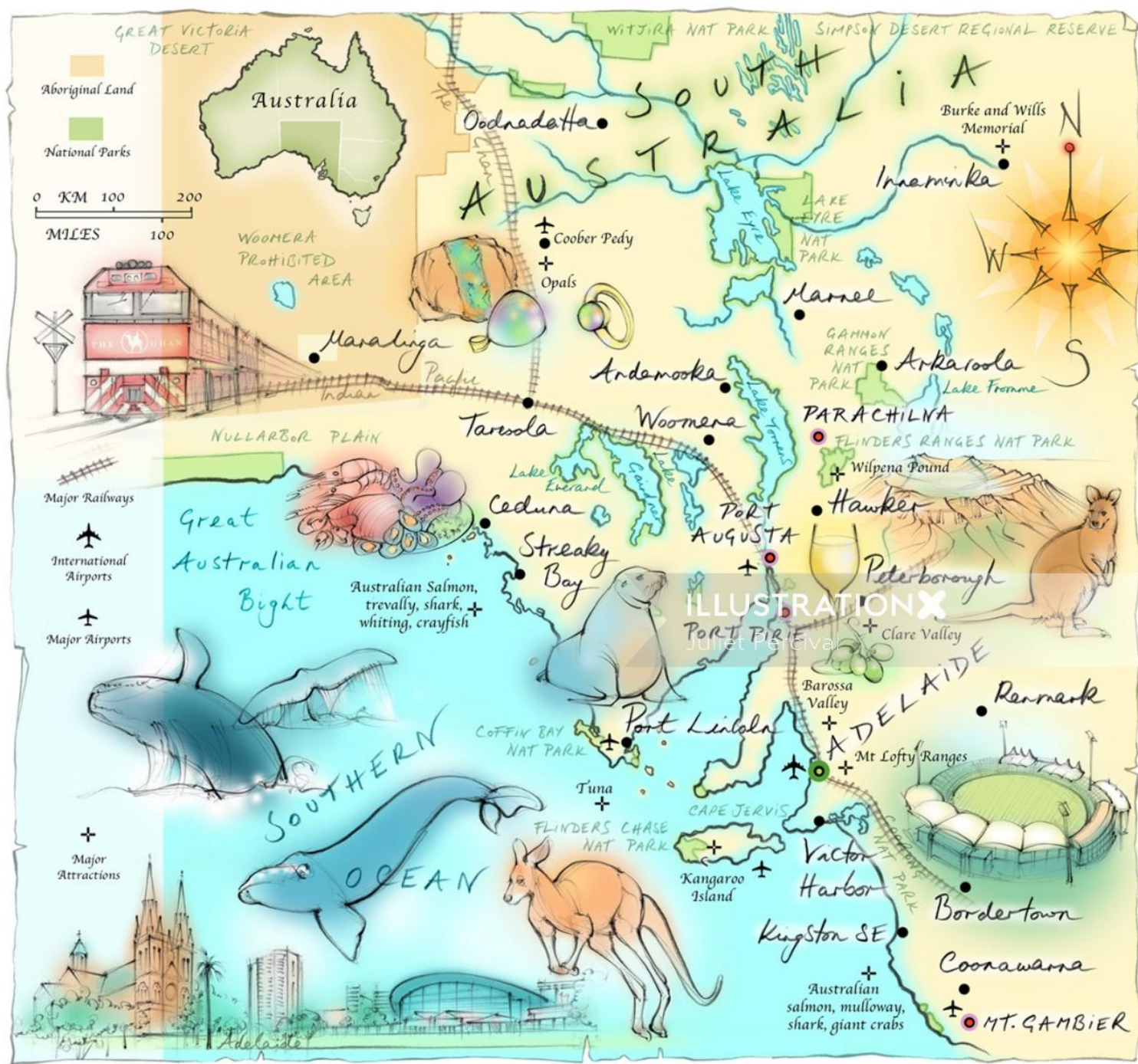


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## nature REVIEWS

december 2002 volume 3 no. 12  
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## MOLECULAR CELL BIOLOGY

