

**FM 15:**  
**Search for water and life's building**  
**blocks in the universe**

# Search for water and life's building blocks in the Universe

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Water is the common ground between astronomy and planetary science as the presence of water on a planet is universally accepted as essential for its potential habitability. Water assists many biological chemical reactions leading to complexity by acting as an effective solvent. It shapes the geology and climate on rocky planets, and is a major or primary constituent of the solid bodies of the outer solar system. Water ice seems universal in space and is by far the most abundant condensed-phase species in our universe. Water-rich icy layers cover dust particles within the cold regions of the interstellar medium and molecular ices are widespread in the solar system. The poles of terrestrial planets (e.g. Earth, Mars) and most of the outer-solar-system satellites are covered with ice. Smaller solar system bodies, such as comets and Kuiper Belt Objects (KBOs), contain a significant fraction of water ice and trace amounts of organics. Beneath the ice crust of several moons of Jupiter and Saturn liquid water oceans probably exist.

In addition to water, another requirement for life as we know it are organic compounds. Our understanding of the evolution of organic molecules and their journey from molecular clouds to the early solar system and Earth provides important constraints on the emergence of life on Earth and possibly elsewhere. Astronomical observations have shown that carbonaceous matter is ubiquitous and a significant number of molecules that are used in contemporary biochemistry on Earth are found in interstellar and circumstellar regions as well as protoplanetary environments. Currently more than 180 molecules have been detected in the interstellar and circumstellar gas. Circumstellar envelopes, regarded as the largest factories of carbon chemistry in space, are where small carbon compounds are converted to larger species and into solid organic compounds with mixed aromatic/aliphatic structures. During the formation of the solar system, this interstellar organic material was chemically processed and later integrated in the presolar nebula from which planets and small solar system bodies formed. The large quantities of extraterrestrial material - both water and organics - delivered to young planetary surfaces may have played an important role in life's origin.

FM 15 was held during the IAU GA between August 3 and 5, 2015. A total of 17 invited and 17 contributed oral talks were presented. A total of 11 countries were represented among the speakers. Over these 3 days, we discussed the development of simple organics in space to provide initial context for understanding their subsequent evolution within a young planet-forming disk. Among the topics of presentation are discussions of the water and organic formation in space, their transport to a forming disk, their delivery to form terrestrial planets, and incorporation into giant planet atmospheres. The various potential sources of volatile delivery (comets, asteroids, internal to the Earth) were presented along with a discussion of the early development of life on the Earth.