Abstractions

FIRST AUTHOR

During the past ten years, astronomers have identified more than 200 planets relatively close to our Solar System. Most orbit around high-mass stars. Some are massive, with orbits lasting for as little as 1.2 days. These large bodies have been dubbed 'hot Jupiters', because their surface temperatures measure more than 1,000 kelvin. To find out whether similar planets exist further afield, scientists used the Hubble Space Telescope to probe the distant star-filled centre, or galactic bulge, of the Milky Way. They found 16 planetary candidates and identified a new class — ultra-short-period planets (USPPs). These orbit around low-mass stars, and their orbits last for less than one day (see page 534). *Nature* spoke to Kailash Sahu from the Space Telescope Science Institute in Baltimore, Maryland, to get the stellar scoop.

What is so intriguing about hot Jupiters?

What is most impressive is that they can survive for billions of years despite being very close to the star they orbit. If they were any closer than where the hottest Jupiters have been found, they probably wouldn't survive. No one expected Jupiter-sized planets to exist so close to stars, and hot Jupiters are abundant — they make up about 10% of all planets discovered so far. We think they form far from a star and migrate inwards.

Are you optimistic that the extrasolar bodies you identifed will be confirmed as planets one day?

We believe at least 45% are genuine planets. And we have measurements for two candidates that support a planetary nature. Our best chance to confirm these as planets will be through the James Webb Space Telescope, due to be launched in 2013.

Why have ultra-short-period planets not been found until now?

USPPs occur around low-mass stars, perhaps because the proximity of USPPs to their parent stars limits the size of star they can orbit. So far, ground-based telescopes have looked at more than 200 low-mass stars. But many more stars need to be monitored to find the right combination of low mass and high metal content that is known to be most likely to support USPPs — in part because nearby stars typically have low metal contents.

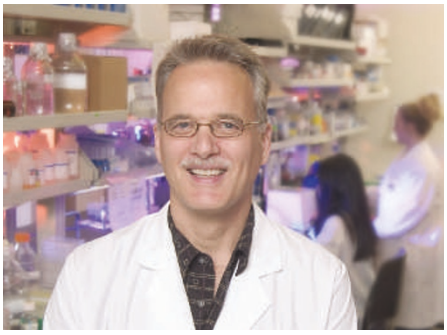
Is a day in the life of an ultra-short-period planet like a galactic 'Groundhog Day'?

The world of a USPP would be very different from ours. Such planets are so close to their star that they are likely to be tidally locked. And it would always be day on one side of the planet and night on the other. For a change in weather you might have to travel to a different part of the planet! ■

MAKING THE PAPER

John Schuetz

Solving the function of a protein that Dracula may have lacked.



BIOMEDICAL COMMUNICATIONS, ST JUDE CHILDREN'S RESEARCH HOSPITAL

Legends of deathly pale vampires that rise from their graves at night to search for human blood may have been inspired partly by a rare disease known as porphyria. This is caused by defects in haeme production. Haem gives blood its characteristic red colour and its ability to carry oxygen. People with some forms of porphyria are sensitive to sunlight and suffer from anaemia — key features of Dracula. Although porphyria may have coloured Bram Stoker's famous literary creation, scientists know little about the disease's molecular origins. Work by John Schuetz and his colleagues at the St Jude Children's Research Hospital in Tennessee has provided some answers. These could lead to new ways of treating the disease.

For a long time, Schuetz had been studying different ATP-binding cassette (ABC) transporters. These are proteins that help move different molecules, such as nucleotides and lipids, across cell membranes. In 1997, his group isolated a new transporter, known as ABCB6. "For a long time it was an orphan transporter — we didn't know what it did," says Schuetz. ABCB6's function remained a mystery until two postdocs in Schuetz's lab took the lead on a project to uncover its role. They showed that ABCB6 localizes to the outer membrane of mitochondria, where it binds to a small molecule known as porphyrin, from which haem is made (see page 586).

This was contrary to conventional wisdom, which held that the transporter protein could not reside in the outer mitochondrial membrane because the membrane contained no other such proteins. "The biggest hurdle was overcoming criticism from others in the field," says Schuetz. But this scepticism only motivated the group to make an air-tight case for their theory.

The first clue Schuetz and his colleagues had about their protein's function was that it localizes to the mitochondria. By scouring microarray expression databases, they discovered that ABCB6 is most prevalent in red blood cells, particularly at a time early in development when the cells are actively synthesizing haem. They knew that, during this process, porphyrin must travel from the cytoplasm, where it is made, into mitochondria, where it binds iron to make haeme. Schuetz's group did not think porphyrin, which has a negative charge, could enter mitochondria — also negatively charged — alone, as others had proposed. "It would be like putting two magnets with opposite poles together," says Schuetz. He and his team therefore reasoned that the job of ABCB6 might be to help carry porphyrin across the mitochondrial membrane.

Pinpointing the tranporter's localization to the outer mitochondrial membrane — where it could bind freshly made porphyrin in the cytoplasm — and demonstrating a direct correlation between its activity and haem production in red blood cells proved their instinct was correct. The team's work suggests that some types of porphyria might stem from factors that interfere with the transport, rather than the synthesis, of porphyrin. "The mechanism of drug-induced porphyrias has not been explained. This might give us a molecular handle to start investigating the process," adds Schuetz. If the team's hypothesis is correct, restoring the function of ABCB6 may provide relief from disease symptoms and help some porphyria patients lead more normal lives. It might have saved Count Dracula a lot of sleepless nights. ■

KEY CONTRIBUTION

The work of two postdocs in different labs at the University of Washington in Seattle has solved the mechanics of a protein complex involved in DNA repair, replication and transcription (see page 590).

Ti Li, a fellow in Ning Zheng's lab, took on the structure of the ubiquitin-ligase machinery. "This has many parts, and some are very difficult to prepare from bacteria," says Zheng. Li separately purified three components of the complex, two from *Escherichia coli* and one from insects, then put them together. This was daunting; she could only obtain minute amouts of the sample and had no clear guidelines on when and how to attach the components.

Li then took advantage of a viral protein that hijacks the cellular protein machinery to obtain diffracting crystals.

Next, Zheng's group sought insight into how the complex works in cells. The team drew on a method developed by Stephane Angers of Randall Moon's lab. He had developed a proteomics method to study the WNT pathway, a key player in development and cancer.

Angers found that some WNT-pathway proteins are controlled by ubiquitin-ligase machinery similar to that which Li had studied. "We realized how powerful his method was and how it could be applied to this system," says Zheng. The method effectively identified a number of novel proteins. ■