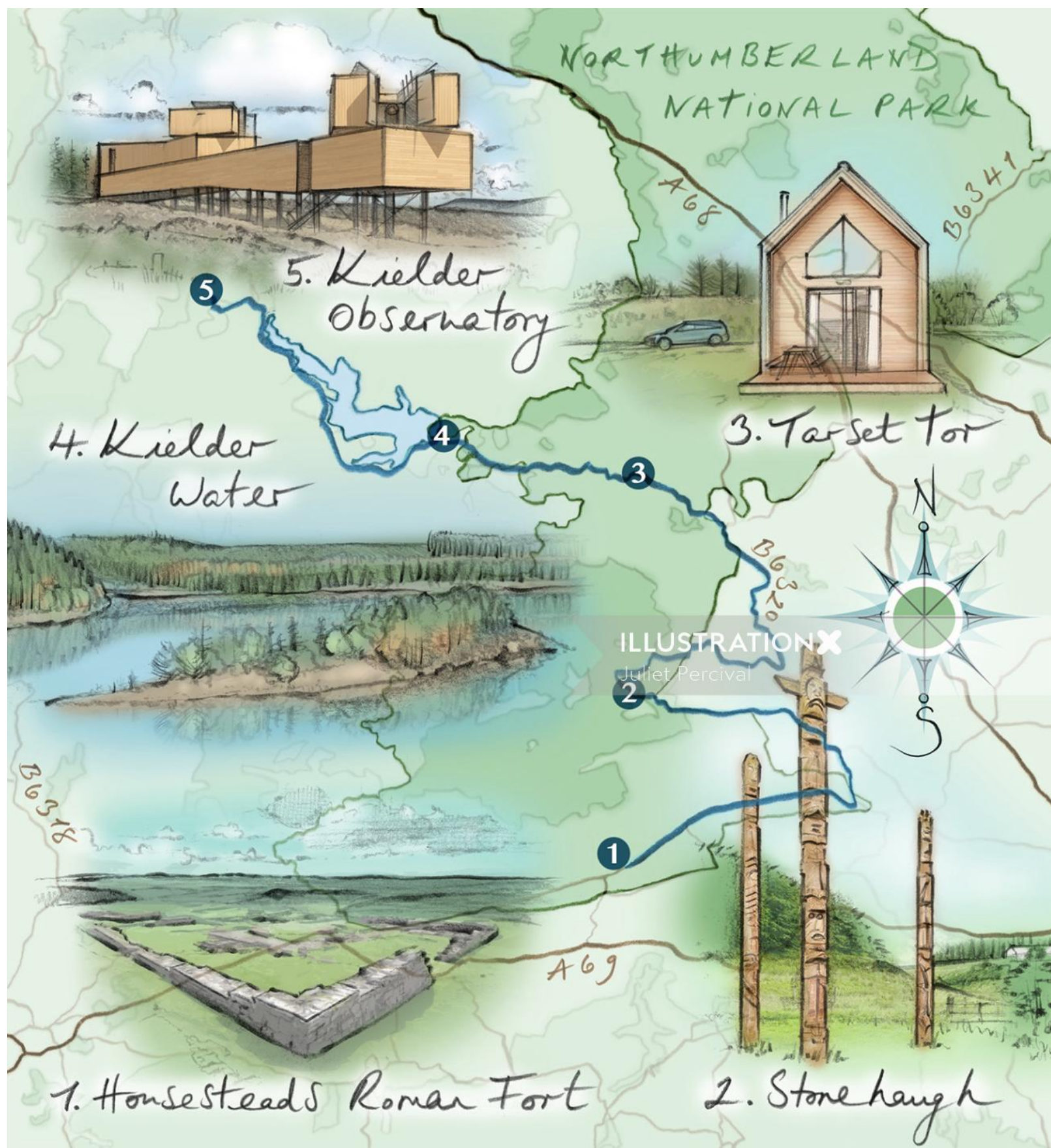


*Cell Migration*



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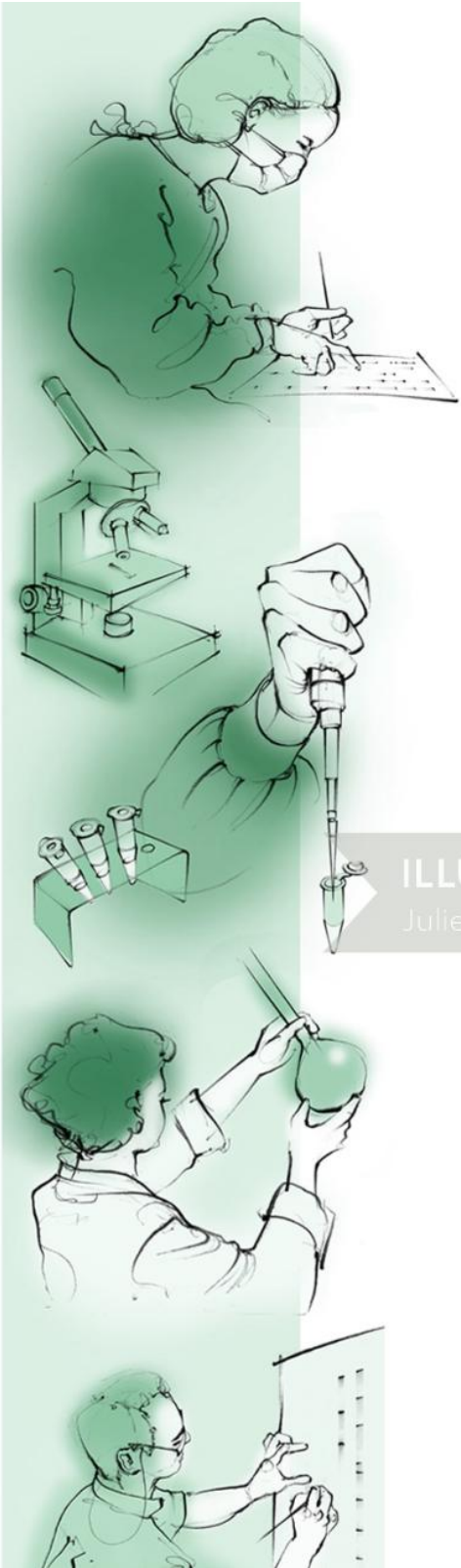
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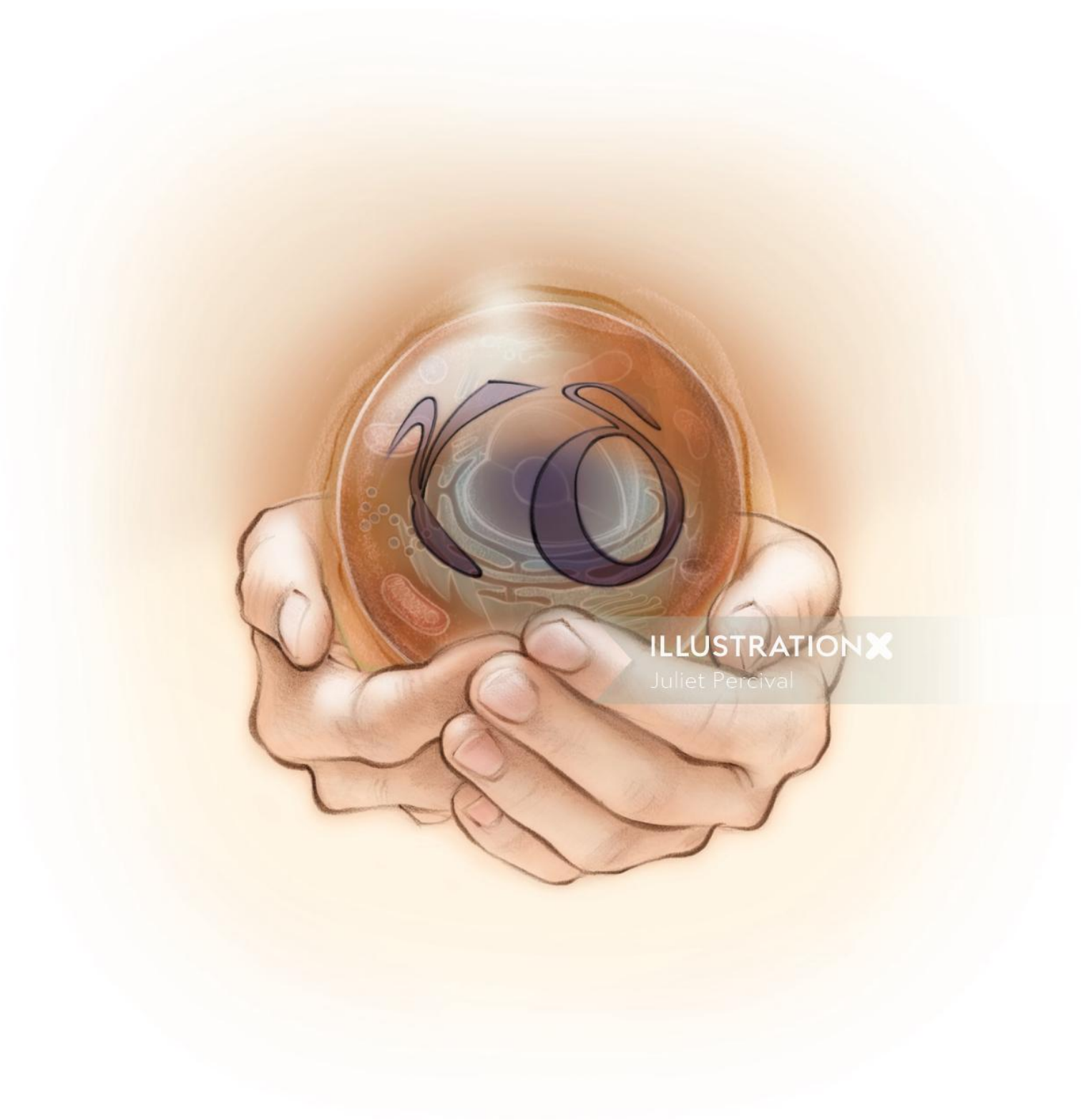
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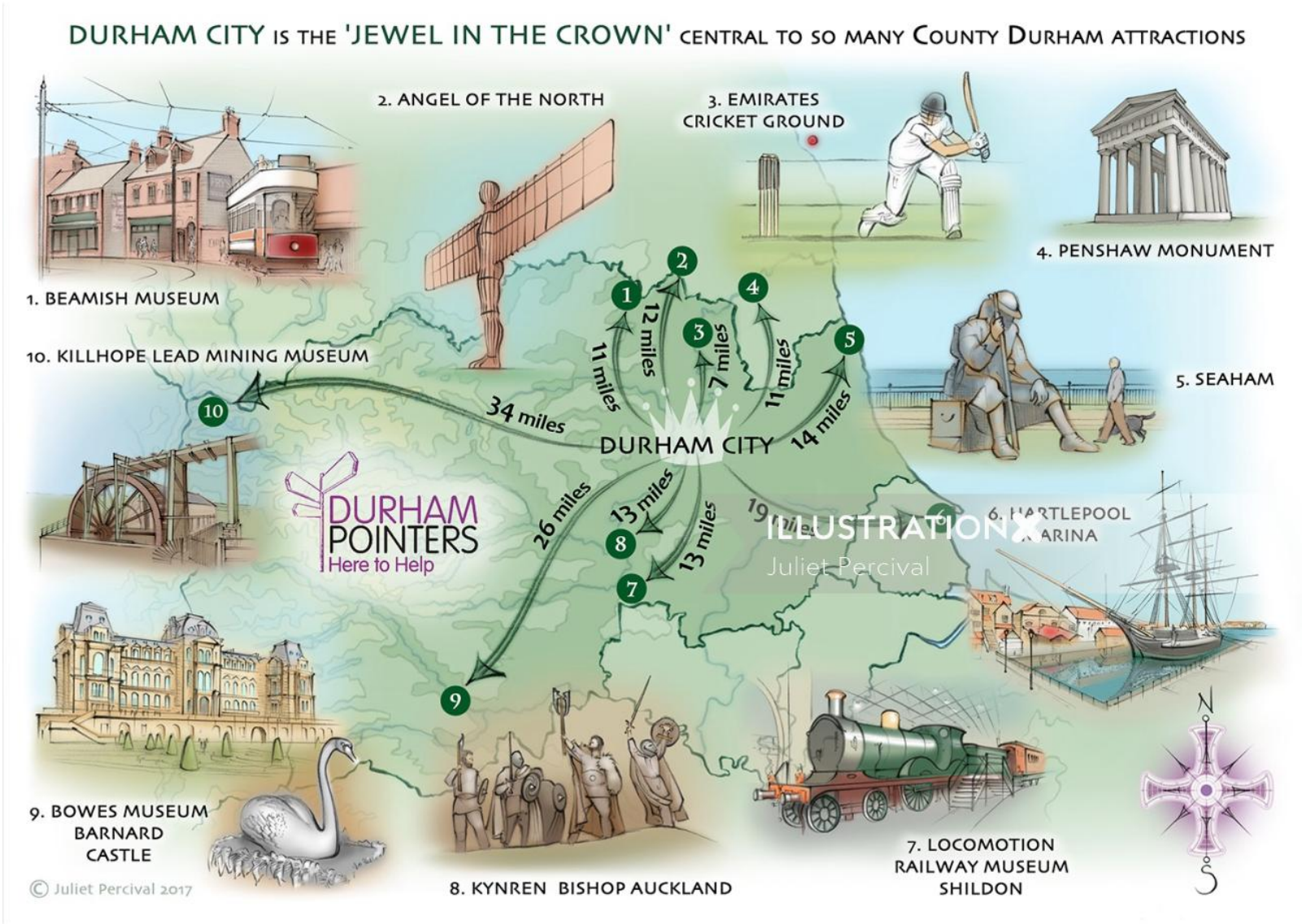
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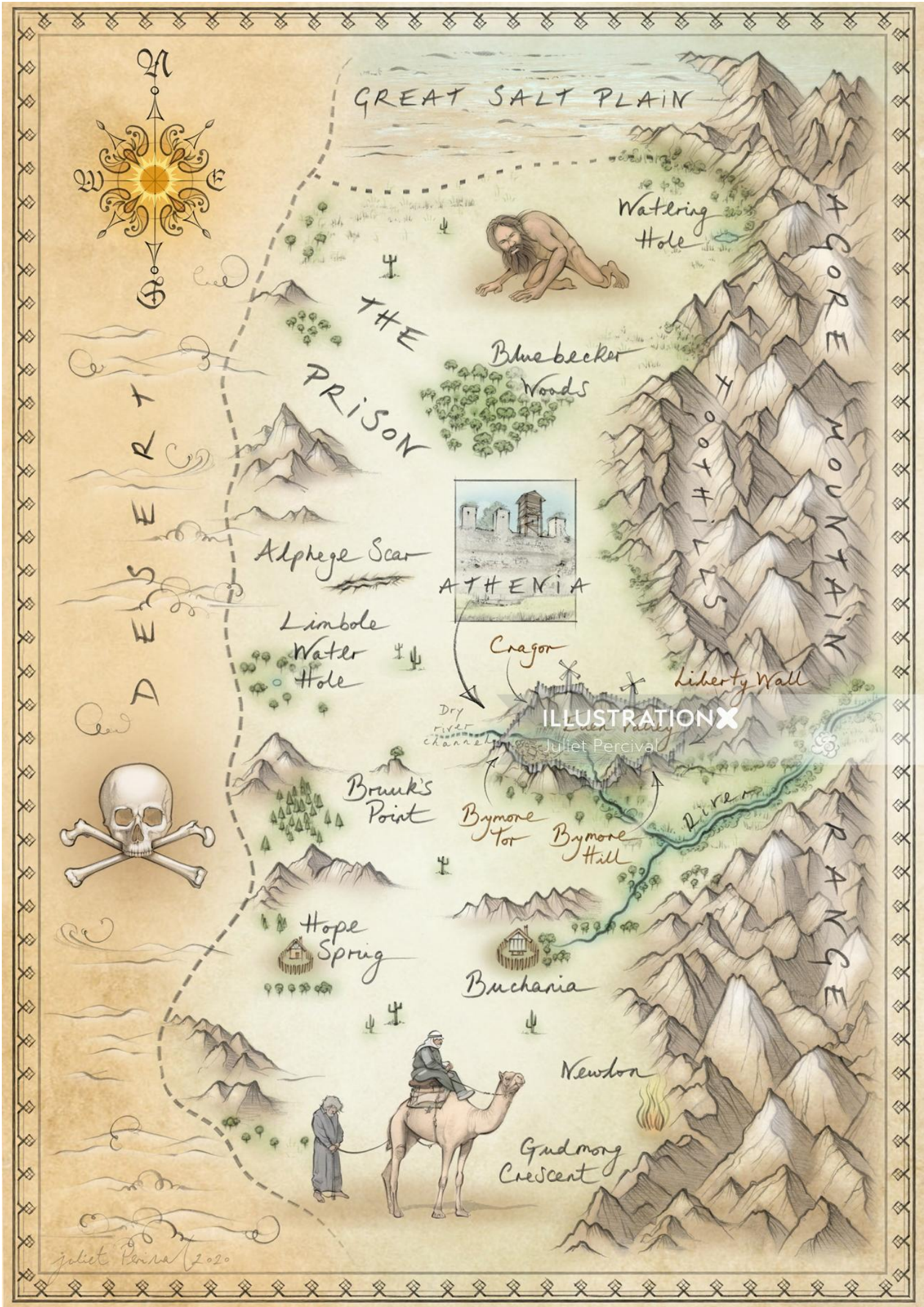
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FEATURE | MOTHS AT NIGHT

