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The Distance from Computer Science to Astrobiology is "0" in Mike Gowanlock's Universe

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Mike Gowanlock is travelling numerous roads on his journey to a Doctorate in Computer Science from the University of Hawaii.

The computer-science aspect that Mike is involved in is high-performance computing. He's devising new methods that will decrease the time necessary to carry out computationally intensive simulations. In his endeavours, he's acting both as the scientist (astrobiologist) and the computer scientist, searching for faster solutions to increasingly complex problems. The journey is not yet complete, but his travels have already taken him along some fascinating pathways.

In addition to his pursuit of a Ph.D., Mike is also a Research Assistant with the NASA Astrobiology Institute. The project for his research assistantship came out of the challenge of overlapping disciplines and their respective sets of terminology. Integrating that terminology into a common vocabulary is a big undertaking. Mike's job is to measure the degree of interdisciplinary thinking present in papers authored by scientists who are funded by the NASA Astrobiology Institute—but that's just one aspect of his work. Knowledge from many fields is required to perform scientific research.

Mike's expertise on habitability within the Milky Way Galaxy comes from his M.Sc. work at Trent University. Initially, one of Mike's computer-science professors at Trent, Dr. Sabine McConnell, suggested that he consider working with her and Trent's Dr. David Patton on an astrobiology project for his Masters thesis. Titled *A Model of Habitability within the Milky Way Galaxy*, the work was published in the international, peer-reviewed journal *Astrobiology* in the November 2011 edition. Mike sums up the study with these words:

> *If you wondered where the most habitable places in the galaxy might be, using Earth as a model, you would look for conditions similar in temperature that would allow for liquid water on a planet's surface, conditions that would be conducive to the possibility of life. To begin with, you have to have a star that hosts planets.*
>
> *As metallicity increases over time due to the continual birth and death of stars in certain areas of the galaxy, chances for the development of planets increase. Metallicity refers to the abundance of elements heavier than hydrogen or helium, in other words, the stuff that planets are made of.*

Figure 1 — Mike Gowanlock.

Is there life on Mars? "Not that we know of," says Gowanlock, "but we're following the trail of water. We have reason to believe basic life is widespread," he continues, "but complex life (like a plant involved in the process of photosynthesis, for example) may not be common at all."

Mike's M.Sc. paper laid the groundwork for his on-going involvement in astrobiology. According to Mike, "I've been working on implementing a more sophisticated model of the Milky Way that will allow us to probe habitability in the inner region of the galaxy. This is an area that was not modelled in our previous work."

"Our previous work suggested that the inner region of the galactic disk contains the greatest number of habitable planets conducive to complex life, as based on estimates of planet formation rates and considering the dangerous effects of supernovae sterilizations. We did not attempt to model the innermost regions of the galaxy in this model. The innermost region that we modelled was at 2.5 kpc from the galactic centre."

In the pursuit of his Doctorate, Mike continues to work with Trent U. colleague, Dr. David Patton and is widening the scope of his original study.

> *Astrobiology is a relatively new field, and I think that the field benefits from the fact that many of the discoveries made are of great interest to the public. Advancements made in astrobiology are beginning to answer some of the most fundamental questions regarding life in the Universe. These are questions that civilizations have pondered for millennia, which we are now finally able to study through scientific means.*

Furthermore, advancements in the field seem to be occurring rapidly. For example, after the first exoplanets were found, many researchers focussed their efforts on the field of planet formation. This exciting field is trying to understand how planets form around other stars. Between theoretical models of the formation of planetary systems and observational studies, we are finding that there are many different configurations in which planetary systems are found. These studies captivate the public's imagination.

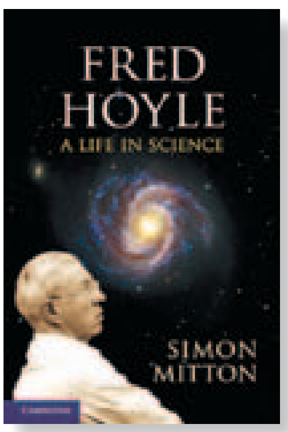
I think of exoplanet searches as a key component of astrobiology. The Kepler mission is giving us incredible information pertaining to the frequency of planets around other stars. One of the main goals of these searches is estimating the frequency of Earth-sized planets. Of particular interest is the habitability of these other planetary systems; a key component of such an assessment is determining the distance that these planets orbit their host stars such that water can remain in a liquid state on the planet's surface.

If it had not been for my Trent U. Professors Sabine McConnell and David Patton, I'd likely be working in something radically different. I have to say, I'm very happy with how my academic career has developed thus far. Looking back, I can't imagine focussing my efforts in work unrelated to astrobiology. ✶

John Crossen has been interested in astronomy since growing up with a telescope in a small town. He owns www.buckhornobservatory.com, a public outreach facility just north of Buckhorn, Ontario.

Reviews / Critiques

Fred Hoyle: A Life in Science, by Simon Mitton, pages 369+xi, 16 cm × 23 cm, Cambridge University Press, 2011. Price £20. Paperback (ISBN: 978-0-521-18947-7).



In *Fred Hoyle: A Life in Science*, Simon Mitton has assembled an engaging biography of one of the most productive, influential, and controversial astrophysicists in recent British history. From his birth in 1915 to his death in 2005, Fred Hoyle devoted most of his life to the pursuit of a variety of high-profile scientific investigations, almost all of which were ground breaking, of an astronomical nature, and directly linked to subsequent work in the field. Even his war service working on improvements to naval radar ranging was an important contribution to the ultimate Allied victory.

Mitton's *A Life in Science* is arranged in somewhat unusual fashion. Initially, it is ordered temporally to describe Hoyle's origins, childhood experiences, and education, continuing the thread through his experiences as an undergraduate student, graduate student, and postdoctoral fellow at Cambridge. Much of Hoyle's life will be of interest to readers wishing to learn more about the vagaries of the British educational system of the early 20th century, a system in which intelligence and ability were not necessarily a guarantee of success or acceptance. After that, the ordering is roughly by research topic, in order to provide details of how Hoyle's work in those areas evolved over the years.

Mitton does a good job of placing Hoyle's scientific and later administrative efforts into the context of what was happening at the time, to the point that I developed a deep appreciation for the philosophy and methodology that Hoyle followed in order to seek the shortest path to advancing knowledge in astrophysics. He was a strong adherent of allowing bright minds to find and pursue unhindered those areas that interested them most, which is not always the case in science. My impressions of Hoyle and his work during my younger days were often formed from a distance in the context of the sometimes negative or derogatory reactions generated in other astronomers of my acquaintance, and I was happy to learn more of the positive details of the controversial sections of Hoyle's career: his ongoing feud with Martin Ryle, the founding and operation of the Institute of Theoretical Astrophysics (IOTA) at Cambridge, and his years as a media icon.

The human side of Hoyle is also described, from his long-term goal of climbing all of Britain's peaks to his never-ending quest to find adequate finances to support his education, career, family, and research. I found myself growing closer to Hoyle and his ideologies the more I read. It was also interesting to discover how he was responsible for introducing Julie Christie to a potential career in the cinema as a result of finding actors for his *A is for Andromeda* series on the BBC. My years in Canada left me unaware of Hoyle's lengthy media career in Britain, where he was a household name for many years on matters of science and astronomy.

Hoyle's prolific publication record focussed on a selection of somewhat diverse topics. His early work on the accretion theory of star formation with Ray Lyttleton is little cited these days, and he is much better known for his work with Willy Fowler and Margaret and Geoffrey Burbidge on the seminal papers on the origin of the elements in the 1950s, the famous