In 2021, three different space missions have successfully arrived at Mars, including the landing in Jezero crater by the NASA’s Perseverance rover, which is expected to significantly advance our search for life on the Red Planet. Perseverance is the first step of the Mars Sample Return (MSR) mission and will collect and cache samples for future return to Earth, where they can be analyzed in our laboratories. The Perseverance rover carries seven instruments to conduct important science and technology investigations while on the surface, including for the first time measurements using a Deep UV fluorescence and Raman mapping spectrometer able to detect organic molecules and their spatial distribution. Although the results alone cannot prove that biosignatures are present, they will be able to identify carbon-containing compounds and help classify contained organic functional groups. In parallel, the European Space Agency (ESA) ExoMars mission, which includes the Rosalind Franklin rover, is scheduled to launch in 2022.

The 2021 summer school will review and assess the types of techniques that are necessary for detection of biosignatures on Mars, including Raman spectroscopy, the isotopic and chirality analyses that Rosalind Franklin rover will perform, and the advanced techniques needed to analyze samples both in-situ and in Earth-based laboratories. The central question will be “how can we unequivocally detect biosignatures on Mars?” and the discussions will involve in-situ rovers, sample collecting and return, laboratory analyses on Earth, and the experiments that future human explorers may be able to perform. The lectures will be focused on instrumentation, techniques, and the science they provide. In addition to them, during the week the students will participate in discussions about the theme, prepare and present group projects, and take part in an excursion to a relevant geological site near Santander.
Directors
Víctor Parro García
Director
Centro de Astrobiología (CSIC-INTA), Spain

Rosaly M.C. Lopes
Jet Propulsion Laboratory; NASA, USA

Scientific Secretary
Carlos Briones Llorente
Centro de Astrobiología (CSIC-INTA), Spain

Mon, 6 Sept
10:00-11:30: Welcome lectures
   Rosaly M. Lopes
   Jet Propulsion Laboratory, NASA, USA
   Víctor Parro
   Centro de Astrobiología, Spain

11:30-13:00: ‘Microbial life in extreme environments’
   Mike Malaska
   Jet Propulsion Laboratory, NASA, USA

13:00-15:30: Lunch

15:30-17:00: ‘Past and present Martian habitats: targets in the search for life’
   Bethany L. Ehlmann
   Caltech, USA

Tue, 7 Sept
Excursion to a relevant geological site near Santander (whole day)

Wed, 8 Sept
10:00-11:30: ‘The Martian atmosphere and its importance for habitability’
   José Antonio Rodríguez Manfredi
   Centro de Astrobiología, Spain

11:30-13:00: ‘Biosignatures for alien life’
   Mike Malaska
   Jet Propulsion Laboratory, NASA, USA
13:00-15:30: Lunch

15:30-17:00: ‘Biosignatures of the oldest terrestrial microorganisms as analogues for biosignatures of Martian life’

Frances Westall
CNRS, France

19:00-20:00: Open Lecture (in Spanish): En busca de vida en Marte: nuevas misiones y nuevos retos

José Antonio Rodríguez Manfredi
Centro de Astrobiología, Spain

Carlos Briones
Centro de Astrobiología, Spain

Thu, 9 Sept
10:00-11:30: ‘Mars 2020: Overview of the payload, landing site, and results to date’

Bethany L. Ehlmann
Caltech, USA

11:30-13:00: ‘Mars Environmental Dynamics Analyzer (MEDA): Perseverance’s instrument for characterizing the atmosphere’

José Antonio Rodríguez Manfredi
Centro de Astrobiología, Spain

13:00-15:30: Lunch

15:30-17:00: ‘Searching for life on Mars with the ExoMars 2022 mission’

Frances Westall
CNRS, France

Fri, 10 Sept
10:00-11:30: Student presentations
11:30-12:00: Synthesis + diplomas
12:00: Adjourn