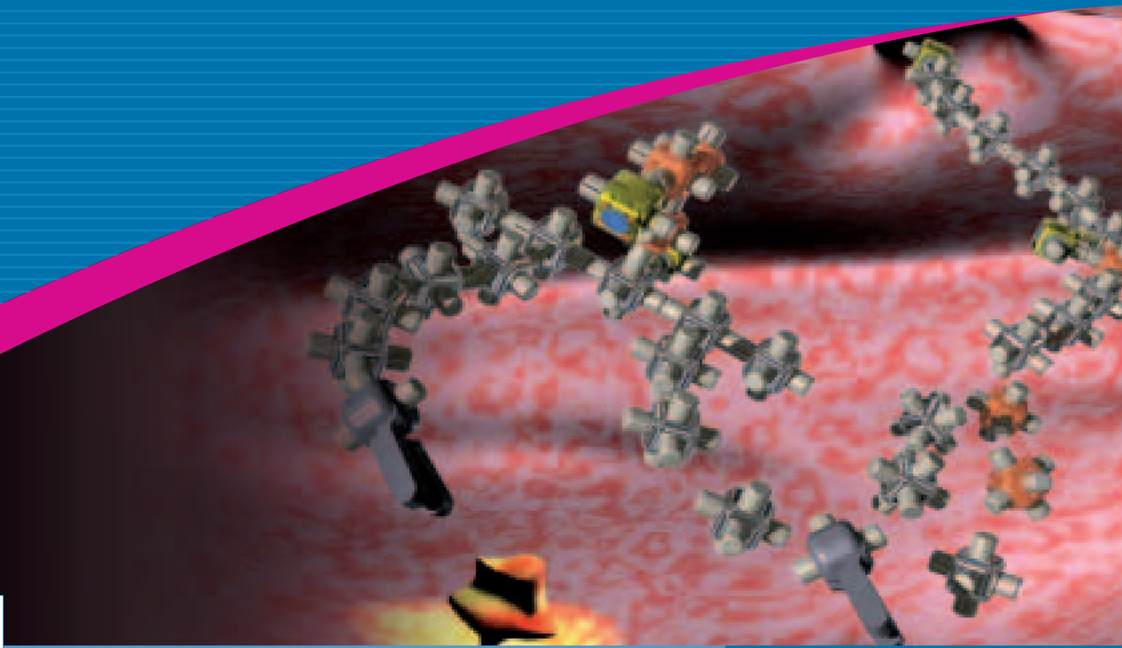


ARES
NEST ADVENTURE

ARES robot configurations.

Robotic repair kit for the body

Imagine the day when complex internal surgery is performed by tiny robotic machinery that assembles itself within the body, performs its task, and is then removed or disintegrates. This is the adventurous vision of the ARES project which is developing prototype screening and interventional robots to plan and perform surgery within the gastro-intestinal tract. Innovations in robotics, computation and micro- and nanotechnology will all be required to make this dream a reality.

Surgical procedures of the future are expected to increasingly involve 'endoluminal' approaches, in which very small precision-guided tools travel through the natural vessels and tubes of the human body. Such procedures will minimise the trauma and damage associated with surgery, enabling more effective and targeted treatment and much shorter recovery times.

This will require new surgical tools which are capable of entering the body through natural openings or very small incisions and then configuring themselves into complex operational structures at the specific site of intervention. The primary objective of the ARES project is to investigate a revolutionary system for endoluminal surgery and to develop two prototype surgical robots.

Complex challenge

The planned forms of endoluminal surgery will encompass several distinct steps. The first will use scanning images and other medical data to plan and simulate the intervention. This will be followed by computer-aided design of the optimal configuration of the endoluminal robotic tool that will be customised for the specific therapy at the target site.

