Experts reveal how plants don't get sunburn

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(PhysOrg.com) -- Experts at the University of Glasgow have discovered how plants survive the harmful rays of the sun.

UV-B wavelengths are the most powerful part of the daylight spectrum and are potentially damaging both to humans and plants. However, plants rarely show signs of damage because they have evolved a way of protecting themselves from the sun's harmful rays by making their own chemical sunscreen in their leaves. Last year, the group of scientists discovered that a protein called UVR8 detects the presence of UV-B and initiates the process of protection.

Now a paper published today in *Science*, reveals more details of the molecular structure of the protein UVR8 and explains how it senses UV-B light.

UVR8 is a 'photoreceptor' – a light detecting protein. Organisms use photoreceptors to sense particular regions of the daylight spectrum. For instance, vertebrates have photoreceptors for vision and plants have photoreceptors that direct their growth towards a light source and trigger when they flower.

The Glasgow group and their collaborators have found that UVR8 is a completely new type of photoreceptor in organisms, because it does not use an additional, bound small molecule to act as the light sensor. All known photoreceptors consist of proteins with attached 'chromophores' that sense light of particular wavelengths. Instead, UVR8 employs specific tryptophan amino acids in its own structure to detect UV-B

light. These amino acids very effectively sense UV-B.

The research was undertaken jointly between scientists at the University of Glasgow and at The Scripps Research Institute in California. Gareth Jenkins, Professor of Plant Cell and Molecular Biology at the University of Glasgow and co-author on the paper, described the paper's findings as "groundbreaking".

"The search for this UV-B photoreceptor was something of a Holy Grail for plant photobiologists and we were very pleased last year when we discovered that UVR8 was the UV-B photoreceptor. Now, with our collaborators we have found that UVR8 detects UV-B by an entirely novel mechanism" says Professor Jenkins.

Normally in plants two molecules of UVR8 associate to form what is called a dimer. UV-B light converts the dimer into single molecules of UVR8, called monomers, which are then active in the cell. The paper shows the molecular structure of the UVR8 protein, which resembles a propeller with 7 blades. The two molecules of UVR8 that form the dimer are held together through the attraction of positively and negatively charged amino acids on one surface, rather like two adjacent batteries. UV-B is detected by a small group of tryptophan amino acids located adjacent to the charged amino acids. The activation of the tryptophans by UV-B causes the charged amino acids to break apart and the two UVR8 molecules to separate, forming the active monomers.

This research opens up new directions for understanding how plants respond to UV-B and provides new insights into the ways organisms detect their environment.

More information: Paper online: www.sciencemag.org/content/332/6025/103.full

Provided by University of Glasgow

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