

NEWS

JEB author selected for NASA astronaut training

In years to come, few of us will remember what we were doing on the 6 June 2013, but Jessica Meir will never forget the day when she answered a call and heard Janet Kavandi, Director of Flight Crew Operations at the NASA Johnson Space Center, say, 'Jessica, second time is a charm'. Not only had her life changed forever but also her lifelong dream had finally come true. Kavandi was calling to tell Meir that she had just been accepted for the prestigious astronaut-training programme at the NASA Johnson Space Center in Houston, Texas.

'I think I was five when I first knew I wanted to be an astronaut', recalls the Assistant Professor of Anesthesia at Harvard Medical School. 'My first distinct memory, though, was in first grade, when asked to draw what we wanted to be when we grew up. I remember drawing an astronaut landing on the moon', she says.

Growing up in Caribou, ME, USA, Meir made sure that she was already immersed in all things 'NASA' before she even graduated from high school. Attending the Space Camp at Purdue University, USA, in 1993 and participating in the Space and Life Sciences Training Program at the NASA Kennedy Space Center before her sophomore year at Brown University, Meir pursued her dual passions of becoming an astronaut and studying biology from an early age. And by the time she was ready to begin her Masters Degree in Space Studies at the International Space University in Strasbourg, France, Meir had already experienced microgravity, having completed her first 'vomit comet' flight shortly after graduating from Brown University. After returning from France, Meir joined the Human Research Facility at the NASA Johnson Space Center, working with a team of scientists investigating the effects of microgravity on human physiology. And it was during this time that her passion for marine biology was rekindled: 'That was when I got to do the underwater mission in Aquarius,' she explains.

'Aquarius is an underwater habitat off Key Largo, Florida, and it's down at about 50 feet', says Meir, adding, 'If you are a coral reef biologist and you want to maximise dive time, you saturation dive and you can dive for hours a day; you never have to come up'. Joining a team of two astronauts, a flight director and two habitat technicians, Meir descended for 5 days to explore the underwater environment and evaluate its potential as an analogue for spaceflight. 'It was really cool, you are on the other side of an aquarium, you are eating dinner and looking out the window at fish going by. It was an amazing experience', she recalls.

Meir began reading about diving physiology and stumbled across the name of Jerry Kooyman. 'I thought this Jerry Kooyman guy sounds like he's quite the legend', she says. Convinced that such a

senior scientist would not answer the phone when she called, Meir was astonished when Kooyman himself did pick up, 'And of course he was the nicest guy ever', she chuckles.

By now Kooyman was no longer officially taking students, but he recommended Paul Ponganis to Meir, and she eventually registered as a PhD student at the Scripps Institution of Oceanography (University of California, San Diego) to work with him. 'I didn't know specifically what I was going to do for my thesis right away', says Meir, but she eventually focused on blood oxygen depletion in diving emperor penguins and elephant seals. Describing both species as the 'extreme' divers of the avian and seal worlds, Meir says, 'When you start to follow the Krogh principle and start with the extremes, you may be more likely to

find real examples of adaptation or pronounced physiological responses that are even more extreme in these animals. That is exactly what we found.'

Measuring the blood oxygen levels of diving emperor penguins in Antarctica, Meir discovered that in addition to their enhanced oxygen storage capacity, the submerged birds use their oxygen supplies very effectively. 'They can almost completely deplete the venous oxygen store and they tolerate very low levels of oxygen. We think this helps explain how they are such amazing divers', she says. And when Meir conducted similar studies on elephant seals in collaboration with Dan Costa in The University of California, Santa Cruz, she discovered that this mammal's ability to tolerate hypoxia was even more extreme than that of the penguins.

Graduating from Scripps in 2009, Meir then moved almost 20 deg north to Bill Milsom's lab in University of British

Columbia, Vancouver, Canada, to work on yet another extreme performer, the bar-headed goose, which undertakes one of the world's most arduous migrations: across the Himalayas. 'These birds are flying so high that the oxygen levels are only a half to one-third those at sea level. In addition, flying is the costliest form of vertebrate locomotion, so these birds have a significantly increased oxygen demand but they are doing it in an environment in which the oxygen supply is extremely limited', she says. To learn more about how the geese manage this remarkable feat, Meir needed to train bar-headed geese to fly in a wind tunnel, 'So that was when we decided to take advantage of the imprinting instinct', she explains. Transforming herself into Mother Goose, Meir became proud 'Mom' to a gaggle of goslings, napping and walking with the youngsters until they took to the wing. And when the youngsters became airborne, Meir simply hopped on her bicycle to go out with the flying juveniles, upgrading to Bob Shadwick's scooter when they became too fast. 'They would be coming down



JEB author, Jessica Meir, who has been selected for NASA astronaut training.



Meir 'flying' with one of her imprinted goslings.

the road next to me and that was of course so amazing because you have this bird flying so close to you that its wing tip is sometimes brushing your shoulder and you are looking in the eye of this flying bird', Meir reminisces. And when the time came for the birds to try flying in the wind tunnel wearing a respirometry mask and a backpack system recording various physiological parameters, they didn't let their Mom down. As Meir gradually reduced the oxygen level to that experienced by their cousins crossing the Himalayas, the young geese continued flying happily.

However, despite having discovered her new passion for comparative physiology, Meir still nurtured her dream of becoming an astronaut. 'Recently, they [NASA] haven't been doing selections very often and if you are in life sciences you really need an advanced degree to be realistically competitive. I was just finishing my PhD in 2009 so I was finally in a good position to

apply', she recalls. Making it to the final round of selection, Meir was understandably disappointed when she failed to be selected, but recalls that NASA encouraged her to reapply when the next selections came around. So, when that call came in 2011, Meir was one of more than 6100 qualified hopefuls that filled out the application form.

Recounting how the selection procedure whittled the initial list of applicants down to the final 49 individuals invited for the week-long selection process in Houston, Meir describes the experience as humbling. 'You meet these people that have these diverse and completely astounding skill sets and you think, wow, the chances of me getting selected are probably even smaller than I thought because these people are so incredible', she says, adding, 'I think everybody – even if they end up not getting selected – really enjoys the selection process.'

Reflecting on her remarkable success, Meir says, 'I still am shocked, I don't think it'll sink in until I get there'. And when Meir takes up her NASA appointment on 12 August 2013, she will be embarking on a tough training schedule that will see her learn Russian, complete Naval flight training and learn about robotics. 'We'll have a diverse set of training opportunities and for me the training is going to be one of the most amazing components', she says.

But Meir's elation is also tinged with a hint of regret at the prospect of moving on from research. 'I feel really fortunate to have found something else that I was so passionate about', says Meir, adding, 'And I am still analysing the goose data'. She admits that she is hoping that she might still be able to retain some contact with her scientific roots, even when the astronaut training becomes the day job. 'I think it would be too sad to cut it all off cold turkey', she smiles.

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