SPACEWARD BOUND NAMIBIA - FACT SHEET

SPACEWARD BOUND CAREERS

Spaceward Bound is a NASA programme that brings together scientists and educators in studies of extreme environments (usually very hot or very cold deserts) where they search for and investigate microscopic organisms that are able to survive in very harsh environments. The knowledge and experience gained during these field trips are used to design research methods and equipment that will look for life on Mars.

Meet some of the scientists, engineers and educators that took part in Spaceward Bound: Namibia during April 2010

Don Cowan, expedition leader

Professor Don Cowan coordinates South Africa's participation in Spaceward Bound, and led the Spaceward Bound: Namibia Expedition. He is the director of the Institute for Microbial Biotechnology and Metagenomics at the University of the Western Cape, and studies hot and cold deserts (he gets to visit Antarctica often!). His team is particularly interested in what makes it possible for organisms to survive in extreme environments, and in the similarities in the life forms found between some of the hottest and coldest places on Earth.

Chris McKay, lead scientist for Spaceward Bound

Dr Chris McKay is passionate about understanding extreme life forms on Earth to help us search for life on other planets. He is an astrobiologist, working at the NASA Ames Research Centre in California, USA. As Spaceward Bound expedition leader, he is responsible for the coordination of this programme's research in some of the most extreme environments on Earth. He is also passionate about making young people and science teachers aware of the search for life on Mars. "It is hugely satisfying to see young people grow and blossom as scientists," he says. "You can't make a student or young colleague into an experienced scientist, but you can provide the best possible environment for a student to flourish and grow."

Rosalba Bonnacorsi, astrobiologist

Dr Rosalba Bonnacorsi describes herself as an environmental scientist working side by side with rocket scientists. Her job at the NASA Ames Research Centre in California, USA, entails studying microbes in surface soils and rocks in extreme desert environments all over the globe. She uses disciplines such as sedimentology, organic geochemistry and microbiology to look for life in dry and extremely dry environments. She is especially interested in clays and whether microbes are able to live inside clays. Because clays are able to protect and preserve organic material, she is very excited about the next mission to Mars - the Mars Science Laboratory. If all goes according to plan, this NASA rover, scheduled for launch in October 2011, will bring back clay samples from Mars.

Cassie Conley, planetary protection officer

Dr Cassie Conley is one of only three planetary protection officers in the world. She is based at the NASA Ames Research Centre in California. "The international space treaty dictates that we must be extremely careful when we go to other places in space not to contaminate it, and when we bring something back from outer space we must also take care that it is not something nasty that could be potentially harmful," she explains. "The people in charge of this role at the various space agencies around the world are called planetary protection officers." Before a spacecraft is launched, the planetary protection officer has to certify that it is clean enough to be launched. This used to involve a stringent cleaning process and baking the components of a spacecraft for several days at very high temperatures, sufficient to kill all known organisms. Now, chemical cleaning processes are mostly used until the surface of the space craft has fewer than 300 spores per m2 on its surface. "That is still 10 000 times fewer spores than on the skin of your hands just after you have washed it," Dr Conley says. "If you were to accidently sneeze on a spacecraft, you would put it over the limit."

Henry Sun and Steve Pointing, microbial ecologists

Microbial ecologists are interested in how microorganisms are distributed over space (spatially) and time (temporally) in an environment.

Dr Steve Pointing works at the University of Hong Kong in China. He has worked in the cold deserts of Tibet and hot deserts in Kazakhstan, and is now comparing the organisms found under rocks in these deserts with the spread of similar hypolithic cyanobacteria (blue-green colonies of bacteria that grow under translucent quartz rocks) in the Namib.

Dr Henry Sun is based at the Desert Research Institute in Nevada, USA. He is interested in life in extreme environments and specifically focuses on endolithic microbes - that is organisms that live inside rocks. "It is not only about finding life in extreme environments, but also about how to detect them," Dr Sun remarks. He gets very excited about bacteria, because they are so good at chemistry and harvesting all possible energy sources in their environment. "Some bacteria can even oxidise the iron in rocks and use that as an energy source, almost as if they breathe iron," he enthuses. "The bacteria that grow under or inside rocks here in the desert are cyanobacteria, and the more we know about them, the better our chances of finding similar life forms on Mars." On Earth, cyanobacteria played a key role in the biological history of the planet, because they were the first organisms which evolved to photosynthesise and produce oxygen. Before that, there was no oxygen. Cyanobacteria still play a huge role on Earth today. They float in the top layer of the oceans where they are able to photosynthesise. As a food source for zooplankton, they are the basis of the food web in our oceans.

