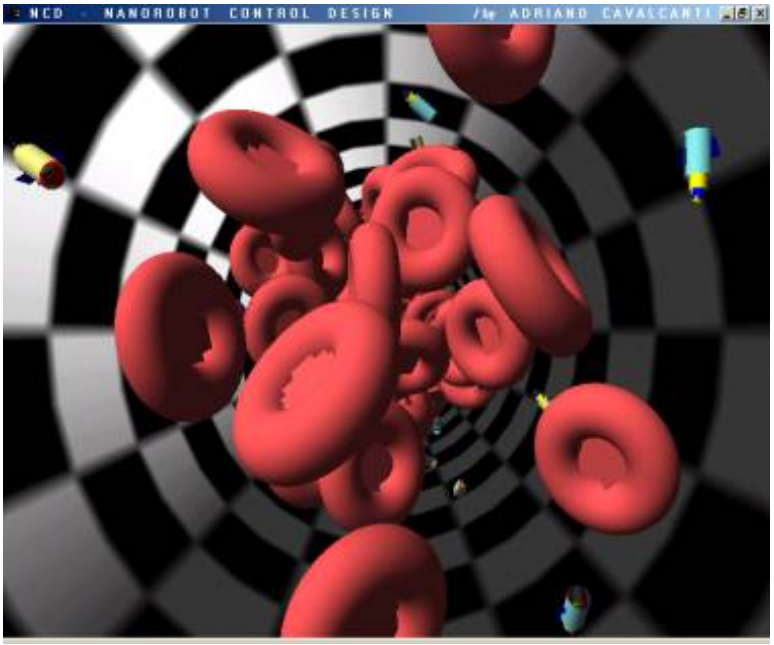
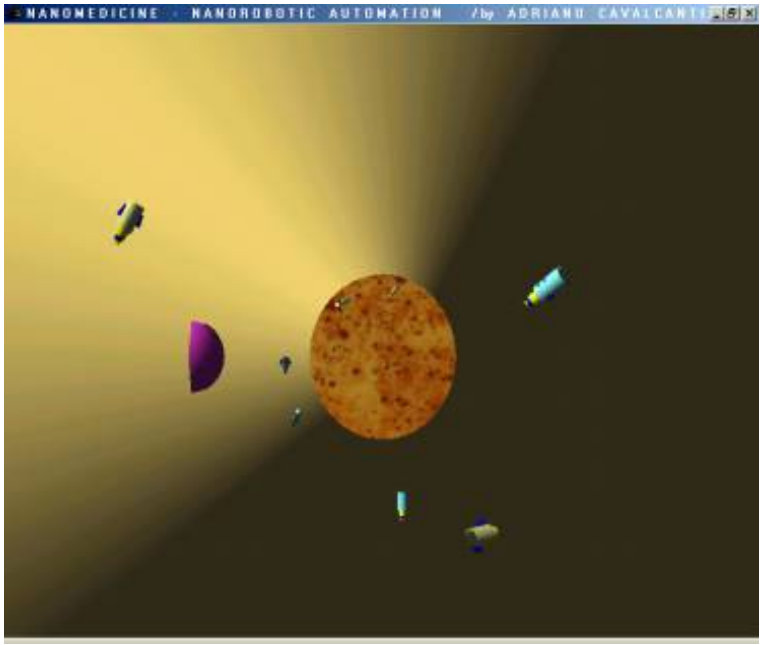
NanoroboticS

Nanotechnology can enable build the bridges for the post-human future through the fabrication of microscopic robots comprised of nanocomponents. Such nanorobots are expected to have dimensions comparable to bacteria. Revolutionary possibilities are expected with the use of nanorobots in biomedical applications. The challenge to effectively build nanorobots and develop control design to enable their operation is a worthwhile effort.



View of simulator workspace showing the vessel wall with a grid texture, cells and nanorobots.

