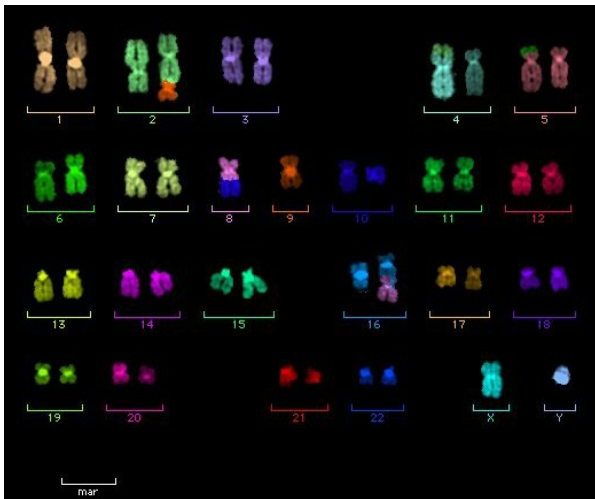


European Experiment Programme

In addition to his tasks as a Shuttle Mission Specialist, ESA astronaut Paolo Nespoli will undertake a number of experiments on behalf of the European science community during the European Esperia Mission. Two of these experiments (Chromosome-2 and Neocytolysis) are sponsored by ESA. The other three experiments (HPA, FRTL-5 and SPORE) are sponsored by the Italian Space Agency, ASI. Chromosome-2, Neocytolysis and HPA are experiments in the field of human physiology. FRTL-5 and SPORE are biology experiments. Nespoli will also be undertaking Educational Activities (see ARISS) coordinated by both ESA and ASI.

Chromosome-2

During space flights crew members are exposed to different types of ionizing radiation. To assess the genetic impact of these radiations, this experiment will study chromosome changes and sensitivity to radiation in lymphocytes (white blood cells) of ISS crew members. The Chromosome-2 experiment is planned to be carried out using eight subjects: four subjects from short-duration flights and four Expedition crew members.



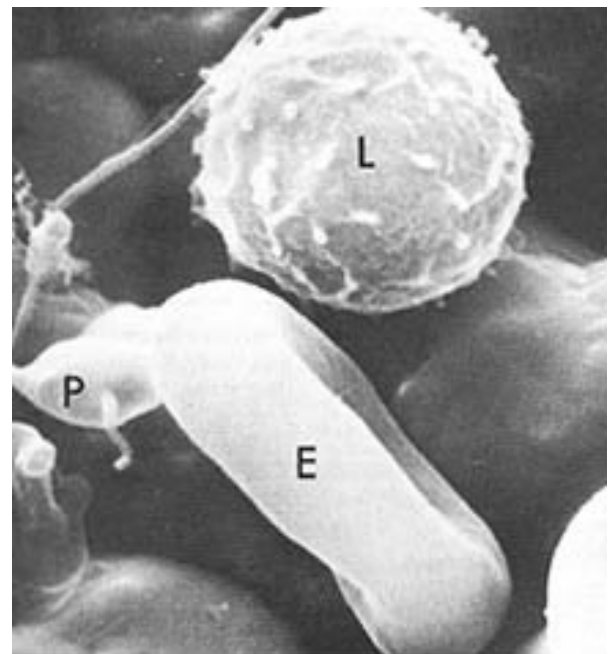
Multi-fluorescent chromosome map of a cell exposed to cosmic radiation. (Image: M. Durante)

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Neocytolysis

This experiment covers the effects of weightlessness on the hemopoietic system: the system of the body responsible for the formation of blood cells. The experiment will study a process called neocytolysis, the selective destruction of young red blood cells. The experiment will analyse the physical and functional characteristics of young red blood cells taken from astronaut blood samples before and after spaceflight. It will be carried out with three subjects from short-term missions.



