

Critical Point Gardening in space

A blog written by a vegetable on the International Space Station gets **Robert P Crease** thinking about the purpose of laboratories

For a few weeks two summers ago, a courgette blogged its experiences aboard the International Space Station (ISS) (blogs.nasa.gov/letters/2012/06). One morning, the vegetable – dubbed Space Zucchini – described a thin sliver of atmosphere as “like a rainbow, but only of shades of blue” that filled the gap between Earth and space with “electrifying diaphanous beauty”. Another day it (the blogger’s gender is unclear) characterized a spacesuit as an astronaut’s version of a seed pod.

Seeing its neighbour Sunflower grow with lopsided seeds, Space Zucchini later remarked, “We are living on a frontier and things are different here.” Other of the vegetable’s blog entries concerned the birth of a younger sibling, whose development Space Zucchini found indicative of unsuspected truths about plant growth, including the lack of need for gravitational signals in aspects of the process. “On the frontier,” it noted solemnly, “even a baby sprout can teach us something new.”

Who knew that vegetables – well, a courgette’s technically a fruit – were so literate? In fact, this one’s even done a poignant reading over National Public Radio. But apart from being a bit of fun, the activities of Space Zucchini – and its rumoured alias, the astronaut Donald Pettit – gave me ideas for new ways to talk about the scientific process.

Life of an “uber-geek”

I decided to get in touch with Pettit, who told me that he is an “uber-geek” whose thoughts turn to science at the slightest provocation. “I’ll be having a quiet, intimate moment with my wife,” he confessed, “catch a drop of water sliding down a glass out of the corner of my eye – and suddenly I’m thinking about surface tension! In the kitchen, I’ll collapse a plastic bag and wonder why it crinkles, or wonder why some powder I’ve spilt fans out.”

Pettit, who is a chemical engineer by training, became an astronaut in 1997. While carrying out experiments on board the ISS in 2002 he realized that, in the weird environment of space, our normal intuitions about simple things like bubbles, flames, liquids and spinning objects don’t necessarily apply. “The explanations are



Space blogger Courgette growing on board the ISS.

In space our normal intuitions don’t necessarily apply

not in the back of a book,” he says. “You have to figure them out.”

Realizing that all it takes to “think up cool things [is to] have a bit of geek in you”, Pettit began to make videos in the ISS of his coolest ideas. In fact, by his third excursion to the ISS, which ran from December 2011 to July 2012, Pettit had amassed about 100 hours of video footage. NASA gave the material to the American Physical Society, which began editing the videos into approximately six-minute segments. There are 14 so far, which together have received some five million hits to date, and Pettit says he has enough footage for a further 45.

Lava lamps in zero g

In one video, Pettit is shown getting a droplet of water to orbit about a knitting needle, then coaxing several droplets to spiral crazily up and down the needle “like flies at a picnic”. Another video has him winging yo-yo tricks that are impossible on Earth. He also watches spinning objects, such as cylinders and bottles, oscillate between rotational and translational motion. “It’s not new physics,” Pettit says, “but it’s astounding to see.”

Elsewhere, Pettit puts a globe of water on a speaker and uses tone generators to create sine and square standing waves. “After playing with that for a while,” Pettit told me, “I thought, ‘What happens when you play music?’” He fashioned a didgeridoo – an Aboriginal instrument – from the ISS’s vac-

uum cleaner hose, donned a tank top that he’d cut from an ISS crew shirt to look more like a musician, and used the instrument to create more waves on the water, pointing out their spacing, resonance frequencies and so forth.

“You can look at it as an art form or as a physics exercise,” he said. “One of my colleagues described it as a zero-gravity equivalent of a lava lamp.”

Pettit’s wit and enthusiasm make the videos far more exciting than the scripted and boring fare usually issued by NASA’s publicity machine. After NASA officials asked him to do something about pendulums – which of course don’t move in space – he started thinking what he could do that was pendulum-like. On his last flight, Pettit took into orbit a weak spring about a metre long and made from it a very thin wire. Using the spring like a pendulum in the weightless environment of space, Pettit demonstrated principles of simple-harmonic oscillation by clamping the spring at either end and fixing a mass in the middle. The frequency it vibrates at depends on the spring constant, and adding more mass makes it oscillate more slowly.

Pettit is back in line for another flight but no date has been set. “I have lots of new ideas for when I return,” he says.

The critical point

Pettit’s blogs, videos and other clips on *You-Tube* show the marvels that can be produced when the gravitational field is switched off and other phenomena – such as surface tension, electromagnetism and sound waves – dominate instead. But his work (and all the talk about courgettes) also got me thinking about resemblances between a laboratory and a garden.

Like a lab, a garden is a special environment where unusual conditions make it possible to grow things that do not appear, or do so rarely, in the wild. Similarly, a laboratory’s special environment allows us to stage new kinds of events, be they subatomic particles or sunflower sprouts. The fact that these events may only take place in laboratories does not mean that they are unworldly. It’s just the other way around: the special laboratory environments make these events part of our world – and their mere existence helps us understand the wild better.

Just ask Space Zucchini!

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