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2017 CALENDAR

Health in Developing Countries


JANUARY

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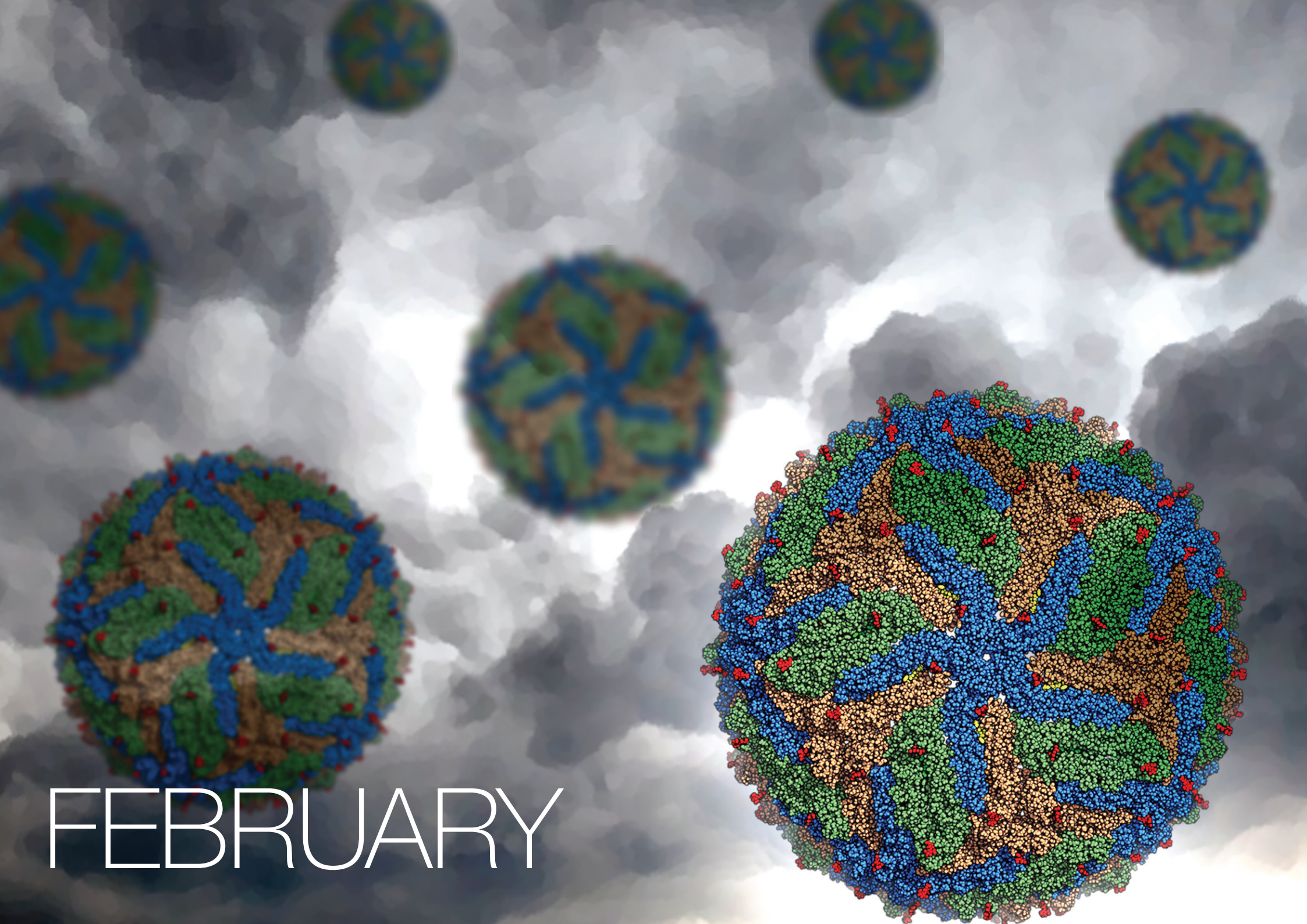
Ebola Virus Glycoprotein Fragment

The Ebola virus is transmitted through direct contact with infected bodily fluids. It can be transmitted from wild animals to humans and also spreads through human-to-human transmission. The protein from Ebola is presented here inside a drop of blood to reflect the blood transmission of the disease. Its structure is highlighted in bleach to reflect the decline of health once infected.

