Abstractions

FIRST AUTHOR

Stars tend to be the hot bodies in the Universe. But now, scientists have found a very hot planet. On page 691, Joseph Harrington, a planetary scientist at the University of Central Florida in Orlando, details an extrasolar planet that reaches a sweltering 2,300 Kelvin (K). To get to that temperature, the planet — called HD 149026b — must absorb all the starlight that reaches it. *Nature* asked Harrington what this and other space oddities can teach us.

Why is this hot planet so intriguing?

Scientists predict a planet's temperature from how much starlight it absorbs. The predicted temperature for this planet is about 1,400 K and black planets tend to be around 1,700 K. But we measured 2,300 K on the day side, which is a shocker because every other exoplanet has followed the usual predictions. Observing weird things is like striking gold because it means there is something more to learn. Maybe the day side is hotter than the night side, but if so, why isn't that true for all exoplanets? HD 149026b contains more heavy elements than our entire Solar System, so its chemistry might allow it to absorb starlight better than other exoplanets.

Why do you think the planet is so hot?

Our simple model suggests that HD 149026b is a black planet. It absorbs all the light that falls on it, but quickly re-radiates that energy as infrared light. The planet is therefore hot enough to emit its own light — projecting a visible orange-red glow from the area closest to the star. The picture is quite tolkienesque. This, and other evidence, makes us think that hotter planets' temperatures might differ between the day side and night side. A planet we observed last year, υ Andromedae b, is 1,400 K hotter on its day side than its night side. Another planet, HD 189733b, was shown last year to have a more modest day–night temperature difference. A picture is starting to emerge, but proof requires more work.

What will studying exoplanets tell us about Earth and the Universe?

Every time we look at a familiar thing in an exotic environment, we learn a lot. We live on a planet with some really nice conditions, and our actions affect the planet. We can learn how our planet works, such as its changing climate, by learning what happens on other planets. Also, everyone wants us to find life beyond Earth. HD 149026b is too hot for liquid water — the main requirement for life — but today's young people can expect that the conditions for life will be found on an exoplanet during their lifetimes. ■

MAKING THE PAPER

Richard Cornall

A genome screen reveals how stem cells age.

A genome-wide screen for genes crucial to the immune response has taken Richard Cornall of the University of Oxford, UK, and Christopher Goodnow of the Australian National University in Canberra beyond the confines of immunology. The work, described on page 686, shows that exhaustion of stem cells due to accumulating DNA damage could be a key mechanism in ageing — a long-held hypothesis that had, until now, been difficult to assess.

"The project had its beginnings five years ago," says Cornall, who worked with Goodnow before establishing his own group in Oxford. At that time, Goodnow had just set up a facility for creating point mutations throughout the mouse genome using the chemical ethyl nitrosourea and then screening the resulting mice for immunological phenotypes. The point-mutation approach has the advantage that it can find subtle defects, whereas knocking out a gene might result in death of the embryo.

One of the immunological strains generated from the screen caught the attention of Cornall's graduate student, Anastasia Nijnik. The strain had stood out because the mice were small, failed to thrive and had no antibodies or lymphocytes in their bloodstream. The collaborators mapped the mutation to the gene for ligase IV, an enzyme involved in fixing double-stranded breaks in DNA, a type of damage that accumulates in cells as they age. Embryos that do not have this gene die before birth. At about the same time that Nijnik identified the mutant gene, a flurry of papers were published that described patients with immunodeficiency and stunted growth caused by a mutation in the human ligase IV gene. "All these things together made us think the gene was interesting," says Cornall.

To understand the consequences of the mutation, Cornall and Goodnow sought the advice of Penelope Jeggo from the University of Sussex, UK — an expert in double-strand DNA repair. Jeggo's group found that cells from the ligase IV mutant mice do not grow as well as wild-type cells, especially when they are exposed to oxygen, which increases the number of double-strand breaks. Jeggo also showed that the growth defect was due to a failure to repair the DNA breaks.

While analysing the lack of lymphocytes, the collaborators discovered that haematopoietic stem cells — the common precursor for lymphocytes and other blood cells — could not be transplanted from the tiny mice to another mouse; they failed to survive or grow. Because haematopoietic stem cells become less effective as people age, the group's findings suggested that the loss of function could be due to a defect in DNA repair.

The team also found that the number of stem cells in the tiny mice declined with age compared with wild-type mice, presumably because they were not surviving long-term. The stem cells that did remain divided more rapidly in an apparent effort to compensate for those that were lost. "This shows that repair of DNA damage is particularly critical for maintaining the stem-cell population that replenishes our blood as we age, and for transplanting these cells," says Cornall.

He now wonders what role subtle changes in DNA repair have in stem-cell survival in other tissues, and in memory cells of the immune system, which also need to remain in a stem-like state long-term. "This study illustrates how a student with keen observation, and an interdisciplinary team of collaborators, can together leap beyond the boundaries of an individual discipline or question," Cornall says. "Sometimes things go where the student wants to go." ■

FROM THE BLOGOSPHERE

In the Journal Club, the popular weekly column published on *Nature*'s Research Highlights pages, a researcher presents his or her choice of a recent paper and explains why they are enthused about it. On page 617 of this issue, for example, Gautam Desiraju of the University of Hyderabad in India applauds an algorithm that predicts the structure of crystals from their chemical composition.

Because the point of any journal club, whether in person or online, is to dissect and discuss selected articles 'around the table', we have now launched a Journal Club blog (http://blogs.nature.com/nature/journalclub). There, we invite readers to examine the subjects raised in the columns, archived back to January of this year. To browse all published Journal Club columns in your field, you can select by one of 18 subject categories listed on the blog's main page. Please take a look at the entries in your research area, and, as Oliver Morton puts it (http://blogs.nature.com/climatefeedback/2007/05/nature_journal_club.html), "enrich their comment threads with your insight and speculation". ■

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