MOTHS AT NIGHT | FEATURE

# Shine a light

Optometrist and Butterfly Conservation member **Simon Berry** discusses his remarkable research into how nocturnal insects' eyes adapt so they can see at night.

**IllustrationX**  
Juliet Percival

**I**'ve always been interested in photography and capturing things that are unusual or have never been seen before. At my optometry practice, we use a specialist bit of equipment called an OCT (Ocular Coherence Tomography) scanner, which shows a cross section of biological tissue. This 3D scanner, sometimes likened to optical ultrasound, is very useful in diagnosing certain eye conditions.

A few years ago, I became interested in whether this scanner could be used to scan insect eyes, and wondered if it could reveal something new about them. In 2018 I started scanning butterfly eyes – I managed to scan 12 different species of our local butterflies found in Durham. This is the first time anyone has ever scanned a compound eye with an OCT scanner. For someone used to looking at these scans, the scans do look unusual, but they didn't really show anything new about butterfly anatomy. Then in 2019, I started scanning moth's eyes, and they turned out to be more interesting.

**Adaptation**  
To see effectively at night, moths and other nocturnal insects have a problem they must overcome. When light levels are low, their eyes need to be very sensitive, but they also need a way of adapting to environmental light conditions, and protecting those sensitive organs, if they encounter a bright light.

Human eyes have a pupil that changes size to regulate the amount of light entering the eye. Moths have a different method – their eyes have a light-absorbing pigment that can change position to protect the eye. This pigment migrates into a clear zone in the eye, blocking the light and reducing the amount of light reaching the moth retina.

When a moth is 'dark adapted', the pigment is squeezed in between the rhabdoms of the eye. This allows the maximum possible light to pass through the eye to the retina. When the insect becomes 'light adapted', the pigment migrates into a clear zone within the eye, blocking the light and reducing the amount of light reaching the moth retina.

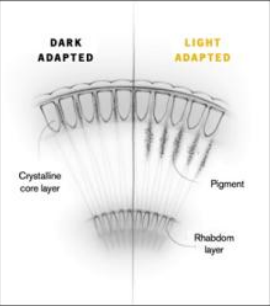
We know about this process of light adaption in insects because they have a tapetum (similar to a cat's eye) which means that moth's eyes glow when light is shined directly at them. The state of adaption can be measured by how brightly their eyes glow.



**Simon Berry**  
Optometrist and Butterfly Conservation member

**DARK ADAPTED**

**LIGHT ADAPTED**



Crystalline cone layer  
Pigment  
Rhabdom layer

**Above:** This illustration shows the pigment migration that occurs inside an insect's eye during light adaption, to protect them in the light.

The only other way of seeing the pigment migration in a moth is to look at the eye of a dead insect under a microscope.

**New ground**  
By using OCT technology on insect eyes for the first time, my research has shown that this can be used to visualise the structures and processes within the compound eye of a live moth. The big advantage of this is that the results



Canary shouldered Moth

cornea  
crystalline cone layer  
CLEAR ZONE  
rhabdom layer  
axons  
basal lamina

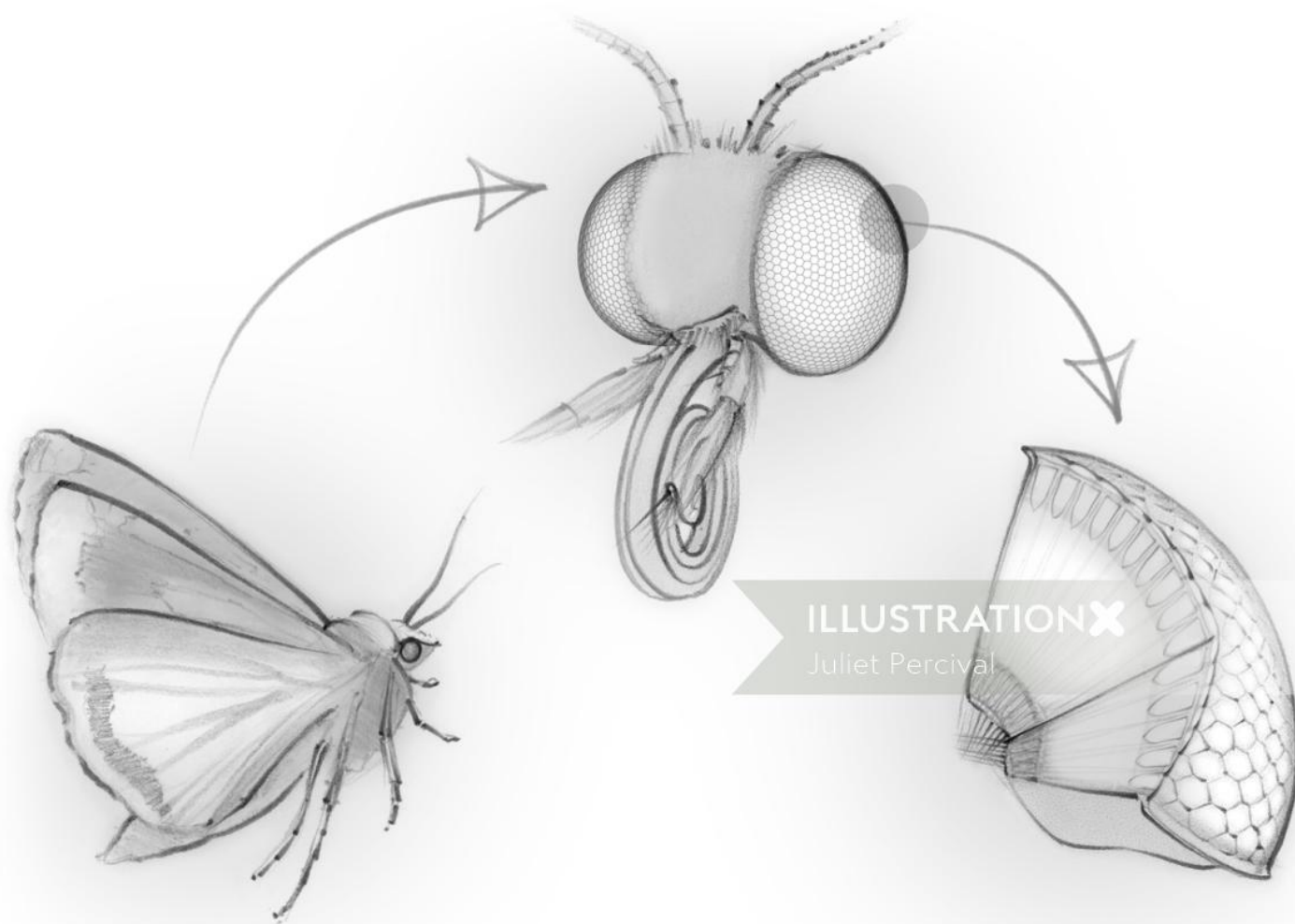
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SPRING 2023 | ISSUE 142 | BUTTERFLY-CONSERVATION.ORG | 21