Paper, ink and bleach
By Anna Valchanova


FEBRUARY

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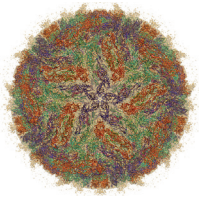
Zika Virus

The Zika virus has been linked to microcephaly and other neurological damage in foetuses. It is spreading so rapidly that the World Health Organization has declared it to be an emergency of international concern. This image depicts the emergence of the Zika virus across the world.

PyMOL software
By Alice Clark




MARCH

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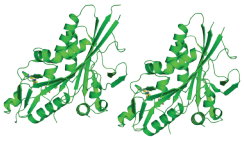
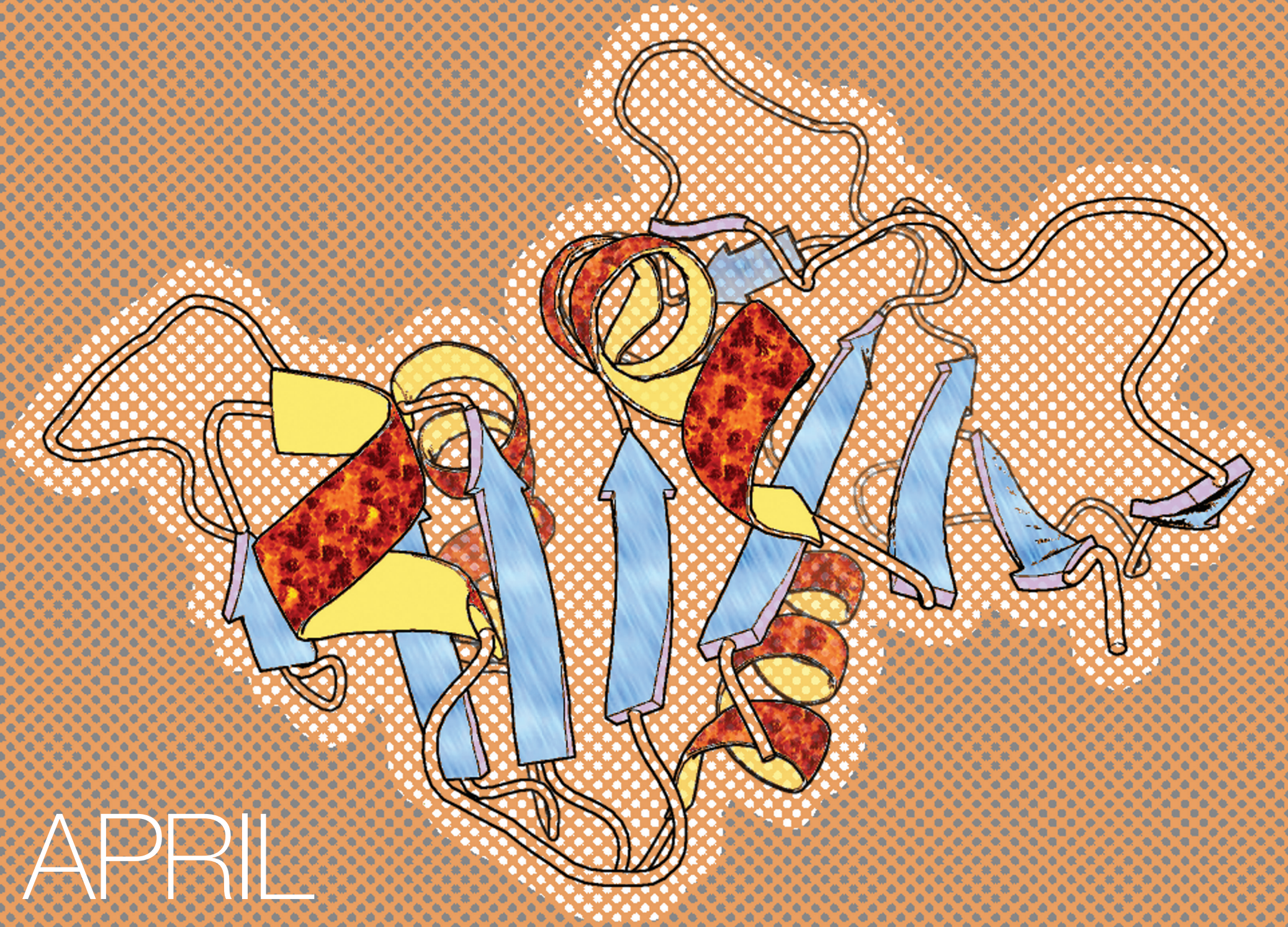
Giardia Motor Protein

