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Students in Space research. The involvement of high school students in the XenoGRISS experiment

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Abstract

The XENOGRISS project won the Italian Space Agency (ASI) – "YiSS - Youth ISS Science 2019" call and was carried out on the ISS in December 2019 during the ESA "Beyond" mission. Xenogriss had both scientific and educational purposes and was designed and presented jointly by researchers from the Universities of Milan and Florence, a group of students from the high school ITIS Meucci in Florence and their teachers. The students were involved in the study of growth and regeneration of Xenopus Laevis tadpoles in weightlessness. With the University researchers, they addressed the biological aspects of the experiment: assembling the aquarium for tadpoles, choosing their feeding, studying the literature for the definition of the experiment requirements, the post-flight analysis of samples and data processing. The students were also involved in the technological aspects concerning the refurbishment of the experiment hardware. This part of the work, which is the focus of this paper, was very demanding for the school team. Being an educational experiment, ASI made available the basic hardware (Biokon container, XEU aquarium, power battery), produced by Kayser Italia and used in previous experiments on the ISS. The students designed and implemented the control system of all the functions required by the experiment, under the guidance of their teachers and the technicians from Kayser Italia. A challenging problem was the power supply batteries capacity integrated in the basic hardware: a series of three 1.5V-3500 mAh AA batteries was the only energy source available for the experiment. The system was required to keep the tadpoles alive for over a month and monitor their growth through images taken by a camera and stored on an SD card. For this purpose, a custom board was designed. It was controlled by a microcontroller card commonly used in the educational field, which allowed the management of all the system peripherals: peristaltic pump, light source, camera, memory card for saving photos, temperature recording. In addition, through an educational programming environment used in teaching microcontroller systems, the software for managing the entire system was developed. The system worked effectively throughout the experiment duration on ISS. An HW-sleep mode of the electronic boards kept the batteries efficient, even after return to Earth. For the students, the project was an extraordinary opportunity to enter the scenario that the ISS represents for science, technology, international cooperation, to experience innovative teaching and to expand their professional and team-working skills.

Keywords: STEM, Xenopus Tadpoles, Tissue Regeneration, Education, ISS