Constituents of blood. E is an erythrocyte or red blood cell, L is a lymphocyte or white blood cell and P is a blood platelet. (Image: NASA)

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Hand Posture Analyser (HPA)

This experiment aims at understanding the ability of the human brain to mentally represent the presence or absence of gravity effects on object motion, and at studying the effects of weightlessness on movement. The Hand Posture Analyser, was launched to the ISS on Progress flight 12P in August 2003, and used during ISS Increments 7 and 8. The preliminary version of the same hardware was used on board the ISS during the "Marco Polo" mission with ESA astronaut Roberto Vittori in 2002. During his second mission in April 2005, astronaut Roberto Vittori performed again the HPA experiment.



ESA astronaut Paolo Nespoli during Hand Posture Analyser training. (Image: ASI)

The HPA hardware consists of two dynamometers for measuring pinch and grip force and a gloved instrumentation device worn by the astronaut, which is attached to an electronics box. The astronaut will carry out three different experiment protocols: IMAGINE whereby the astronaut simulates throwing an imaginary ball up against the ceiling and catching it on the way down, using the instrumented glove and electronics box; MAIS, where the subject uses the same hardware and carries out a protocol of reaching out, gripping and releasing different sized cylindrical objects; and CHIRO, which measures the maximum force exerted on the hand and pinch grip dynamometers by the astronaut, followed by the astronaut again exerting force on the dynamometers but at a reduced level.

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Fischer Rat Thyroid Low serum 5% (FRTL5)

This experiment is aimed at assessing the effects of the Space environment (weightlessness and radiation) on normal in vitro cultures of so-called FRTL5 rat thyroid cells. This experiment will use cells already exposed to the space environment during the FRTL-5 experiment on the 10-day Eneide Mission with ESA astronaut Roberto Vittori in April 2005.



FRTL5 equipment. (Image: S. Ambesi)

The FRTL5 cells will be used in a proliferative state, a state much more affected by the space environment. The cells will be sealed in sterile culture flasks and kept under controlled conditions. One of the reasons for choosing these specific thyroid cells is the relevance they have to human physiology and medicine. Thyroid tissue is an ideal target for Space radiation research.

The cells will be tested on return to Earth for DNA modifications due to radiation and magnetic fields, and the effect of weightlessness on cell behaviour. This kind of research helps to improve our knowledge of the effect of the space environment on the human body, especially with longer-term missions planned in the future (e.g. Mars).

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SPORE

The SPORE educational experiment goal is the study of PY17 bacterial spores response to exposure to weightlessness and ionizing radiations, both characteristic of the ISS environment. The experiment was conceived by high school students.



Cuvette used in SPORE experiment.

PY17 is the name given to a culture of the *wild type* stock spores of *Bacillus subtilis*. 96 sealed cuvettes containing the spores will be equally split across three experiment containers, 32 in each. The experiment will last the duration of the mission. The bacterial spores are absolutely harmless to humans.

Once retrieved, the spores will be compared to control samples that have followed the same experiment protocol on the ground. The comparison will help to determine the effects of residual gravity variation and exposure to ionizing radiations on the spores survival and development.

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ARISS (and additional education activities)

ARISS stands for Amateur Radio on the ISS and is an international association of national amateur radio societies of the countries participating in the ISS programme. It forms a valuable part of ESA's Education Programme, helping to stimulate children and young people's interest in science and technical-based subjects and space in general and thereby providing a stimulation for future careers in these areas.



ESA astronaut Thomas Reiter onboard the ISS during a live inflight call with students in the Columbus Control Centre in Oberpfaffenhofen in Germany on 17 October 2006. (Image: DLR)

During the mission Paolo Nespoli will be involved in two live amateur radio contacts from the ISS. He will answer questions from school children and university students at the IIS Deambrosis-Natta school in Sestri Levante, Genoa, and the University of L'Aquila respectively.

A web-chat with Nespoli either pre-flight or post-flight is also foreseen, as well as the distribution of education material about the mission addressing youngsters in Italy. The education-based activities are being coordinated by ESA and ASI.

Project Team

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