Giardiasis disease is caused by the parasite *Giardia intestinalis* infecting the lining of the small intestine. The image shows two *Giardia* proteins positioned inside the nuclei of the parasite, and this symmetry is a reflection of the symmetry of the two nuclei. The parasite is presented inside a droplet of water to reflect the disease transmission through contaminated water.

Watercolour
By Anna Valchanova





APRIL

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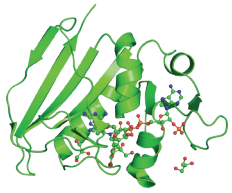
Mycobacterium tuberculosis: DHFR

Tuberculosis (TB) is caused by the bacterium *Mycobacterium tuberculosis*. TB has been present in human society since antiquity, with evidence of it found in prehistoric humans and Egyptian mummies. Currently, it is estimated that approximately one-third of the world's population is infected with TB. A worrying trend is the emergence of multidrug resistance in strains of the bacterium. The protein depicted here is dihydrofolate reductase (DHFR) from *M. tuberculosis*, a potential target for new antibiotics.

PyMOL software
By David Armstrong




MAY

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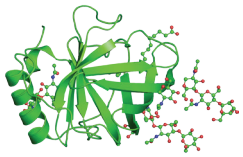
Mites and Milk Protein

This image shows *Tyrophagus* mites that were found feeding on milk powder, having contaminated a milk powder processing plant. The insect milk protein is also depicted in the image. This image highlights the challenges of storing an energy and protein rich food source such as milk powder – a particular problem with infant formula.

Chalk pastel on pastel paper
By John Clark



JUNE

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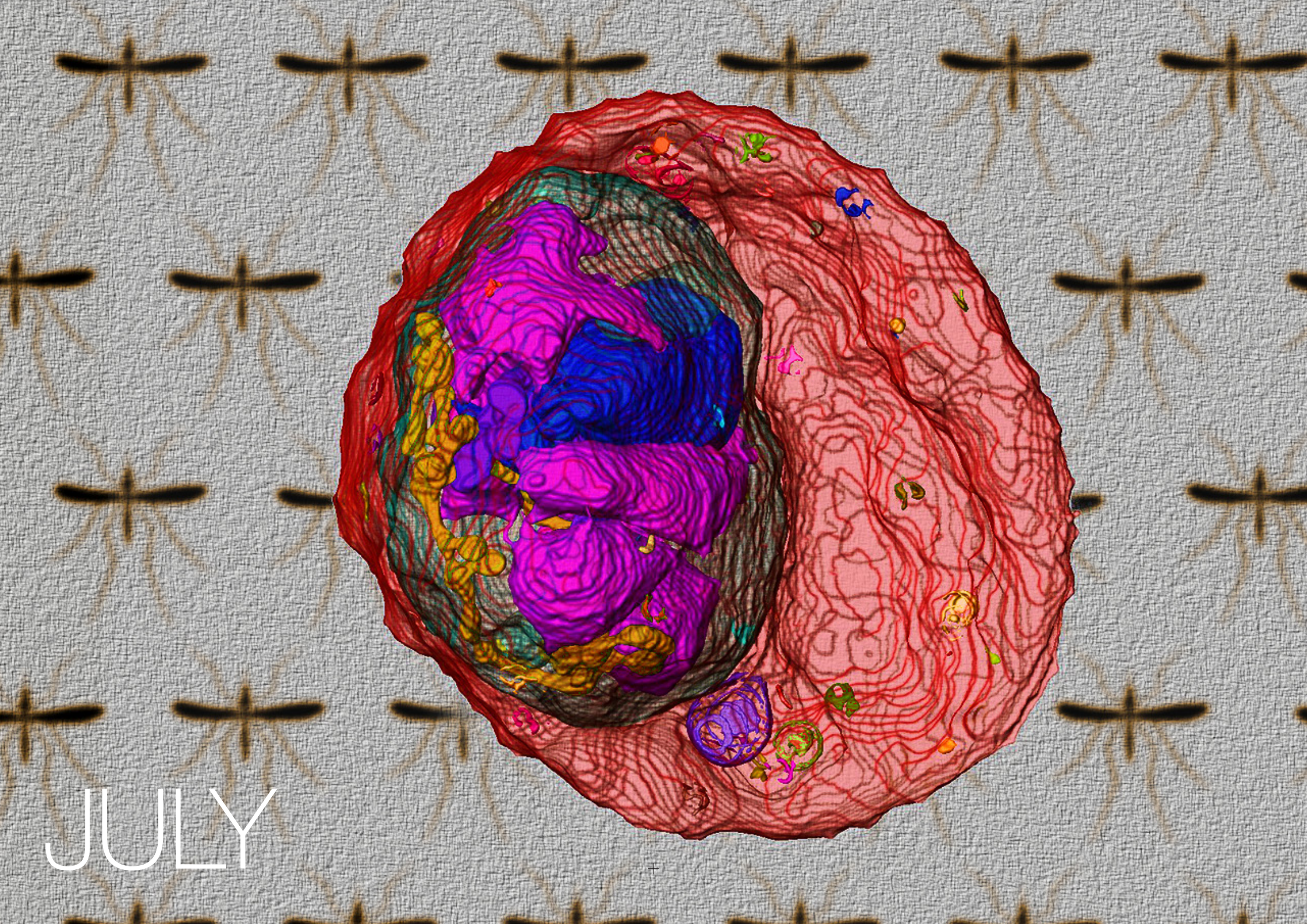
Cystallin Protein and Cataracts

