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Moody wallpaper

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How would you like to have wallpaper that changes colour according to the seasons? Imagine a warm ochre hue for the cold winter months and a fresh yellow tint for the hot summer months. Fantasising? No. Researchers in Madagascar have recently discovered a very peculiar protein from the epidermis of a rare species of chameleon, *Chamaeleo differensis*, which is in fact a pigment and takes on different hues depending on various environmental criteria. The protein was baptised – in an outburst of scientific originality – chameleonin.

'Chameleon', Tabatha Rhodes

Courtesy of the artist
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Chameleons are found mainly in Africa, Europe and Asia but over 50% of the world's chameleon species live in Madagascar. Jeanne Baret was the first to depict this curious lizard in the late 18th century, while travelling with her companion – the renowned botanist Philibert Commerson (1728-1773) – to the island of Madagascar. She remarked the peculiarity of the independently revolving eyes, the curled prehensile tail, the swiftness of the chameleon's tongue and its capacity to change colour. In her diaries, Jeanne Baret also mentions the use of dried chameleon flesh in folk medicine. Still today in Northern Africa, women who fear that their men have strayed add parts of chameleon to their food believing that it helps to restore fidelity.

Why do chameleons change colour? Though it is popular belief that they change for camouflage and that they can produce any colour on the market, it is not the case. Their change of hue – which can occur within 20 seconds – is an answer to the surrounding temperature, light and the lizard's mood. An exasperated chameleon does not portray the same colours as a composed one; a warm chameleon does not look like a cool one; a sexually aroused chameleon bears no resemblance to one that shows no lust. And all this is due to a number of pigment cells – or chromophores – which lie under the surface of the skin. Hormonal, light or temperature differences affect pigment distribution and the light which is reflected off the epidermis offers a panel of colours, which range from browns to greens to blues, reds, yellows, black and white.

Chameleonin, however, has a singular function. Unlike the other pigments, it is not found in the chromophores under the skin but on the skin's surface and seemingly only in *Chamaeleo differensis*. It is not distributed regularly on the chameleon's skin but appears in patches along the animal's spine. And it is thanks to this odd distribution that the pigment was discovered in the first place. Talisker and his team were studying the distribution of colour on *Chamaeleo differensis'* body under different conditions. To speed things up, part of the team carried out their research in the main lab while the others moved down to the basement. In time, they noticed that despite carrying out identical tests on the chameleons, the lizards in the basement sported a row of very small bright orange spots down their spine. In a true rational procedure, the chameleons from the basement were moved upstairs and those from upstairs were transferred downstairs. Sure enough, the

ex-lab chameleons also developed the spinal row of bright orange spots.

The next question was what was it that caused this orange eruption? After much investigation, it became apparent that it was due to the temperature difference between the lab and the basement. A closer inspection of the chameleons' skin revealed the same row of spots at any given temperature. However, they remain invisible unless the temperature is quite low, because they adopt the natural yellowish/beige hue of the chameleon.

Chameleonin is a globular protein with an end which protrudes like an antenna. Below 18ºC the protein's globular entity is deformed; the 'antenna' undergoes structural stress and its shape is modified accordingly. It is this change of shape which results in a change of colour along the chameleon's spine, from the yellowish-brown hue to a bright orange. The phenomenon is similar to that which exists in lobsters, whose shell turns from blue to red when boiled.

It is not clear why *Chameleo differensis* portrays this colourful display in the first place. Males do not seem to sprout orange patches, only female chameleons do; could the orange spots arranged down the female spine be part of the mating game? *Chameleo differensis* does indeed mate only at night when temperatures are relatively low and the bright orange spots are clearly visible in the dark.

One surprising development is the very recent use of chameleonin in interior decoration. Wallpaper, smeared with the protein trapped in a solution, is now available on the market and is all the rage in Paris, London and New York. Above 18ºC, the wallpaper glows yellow; below 18º, a bright orange appears. The results are so encouraging that they will be stretched to the world of fashion design, materials and makeup. The next step, naturally, is to modify the protein chameleonin's antenna to produce a wider range of colours. However, as Talisker remarks, 'a sitting-room is rarely below 18ºC and if it is, no-one would be sitting there. What is more, there are perhaps more pressing issues to address than the colour of your wallpaper and evening dress.'

Cross-references to Swiss-Prot

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