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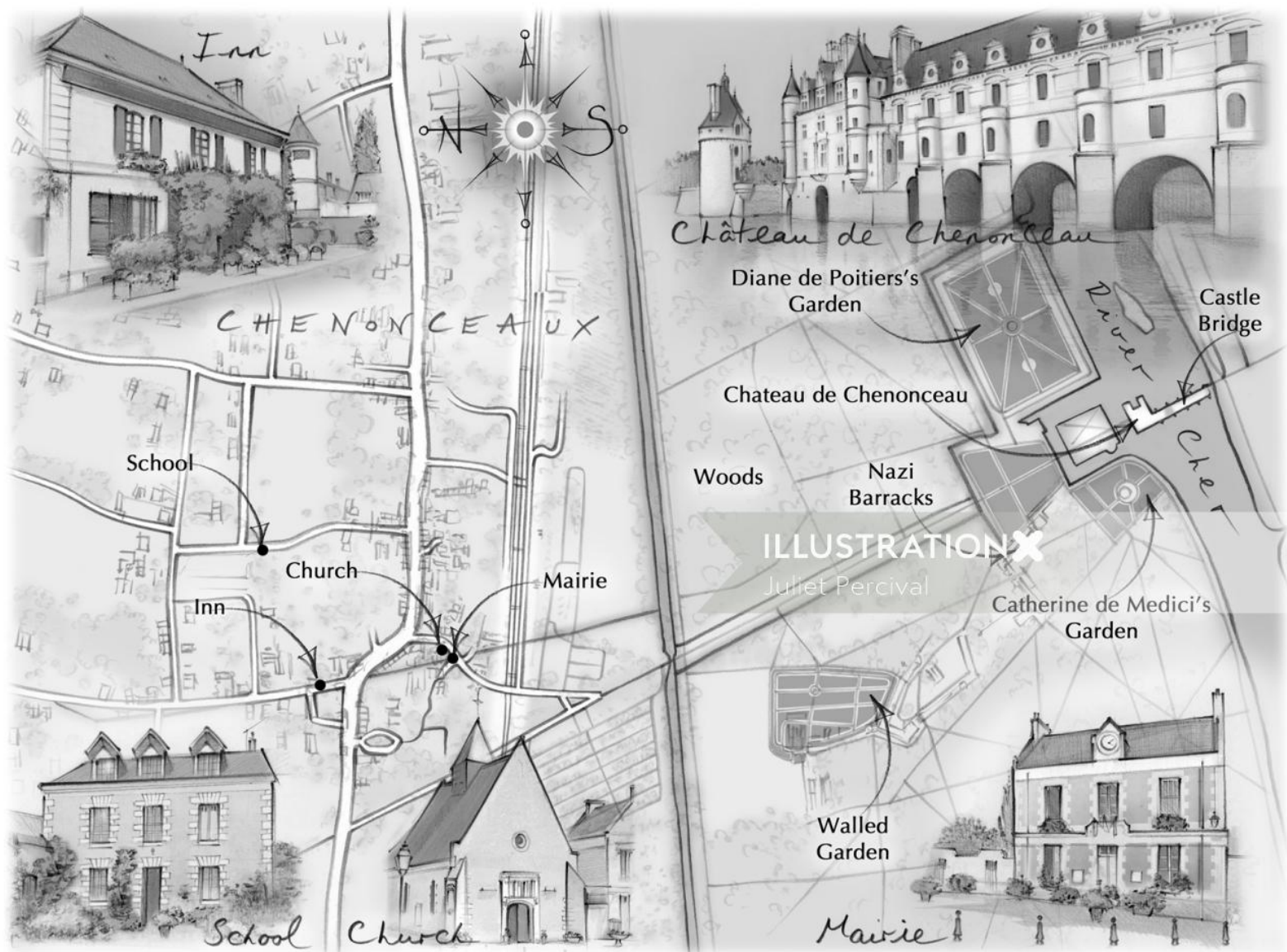
Large yellow  
underwing moth

Section through  
compound eye



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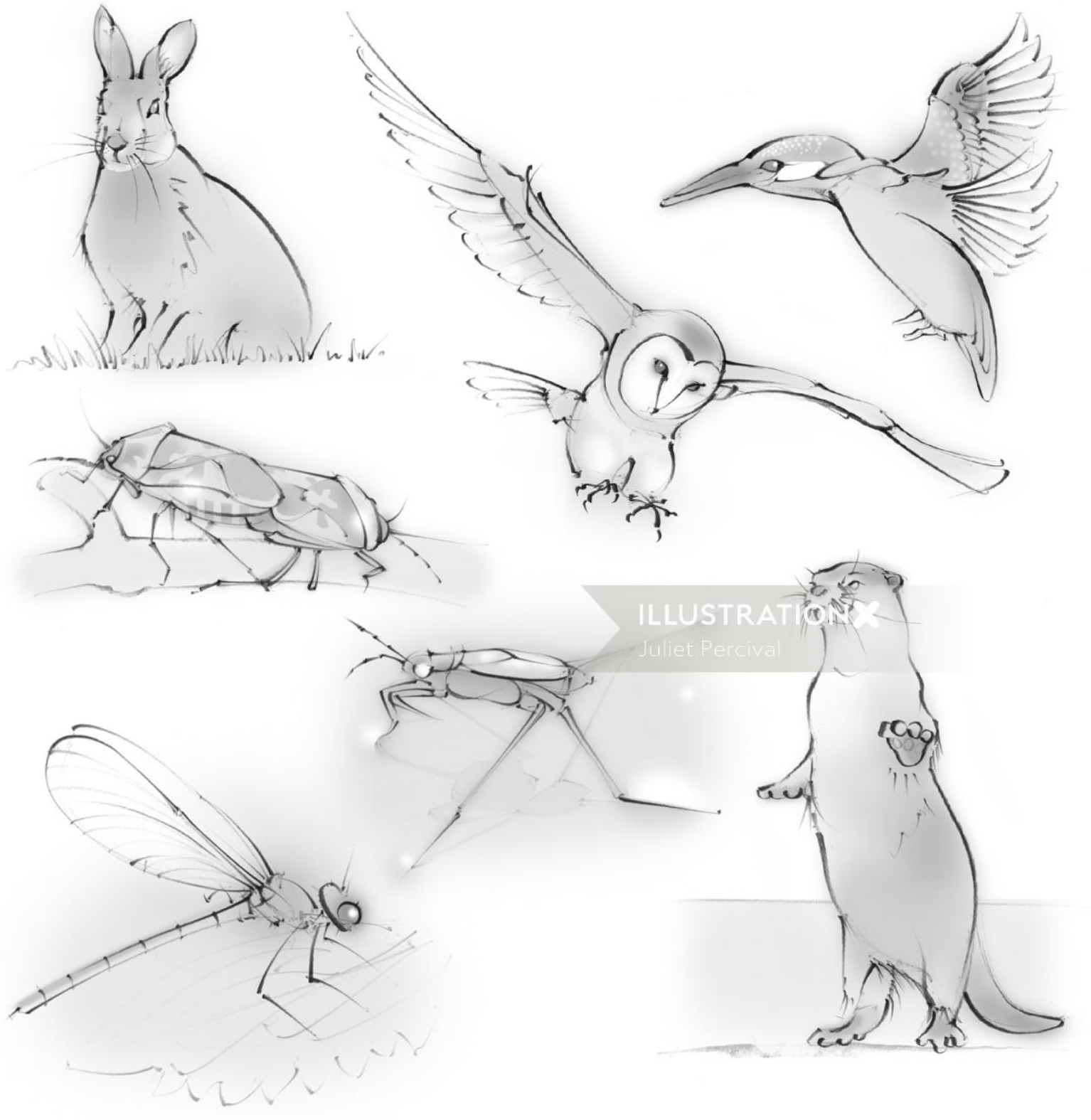
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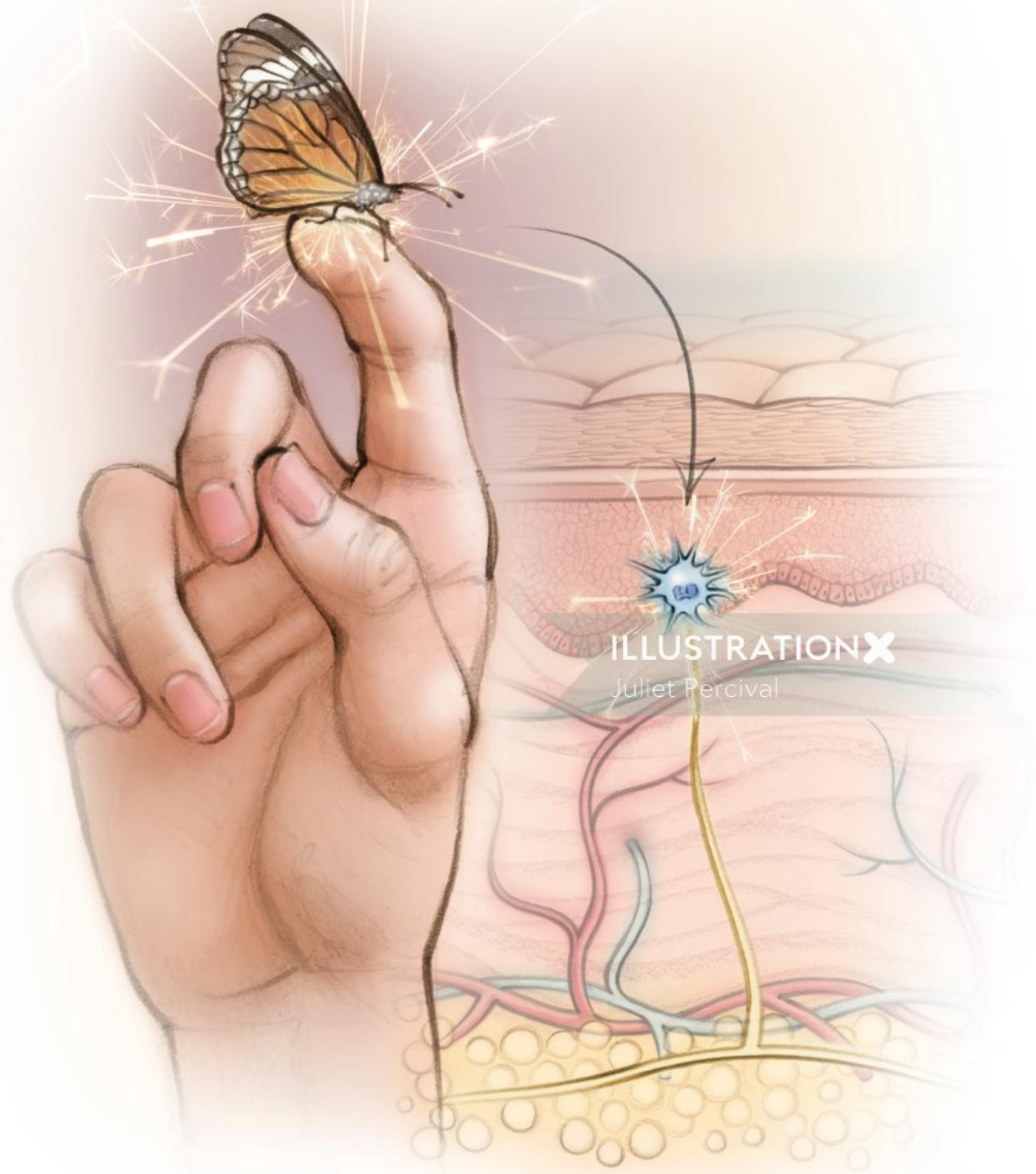
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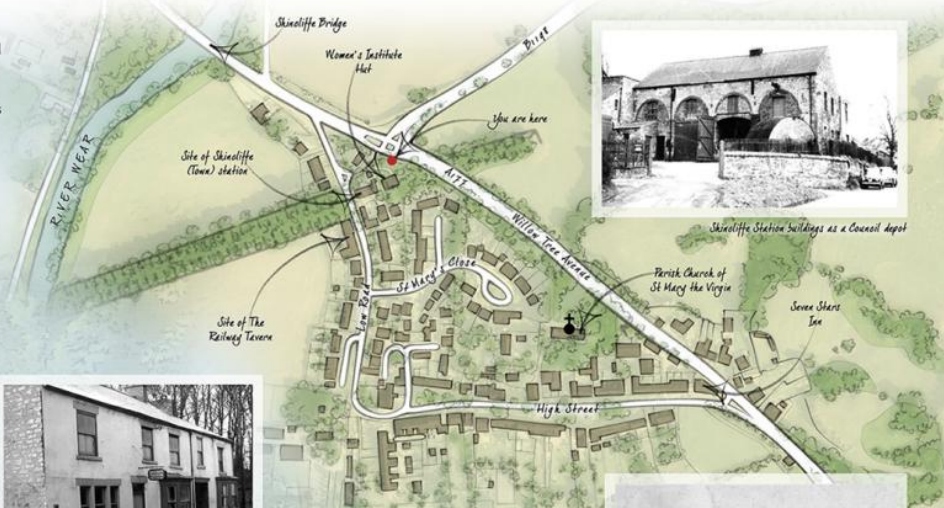
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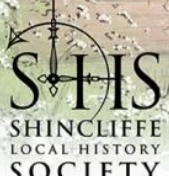