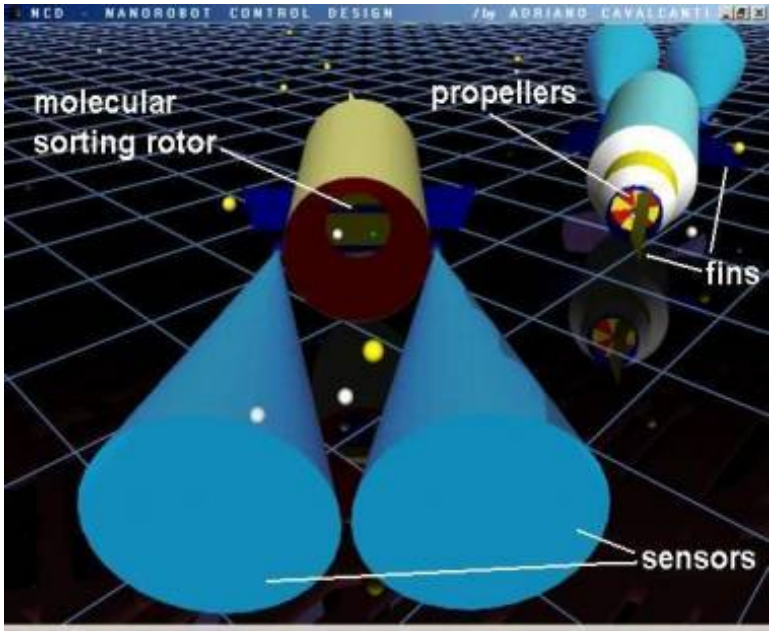


Blood vessel inside view. The target plaque represented by the pink sphere is located left at the wall. The nanorobots swim near the wall region searching for the lesion.

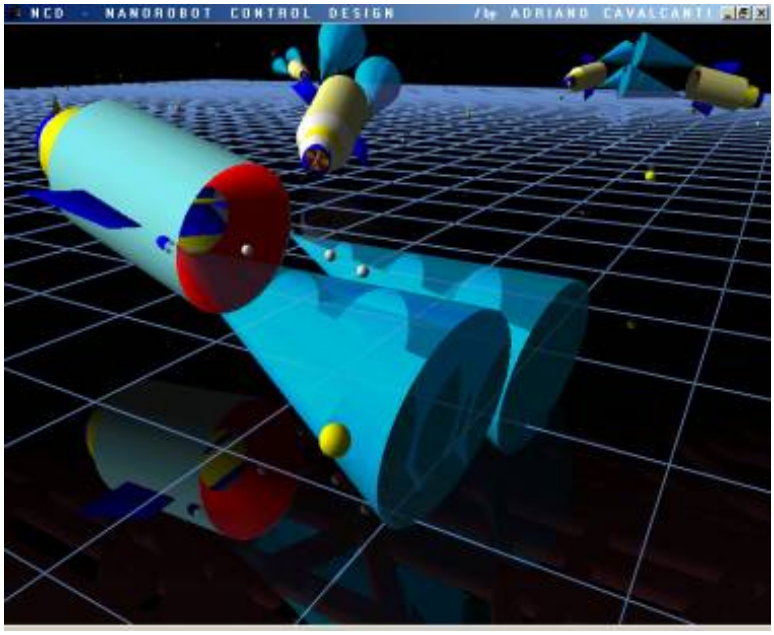
On the question of nanorobots feasibility, we need to remember that a lot of routinely facts today, should sound as improbable for 100 years ago. Now we are talking about a relatively near better future. Recent developments in the field of biomolecular computing have demonstrated positively

the feasibility of processing logic tasks by bio-computers, which is a promising first step to enable future nanoprocessors with increased complexity. Studies targeted at building biosensors and nano-kinetic devices, are required to enable nanorobotics operation and locomotion. Such studies have been advancing recently as well. A first class of nanorobots with revolutionary applications in health care are likely to emerge within the next five to ten years.

Applications of nanorobots are expected to provide remarkable possibilities. Among other biomedical problems, monitoring nutrient concentrations into the human body is a possible application of nanorobots in medicine. One interesting nanorobot utilization is also to assist inflammatory cells (or white cells) in leaving blood vessels to repair injured tissues. Nanorobots might be used as well to seek and break kidney stones. Nanorobots could also be used to process specific chemical reactions in the human body as ancillary devices for injured organs. Nanorobots equipped with nanosensors could be developed to detect glucose demand in diabetes patients, as well as to inject stem cells for the pancreas. Nanorobots will be applied in chemotherapy to combat cancer through superior chemical dosage administration, and a similar approach could be taken to enable nanorobots to deliver anti-HIV drugs. Another important capability of medical nanorobots will be the ability to locate stenosed blood vessels, particularly in the coronary circulation, and treat them either mechanically, chemically, or pharmacologically.



Nanorobot 3D design. The depicted blue cones shows the sensors “touching” areas that triggers the nanorobots’ behaviors.