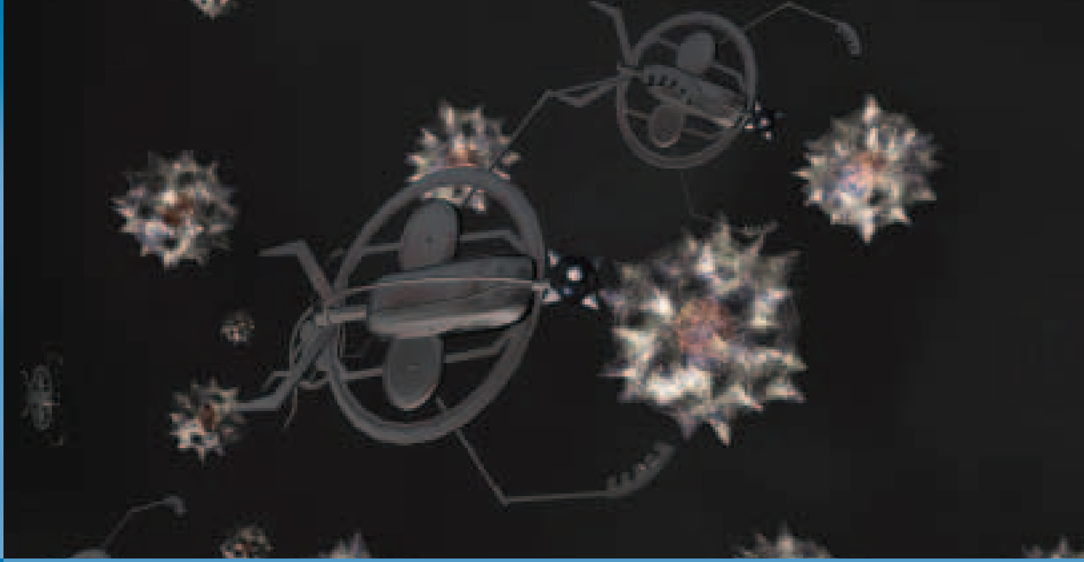
The appropriate robotic modules needed to construct the complete device within the body will then need to be selected. These individual modules may be between 0.1 and 0.5 cubic centimetres in volume, and will interconnect to create whatever specific structure is required for each operation.

The chosen modules will be delivered into the body in capsule form and will auto-assemble, probably *in situ*, to create the pre-planned robotic device. The surgical intervention will then proceed under very precise control. There will be an architecture of shared control: some simple tasks will be operated at module level, some more advanced tasks will be teleoperated by the medical doctor outside. Afterwards, the robot will have to be disassembled and either recovered or biodegraded naturally.

Targeting the GI tract

In order to achieve tangible results in the project's three-year time frame, ARES is focusing on the specific objective of

➔



ARES
NEST ADVENTURE

Nanobots attacking dangerous cells. © Michael Knight

AT A GLANCE

Official title
Assembling Reconfigurable Endoluminal Surgical system (ARES)

Coordinator
Italy: Scuola Superiore Sant'Anna

Partners
- *France: Institut National de Recherche en Informatique et en Automatique*
- *Switzerland: Eidgenössische Technische Hochschule Zurich*
- *Spain: Universidad de Barcelona – Centre de Recerca en Bioelectrònica i Nanobiociència*

Further information
Prof Paolo Dario
Scuola Superiore Sant'Anna
CRIM Lab
P.za Martiri della Libertà, 33
56127 Pisa, Italy
Fax: +39 050 883 402
E-mail: dario@sssup.it

Duration
36 months

Project Cost
€ 1 406 515

EU Funding
€ 1 260 000

Project reference
Contract No 15653 (NEST)

Web: http://cordis.europa.eu/nest

developing two prototype surgical robots for the use in the gastrointestinal (GI) tract.

A 'screening' robot, is being designed to search for medical problems, particularly cancer, using on-board sensors. A separate 'interventional' surgical robot is being designed to follow the indications revealed by the screening robot and conduct surgery using its own microsurgical tools.

The ARES consortium includes groups with expertise in computational robotics, biomedical robotics, bioengineering and microtechnologies, The coordinating team also benefits from the support and input of one of the world's leading pioneers of minimally invasive and endoluminal surgery.

The chosen objective of the project should be assisted by the fact that the GI tract has two natural openings and relatively large internal dimensions. This makes it an ideal target for developing approaches that may later be modified for use in smaller and more difficult locations.

The robotic devices will comprise a set of ingestible modules containing different elements for structural functions, power supply, communication, processing and control. The screening robot will include modules with diagnostic devices, including a camera for endoscopy and a DNA chip. The interventional robot will be equipped with active modules for surgery, such as ablation tools and systems to puncture cell membranes to allow insertion of therapeutic materials.

One of the most critical issues of the project will be to develop joints and connections between distinct modules that can achieve the necessary flexibility in both length and configuration, and allow easy removal at the end of the operation. Some modules may be biodegradable, allowing them to be left in the body, while others will need to be physically removed.

> **ARES is taking the early steps towards a dramatic revolution in medicine.**

ARES is taking the early steps towards a dramatic revolution in medicine. It will also involve significant innovations in several non-medical fields, such as modular robotics, creative robotic design and micro- and nanotechnology.

SIXTH FRAMEWORK PROGRAMME