Cataracts occur as a result of crystallin proteins aggregating in the lens of the eye. Here, the crystallin protein is obscuring the pupil of the eye, preventing any light from entering, similar to how cataracts impair vision by clouding the lens. The bright, vibrant colours of the iris contrast against the dull, grey palette of the protein, reflecting the loss of vision as cataracts develop.

Watercolour
By Anna Valchanova


JULY

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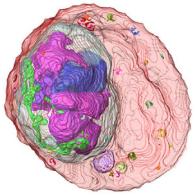
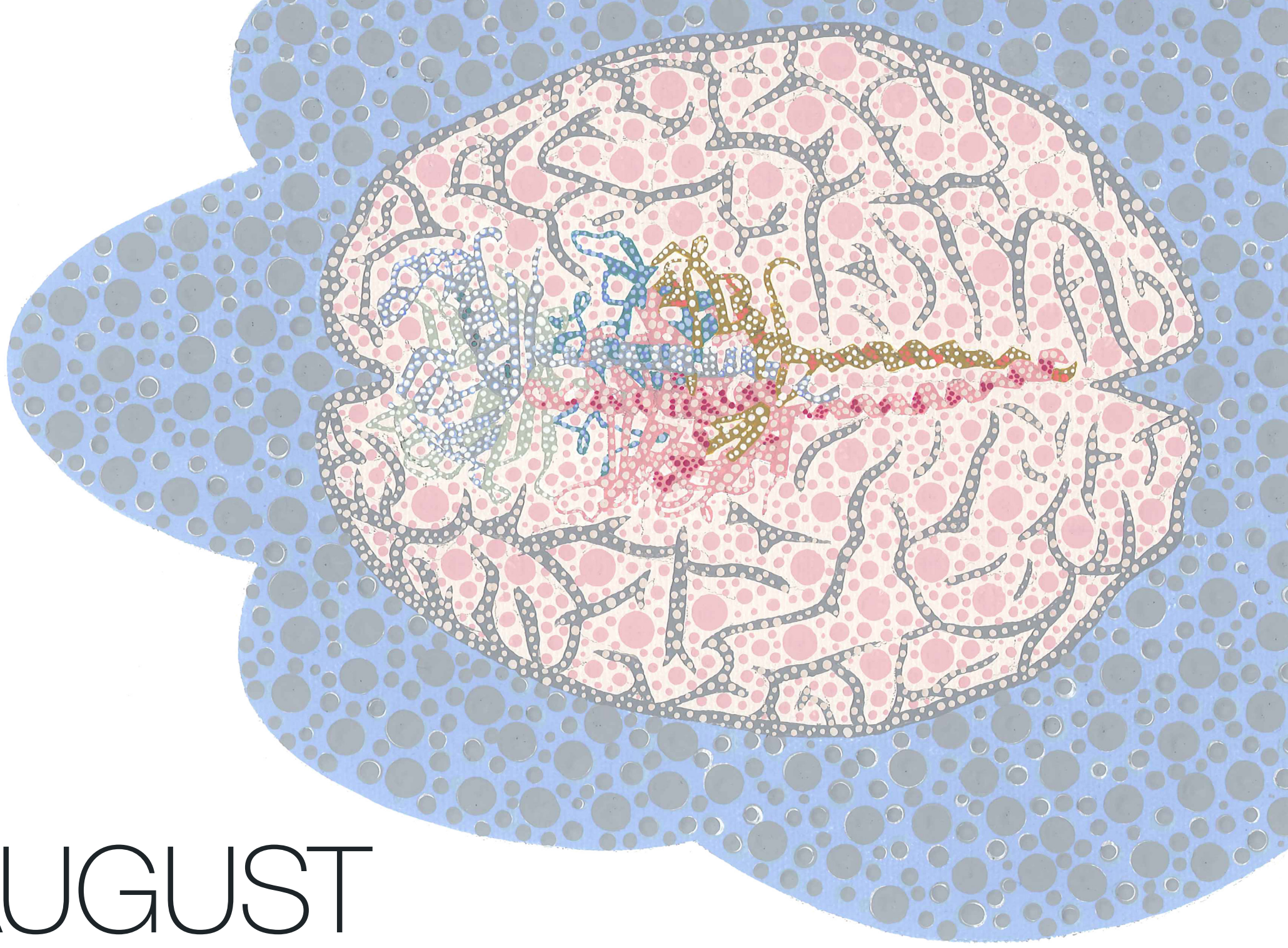
Infected Red Blood Cell

The *Plasmodium* parasite is transmitted via mosquitoes, which inject humans with their saliva when they bite, causing malaria. In this image a red blood cell is shown infected with the early schizont-stage malaria parasite (blue and purple) with the vector of transmission, a mosquito, shown in the background.

GNU Image Manipulation Program
Adapted from EMPIAR entry





AUGUST

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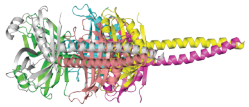
Protein from Leishmania

The three protozoan parasites responsible for Leishmaniasis, Chagas disease and Sleeping Sickness belong to a family of called kinetoplastids. The painting, entitled ‘Hope for the Three’, depicts the Leishmania centriole protein to represent Leishmaniasis and the human brain to represent Sleeping Sickness. The cloud surrounding them highlights the third disease’s similarities to the other two, offering hope to find one day a treatment for all three diseases: ‘every cloud has a silver lining’.