The Shincliffe Memorial Hall, as it was initially known, was opened in 1922 to commemorate local men who had died in the First World War. The building was destroyed by a fire in 1923 but was quickly rebuilt that same year. It has been the home of Shincliffe Women's Institute ever since.

The hall was built on the approach to Shincliffe's first railway station. When it was opened by the Durham and Sunderland railway company in 1839, it was the nearest station to the city of Durham. Closed in 1893, it was turned into a Council depot, making use of the warehousing which had been built beneath the platforms. More recently it was redeveloped as housing. The nearby Railway Tavern in Low Road closed in the early 1990s and has been converted to flats.

Shincliffe W.I. and Shincliffe Local History Society, with support from Durham County Council, have produced this information board to mark the centenary of the hall. There are memorial plaques in St Mary's Church listing the names of those who fell in the two world wars. For more information about Shincliffe's Roll of Honour and Shincliffe W.I., go to [www.slhs.uk](http://www.slhs.uk) or scan the QR code below.





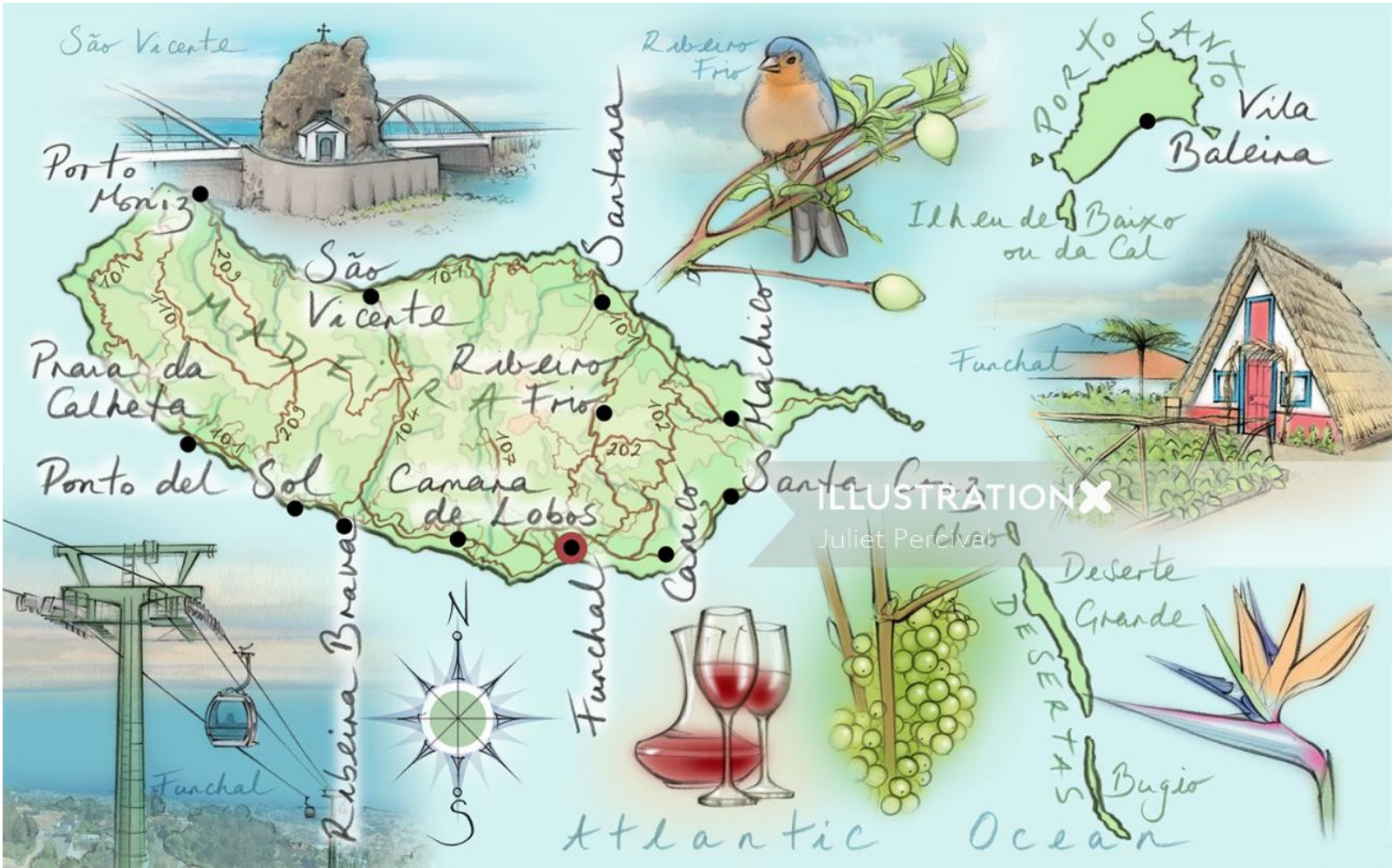
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Design and illustration: [juliet Percival](http://www.julietpercival.co.uk) [www.julietpercival.co.uk](http://www.julietpercival.co.uk) Our thanks are extended to Durham County Council for supporting the installation of this board.