Wanda Davis, Mars analogue site scout

Wanda Davis's job is to find places on Earth that are as close as possible to Mars, as well as some other planets in our solar system and their moons where there might be a possibility of liquid water. She is a planetary scientist working for NASA, based at the NASA Ames Research Centre in California. "We first need to understand as much as possible about the planet or moon we are focusing on, including its geology, geo-chemistry, geo-morphology and its atmosphere. We then look at places on Earth with some similar physical characteristics." Antarctica is both very cold and very dry, making it possibly most similar to Mars. However, some of the hot deserts on Earth, for example the Atacama Desert in Chile, are even drier. "We are interested in this part of the Namib, because it is a fog-shrouded desert," Wanda adds. "We want to understand whether the organisms here get their moisture from the air, or if it precipitates and the organisms then acquire liquid water from the base rocks. We also test out the instruments that are going to be on the spaceship in extreme environments in the field at these analogue sites."

Lauren Fletcher, engineer

Lauren Fletcher is a senior systems engineer, employed by NASA, to focus specifically on the equipment that may help us to discover life elsewhere in the universe, and to determine the extent of life when it is discovered. He is interested in advanced robotic technologies that may help us to detect extraterrestrial life. As a member of Spaceward Bound, he regularly joins microbiologists, biologists and ecologists on excursions to remote places to observe first-hand how they work in the field and figure out the type of robotics and other equipment that could replicate their work in space. "It is really important to observe Earth-based field research first-hand in order to be able to design the best possible robotic equipment to look for life elsewhere in the universe," he explains. "The biological world changes and adapts very quickly and presents engineers with many challenges."

WHAT MAKES A GOOD SCIENTIST?

The scientists who took part in Spaceward Bound: Namibia during April 2010 have all reached the top of their respective fields of research. They now have the opportunity to travel together to a series of remote places on Earth where they study life in extreme environments as part of the human quest to find life outside our own planet. The scientists had the following advice for young scientists aspiring to reach the top and perhaps become part of the ongoing search for life elsewhere in the universe:

BE FLEXIBLE AND COMMUNICATE

A good scientist is inquisitive, flexible, likes to work with other people, likes to write and is also a good communicator. (Wanda Davis, research scientist at NASA Ames, California, USA.)

LEAVE HOME AND CHOOSE THE RIGHT STUDY LEADER

Leave your home country - try to find an opportunity to do doctoral or postdoctoral studies in a different country. Do it while you are young, because later it becomes very complicated. The person you choose to work with as your study leader is very important. Find someone who will support you, and not only promote him- or herself by using your work. It also helps if your study leader works at a reputable university and if there is money to support you. (Dr Alfonso Davilla, NASA Ames Research Centre, California, USA)

BE PATIENT AND PERSIST

Antarctic scientists often say that it takes at least three years to do an experiment. Year one is just to see what is possible. Year two, to try it and probably get it wrong. And then get it right in year three. (Professor Don Cowan, University of the Western Cape, Bellville, South Africa)

KEEP AN OPEN MIND

Explore and have fun with science ... don't decide too early on exactly what you want to do for the rest of your life. Keep on asking questions and keep on pushing the envelope. Be willing to challenge authority. Just because somebody said something is impossible, it does not mean that it's true. (Dr Henry Sun, Desert Research Institute, University of Nevada, Las Vegas, USA)

GET A SOLID FOUNDATION

To be a good scientist, you need a solid foundation in maths, physics and chemistry. This will provide you with the logic, methods and measures to test and develop your ideas throughout your whole career. (Dr Rosalba Bonnacorsi, NASA Ames Research Centre, California, USA)

FOCUS ON DETAIL, BUT SEE THE BIG PICTURE

You need discipline to be able to focus on a particular problem and not get distracted. Once you have your results, you also need the capability to see the bigger picture and the larger implications of your work. It is a two-way process - a reduction process towards the simple building blocks of your research, and a reconstruction process to see where and how everything fits into the bigger scheme of things. (Dr Alfonso Davilla, NASA Ames Research Centre, California, USA)

FIND A GOOD MENTOR

Your career will benefit a great deal if you are able to be mentored by someone who understands the need to foster the careers of young scientists. Spend as much time as possible and get advice from your mentor on all aspects of your career. (Wanda Davis, NASA Ames Research Centre, California, USA)

ENTHUSIASM IS KEY

If a student is enthusiastic about something, the hard work and the desire to know more come naturally. (Professor Don Cowan, University of the Western Cape)

MOTIVATION MAKES ALL THE DIFFERENCE

Motivation is the most important indicator of future success. You can't teach somebody to be motivated; it has to grow from within. But being exposed to interesting environments and meeting interesting scientists can nurture motivation and interest in doing science. (Dr Chris McKay, astrobiologist, NASA Ames Research Centre, California, USA)

Interested in studying extremophiles at postgraduate level? Visit the web site of the Institute for Microbial Biotechnology and Metagenomics at the University of Western Cape - see http://imbm.co.za

NRF National Research Foundation | SAASTA South African Agency for Science and Technology Advancement

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