Dulux test pots on canvas
By Zeena N. Thompson




SEPTEMBER

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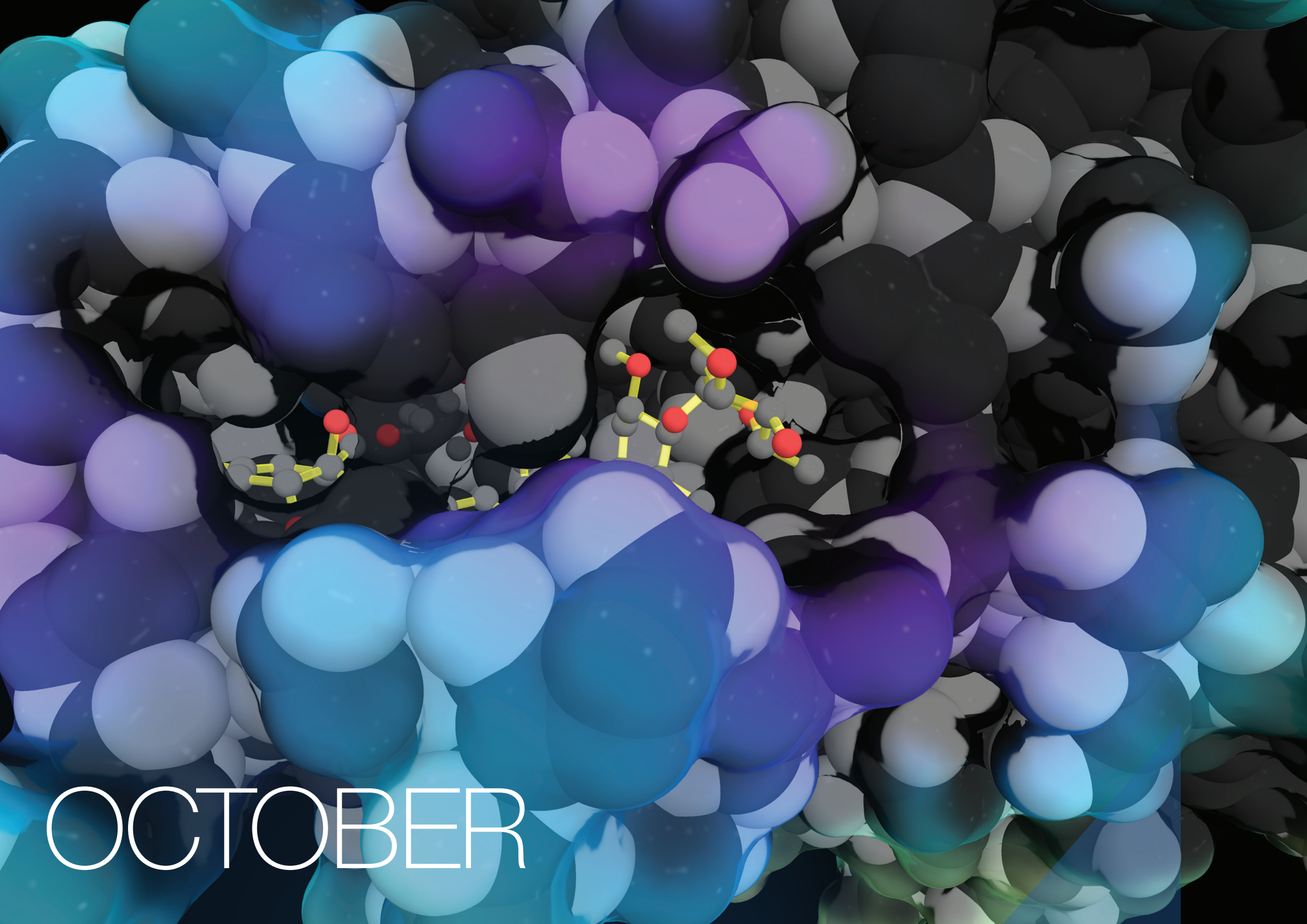
Liver Fluke Thioredoxin

Air-breathing freshwater snails of the *Lymnaeidae* family are the intermediate host for *Fasciola hepatica*, the liver fluke parasite responsible for Fasciolosis. The repetition of the thioredoxin protein structure from *F. hepatica* with increasing size reflects the parasite's growth and development inside the snail, with the watery texture conveying the aquatic environment of the host.