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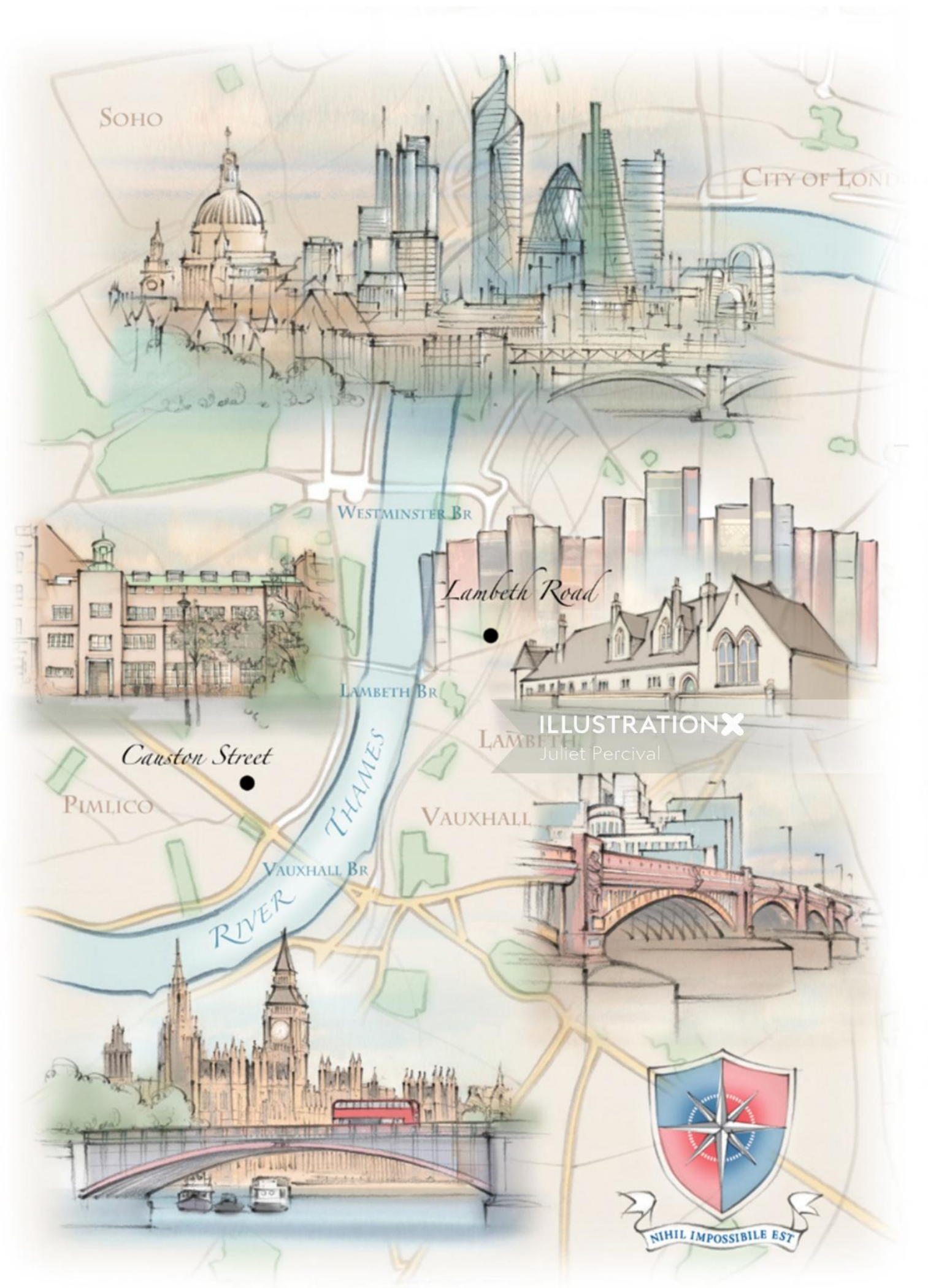
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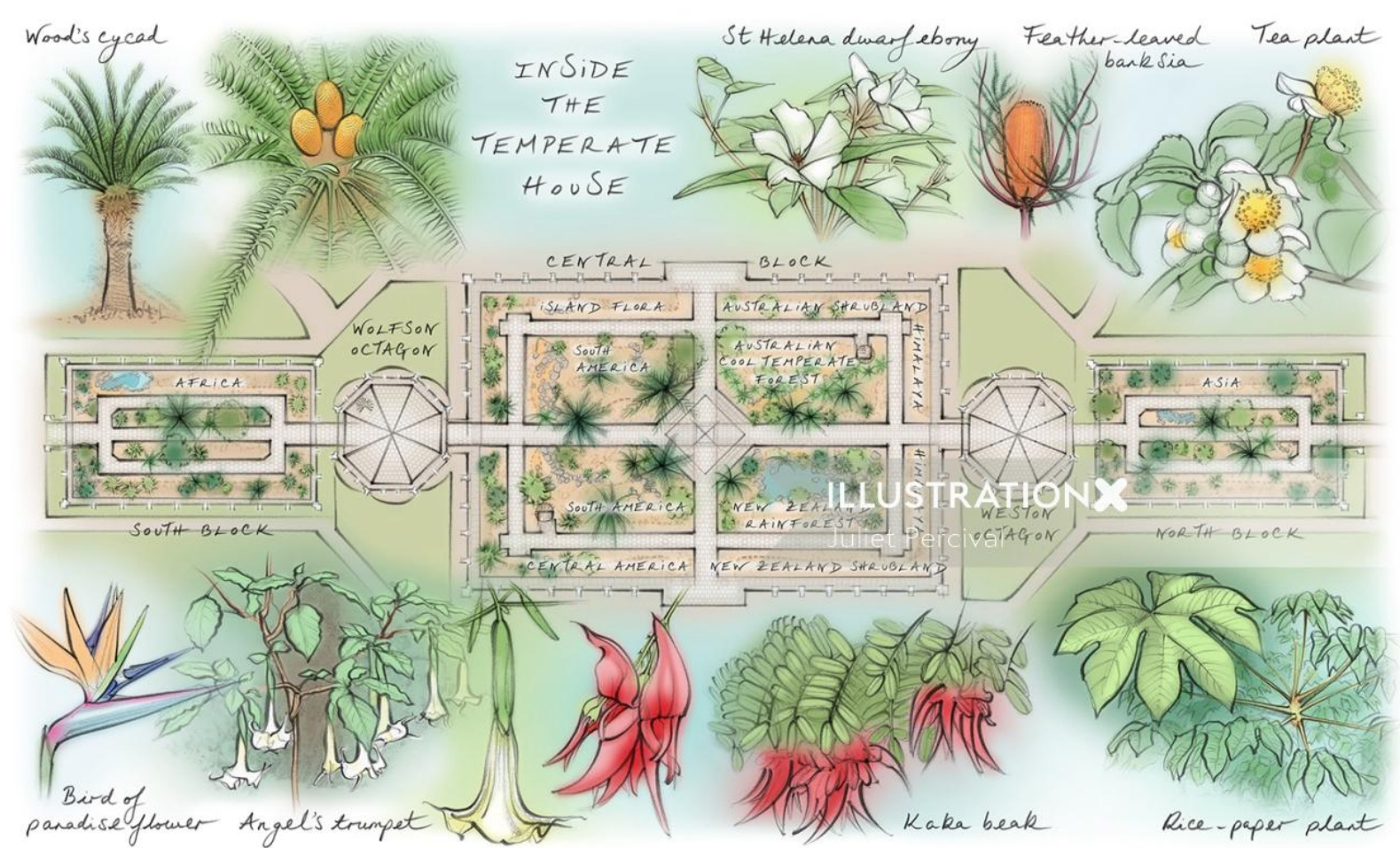
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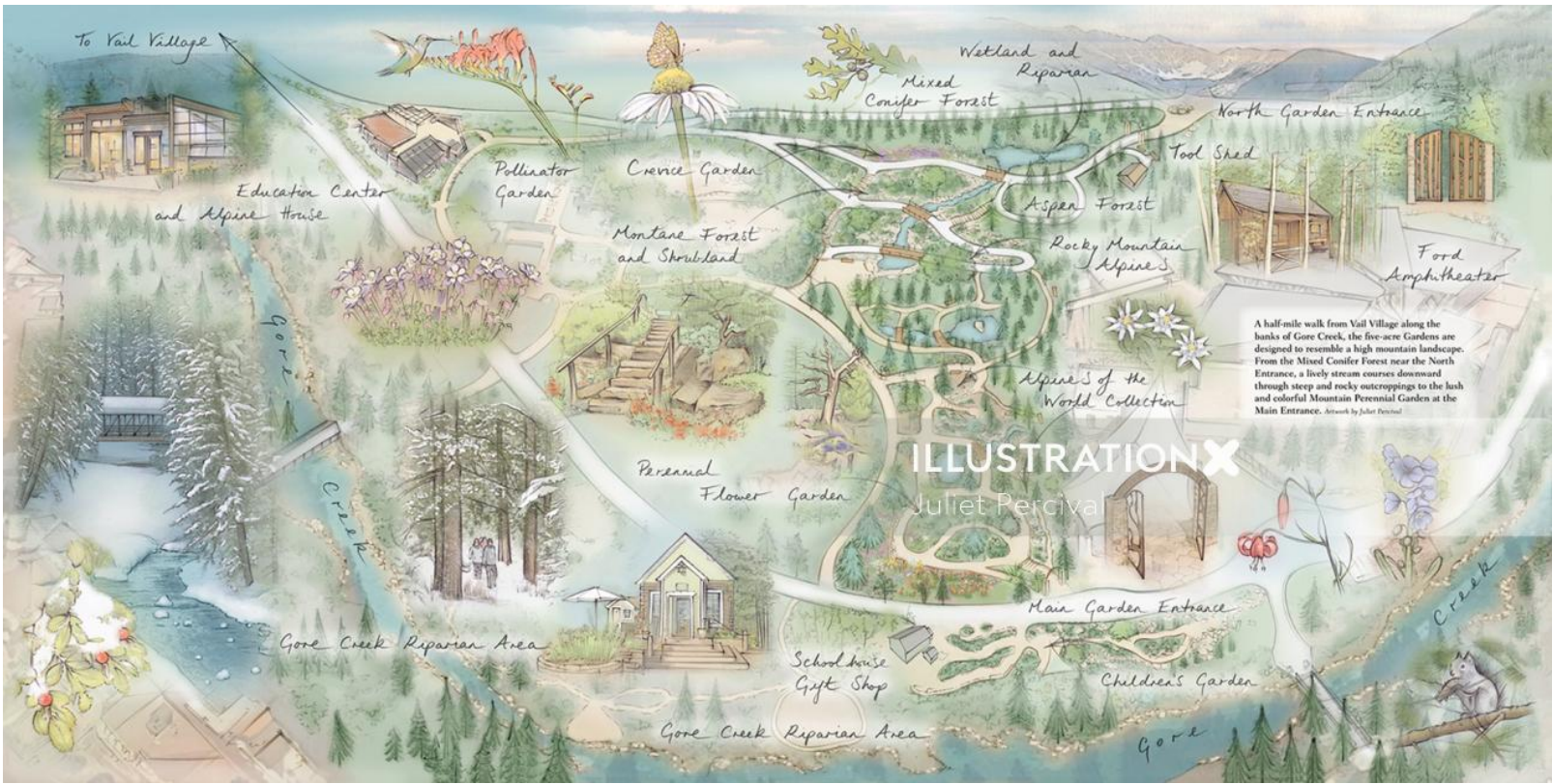
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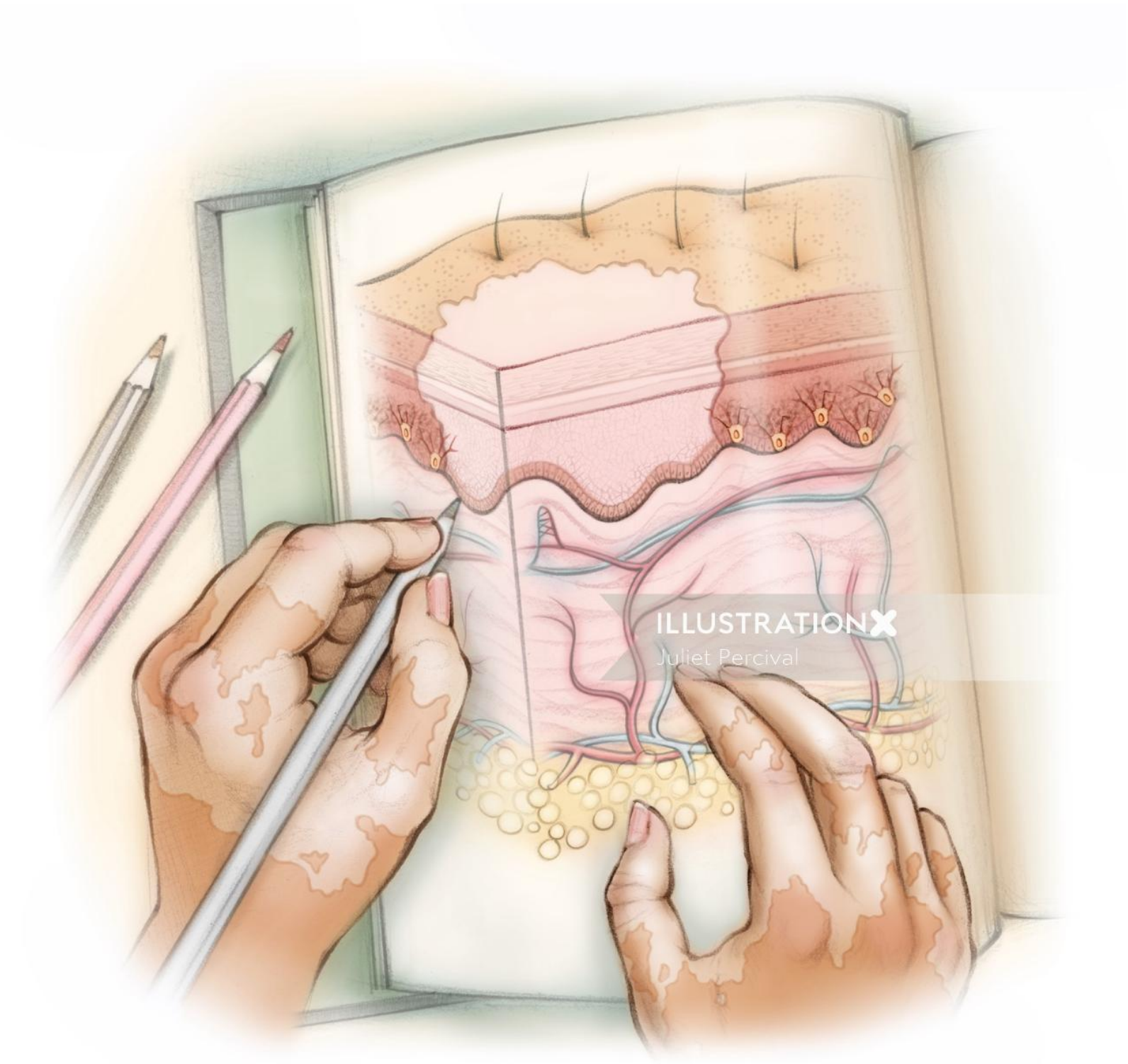
