Abstractions

LAST AUTHOR

As every gardener knows, annual plants flower only once during their life cycle, and need to be replaced each year. Perennials, on the other hand, can flower many times, cycling between flowering and vegetative growth for many years, in time with the changing seasons. Although flowering in annuals has been extensively studied using the model plant *Arabidopsis thaliana* (thale cress), few studies have looked at the regulation of flowering in perennials. Maria Albani, a postdoc at the Max Planck Institute for Plant Breeding Research in Cologne, Germany, and her colleagues looked for genes that regulate perennial growth in *Arabis alpina* (alpine rock cress), a perennial relative of *Arabidopsis thaliana* that grows in mountainous regions. They identified a gene, *PEP1*, that controls flowering in response to low temperatures — ensuring flowering in the spring — and that also restricts the duration of the flowering season and enables the return to vegetative growth every year (see page 423). Albani tells *Nature* about the significance of this gene.

What drew you to this topic?

I'm interested in flowering in perennials — annuals die after flowering but perennials somehow find a way to trick the whole plant-senescence programme and keep growing vegetatively. This is one of the first studies to focus on the molecular mechanisms of flowering in perennials. We hope that *Arabis alpina* becomes the lab plant of choice for studying perennials, as *Arabidopsis thaliana* has for annuals.

Did you encounter any challenges along the way?

We began from zero. When we started, nothing was known about the way *Arabis alpina* grows, flowers or manages to be a perennial. On top of that, the plant's life cycle slowed down our experiments. It took at least four months from the time we planted the seeds for flowers to bloom. We had to do many experiments in parallel because it would have taken too long to wait for one experiment to end before starting the next.

Does your finding have practical applications?

The fact that *PEP1* affects the duration of a plant's flowering season is very important. Many fruit crops — for example, apples and grapes — are perennials. If we can understand how *Arabis alpina* cycles between flowering and vegetative growth every year, it will help us to understand how other perennials go through similar cycles. However, *PEP1* has mainly been found in species closely related to our model plant — not in fruits — and practical applications will require more extensive research. ■

MAKING THE PAPER

Joris De Ridder

Asteroseismology in red giants might yield clues to stellar evolution.

Probing the interiors of the Sun and other stars might sound tricky, but a technique similar to seismology provides a way. Just as seismic waves on Earth reveal information about the planet's interior, sound waves that travel through the Sun provide astronomers with clues about what is going on beneath its surface.

On page 398, Joris De Ridder, a postdoc at the Institute of Astronomy in Leuven, Belgium, and his collaborators reveal that 'asteroseismology' can be applied to the study of red giants — stars approaching the end of their evolution. "If you go to the doctor, he might listen to the sound of your heart to find out about its condition," says De Ridder. "In a similar way, we are listening to the sound of a star to understand its interior."

Sound waves travelling through a star can be detected as variations in the star's brightness. De Ridder and his co-workers had previously tried to detect such variations in red giants using Earth-based telescopes. But the results turned out to be the subject of some debate. One group of researchers, including De Ridder, suggested that the oscillations seen in these red giants were only radial — consisting of spherically symmetrical expansion and contraction — and would therefore contain little information. Others believed that some of the oscillations were non-radial — a type that is potentially a lot more useful for asteroseismology.

Because of this work, De Ridder was asked in 2004 to join the community of European and Brazilian scientists using France's Convection, Rotation and Planetary Transits (COROT) space telescope, launched in December 2006, and to head a group responsible for observing and analysing red giants. As soon as the data from COROT arrived, De Ridder and his colleagues realized that they contained evidence of non-radial oscillations. "I was very happy to be proved wrong," laughs De Ridder.

But the real work is just beginning. "We have collected the sounds giant stars make," says De Ridder. "Now we have to learn how to listen." To analyse the data, De Ridder and his team are collaborating with theoretical astrophysicists. The idea is to develop mathematical models that predict what stars' oscillations would look like on the basis of their internal properties, and then compare those models with observed data. "There was some theoretical work done before that suggested that non-radial oscillations would not be visible in red giants," says De Ridder. "So now we have to go back to the drawing board to figure out why we do see non-radial oscillations."

One detail that De Ridder would ultimately like to extract from the data is the density of a red giant's core, because that measurement relates to a star's evolution. "Red giants are elderly stars. Our own Sun will someday become a red giant. So we want to understand how this evolution occurs," he says.

De Ridder has now been asked to coordinate another project to observe red giants with NASA's Kepler telescope, which was launched into space earlier this year. The instrument will monitor the brightness of more than 100,000 stars for three and a half years. "Among other things, we hope to obtain information about how the stars rotate internally," says De Ridder. "Red giants rotate very slowly, so we need to observe them for a long time." ■

FROM THE BLOGOSPHERE

Only 600 or so hand-picked students get to attend the annual Nobel Laureate Meetings at Lindau in Germany, but anyone can 'virtually' attend a selection of historical lectures. Alison Abbott, *Nature*'s senior European correspondent, describes the history of these meetings on The Great Beyond (http://tinyurl.com/pczhrd).

Count Lennart Bernadotte, great-grandson of Sweden's King Oscar II, who awarded the first Nobels, launched the meetings in post-war Germany to encourage the country's isolated doctors and scientists. In 2005, the meetings were updated to allow students from around the globe to mingle with top scientists.

Now, 100 years after the count's birth, 11 lectures from historical meetings have been digitalized and made available through the meeting's website (www.lindau-nobel.de). "The cleaned up voice recordings, accompanied by an introduction and charming black-and-white photos taken in Lindau, bring legendary scientists to life," writes Abbott. Highlights include Rita Levi Montalcini speaking about human rights and the reclusive Paul Dirac's lecture on the gravitational constant. ■

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