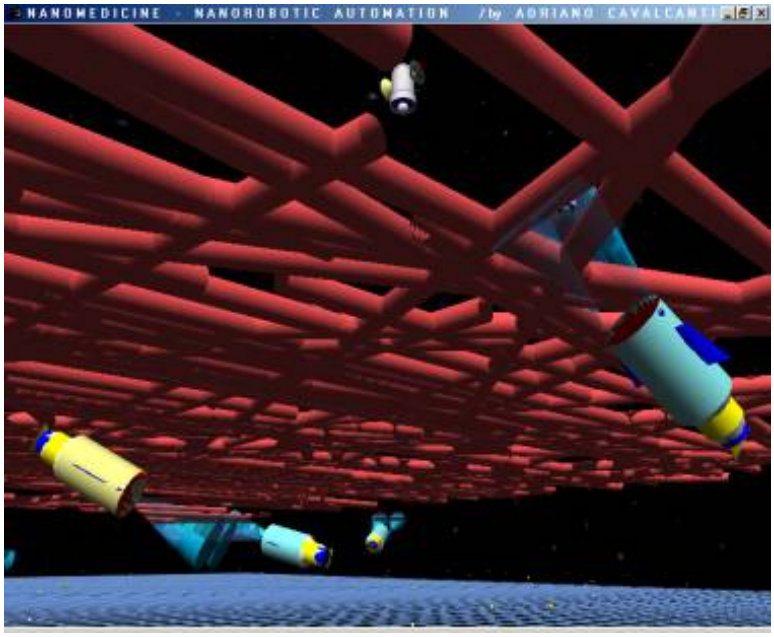


Schematic figure of molecular identification by chemical signals through nanorobot sensors.

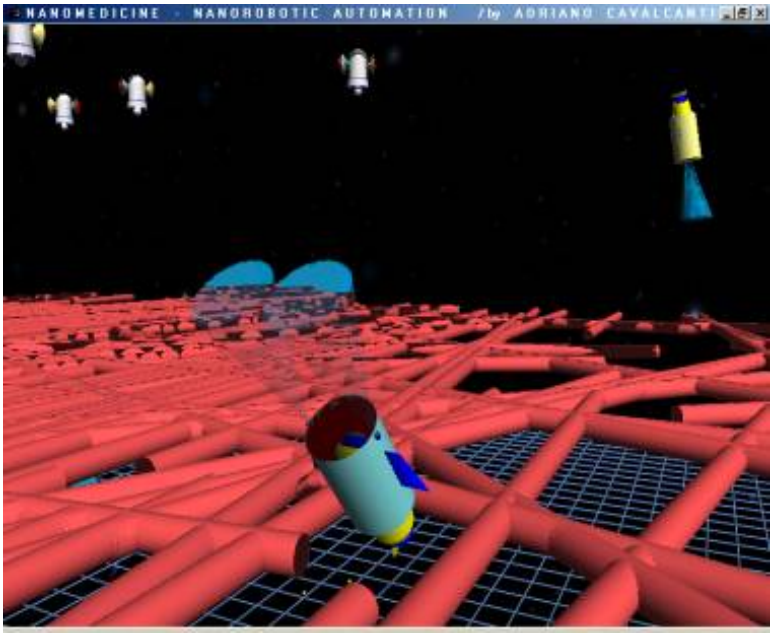
With the emerging era of molecular engineering, the development of methodologies that enable the experimental investigation to make easier automation, and evaluation of new approaches for a better comprehension of the nanoworlds and nanorobotics behaviour, are expected to have a great impact for an effective development on nanotechnology.

Computational nanoborotics approaches are also being explored successfully in nanoscience and

nanotechnology research, to provide researchers with an intuitive way to interact with materials and devices at the nanoscale. Virtual-environment interface to Scanning Probe Microscopes (SPMs) have been provided, giving a virtual telepresence on the surface but downscaled by a factor of about a million to one. The introduction of direct human-SPM interaction creates not only enhanced measurement capability, but also presages a more interactive technology that will enable easy nanofabrication and/or repair of nanostructures. Nanoscale object manipulation systems have been applied with the use of computer graphics for teleoperation, where the requirements for such systems have been clearly established.



Sensing obstacles.



Nanorobot obstacle avoidance.

The importance of nanosystems design for the investigation of nanorobot control has broken up recently as an important aspect for further investigation. Including aspects of the physical environment in conjunction with graphical visualization can provide a feasible approach for nanorobotics automation and control design. The development of nanosystems with high performance and some aspects of artificial intelligence could be addressed via computational nanorobotics.

Our society is living in a remarkable age, where the bridges for the post-human future are being constructed and pursued step by step. The excitement and the expectations around enabling and building nanorobots are quite comprehensible. Among other possibilities, we could foresee inclusive eradicating malignant diseases that ever have tormented the human-beings, with no previous expectation of solutions.

To see more works by Adriano Cavalcanti, visit http://www.nanorobotdesign.com.

– Adriano Cavalcanti

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