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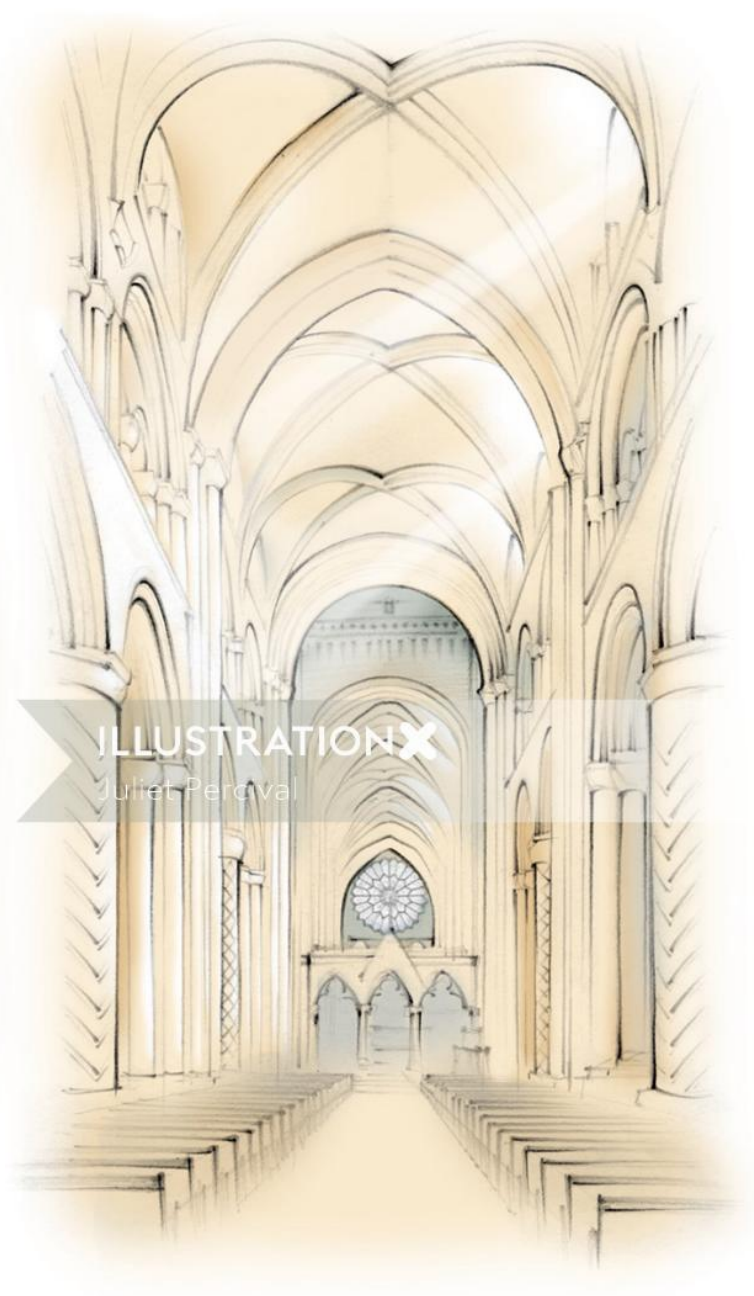
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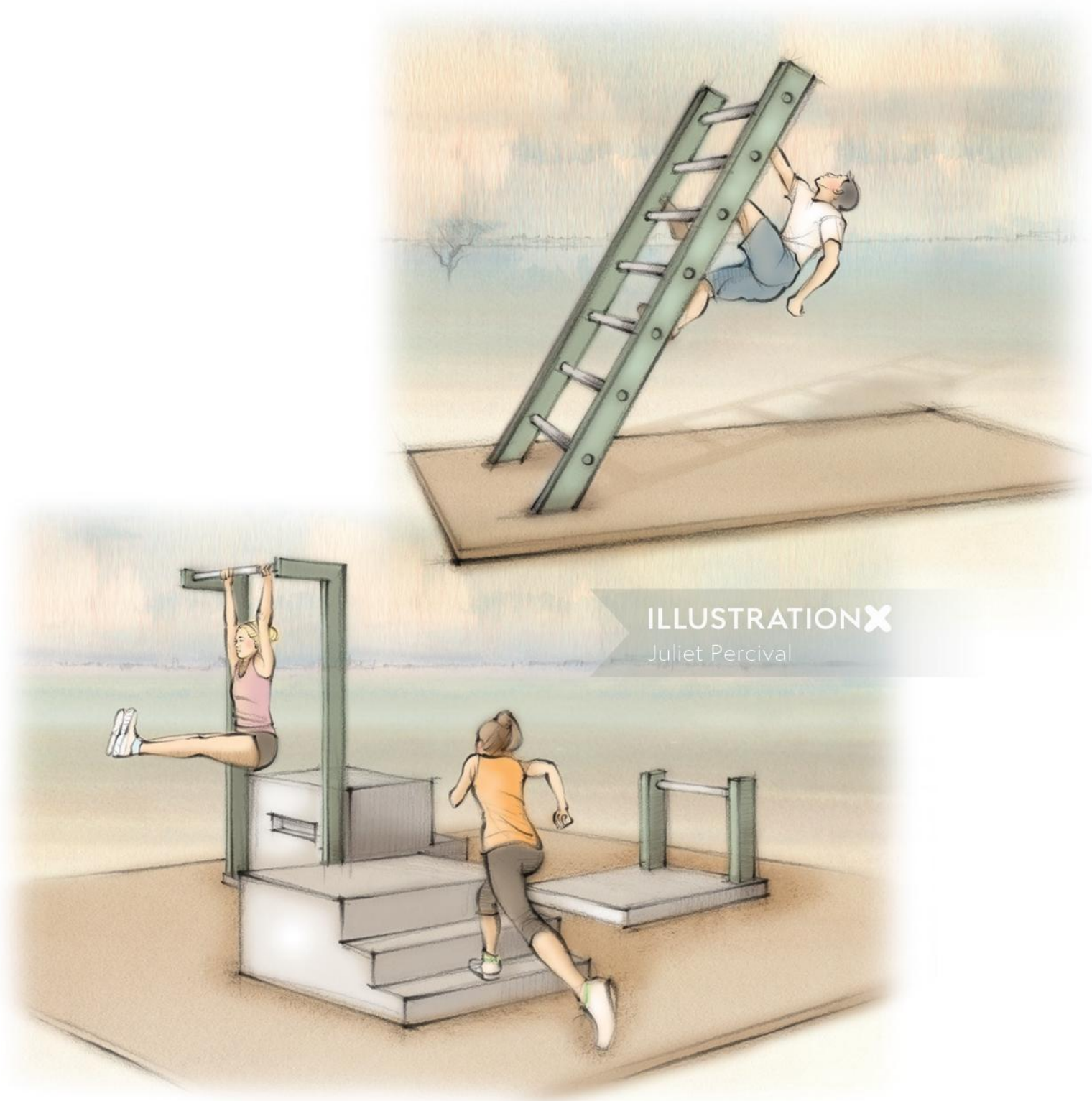
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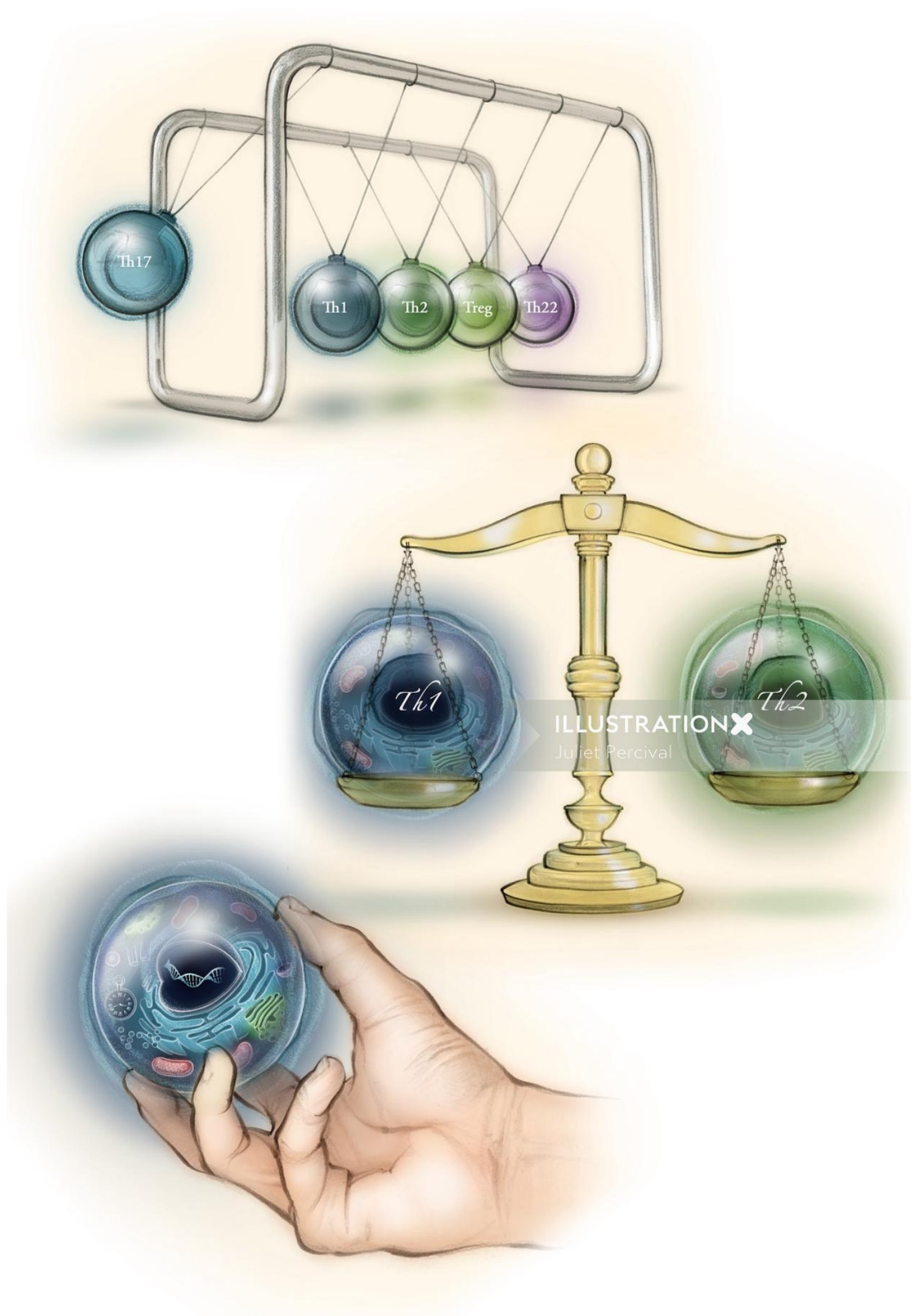


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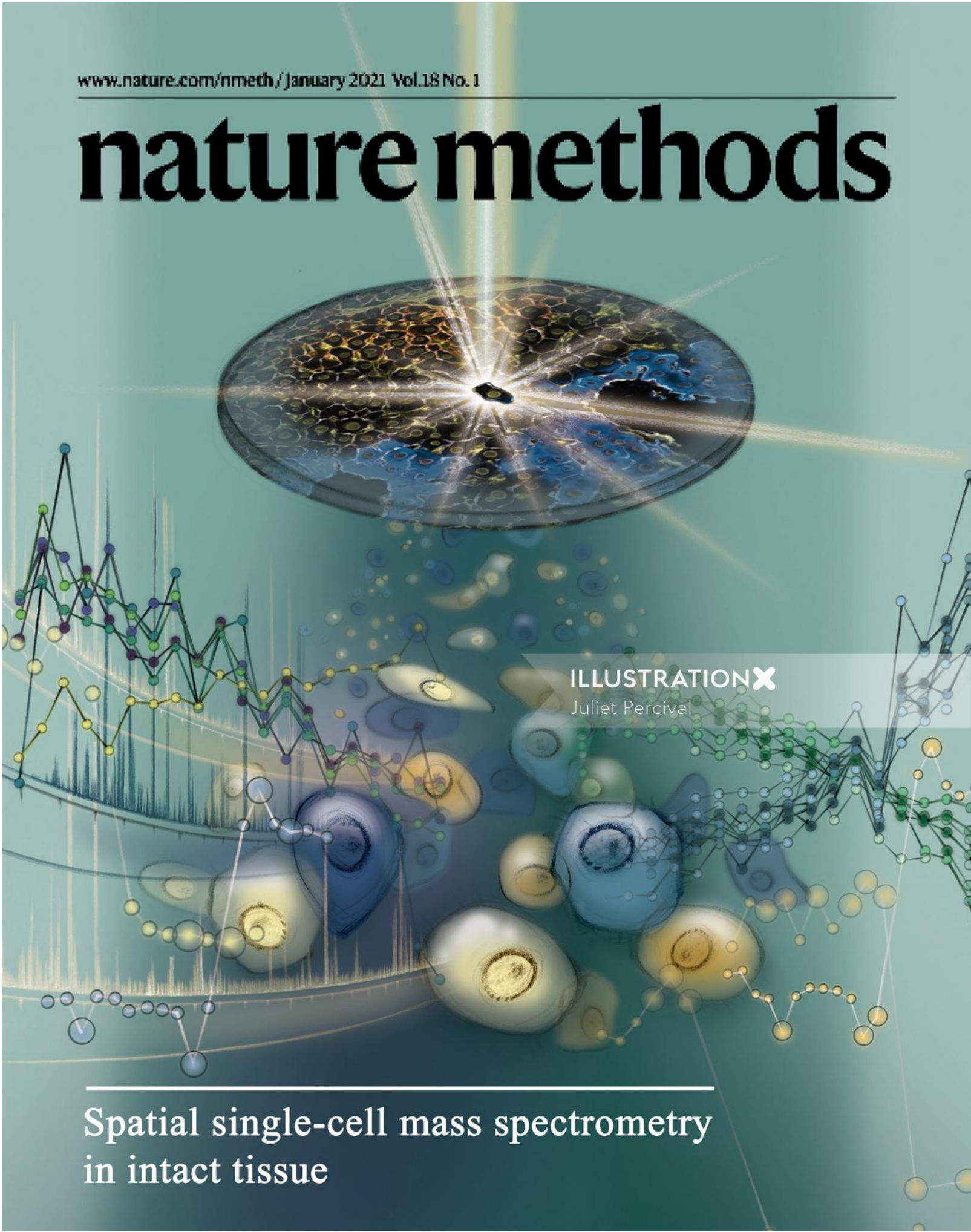
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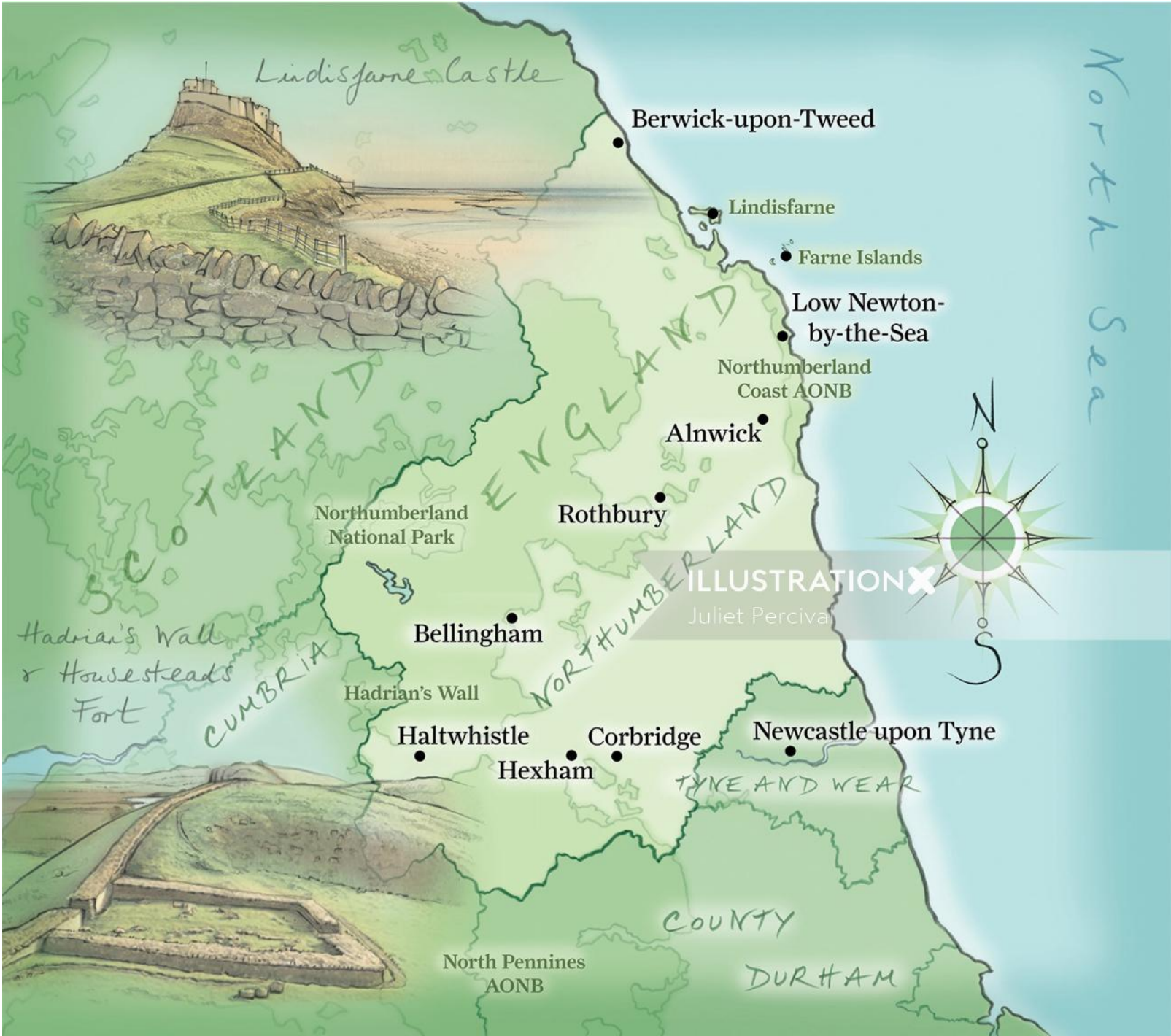
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Spatial single-cell mass spectrometry  
in intact tissue



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