Watercolour
By Anna Valchanova


OCTOBER

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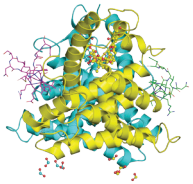
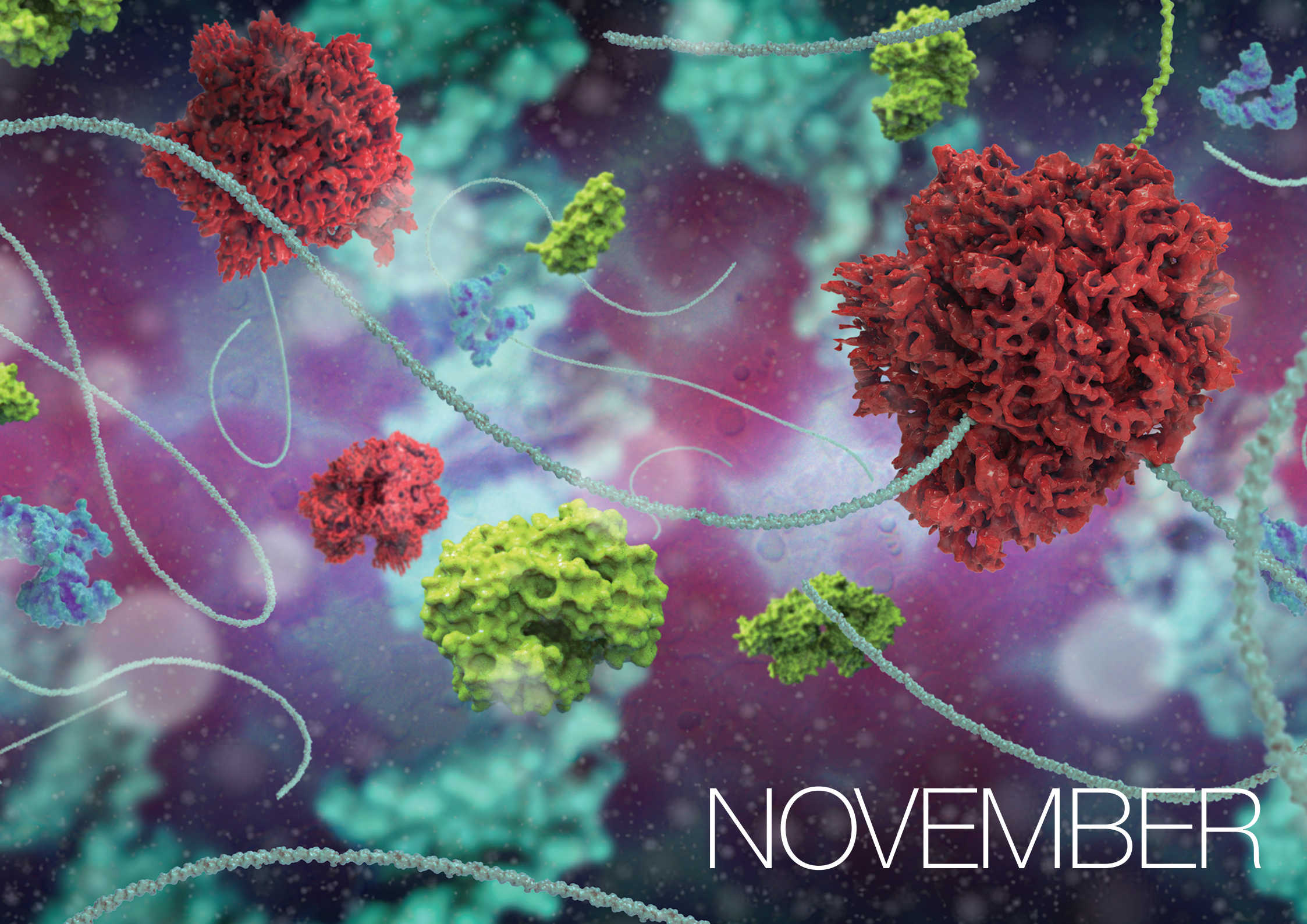
Ivermectin bound to FXR

The drug Ivermectin (Stromectol or Ivomec) is produced by the fungus *Streptomyces avermitilis*. It is widely used for the treatment and control of human parasitic worm infections and also parasites in livestock. It is on the World Health Organization's List of Essential Medicines, and can cost as little as US$0.12 for a course of treatment. In parasites it acts by binding to the glutamate-gated chloride channel. Here it is shown bound to the human protein FXR which helps regulate cholesterol levels.

PyMOL software
By Alice Clark




NOVEMBER

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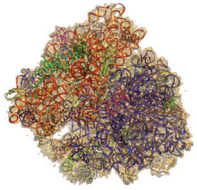
Ribosome Protein

Ribosomes translate the genetic code of DNA into proteins and are one of the main antibiotic targets to treat bacterial infections. Structures of ribosomes bound to naturally produced antibiotics (E.g. streptomycin or chloramphenicol) and semi-synthetic derivatives have provided valuable insights into their mechanisms of action. These ribosome structures are enabling the design of more antibiotics, particularly important for targeting multidrug-resistant bacteria.

3D visualisation
By Spencer Phillips




DECEMBER

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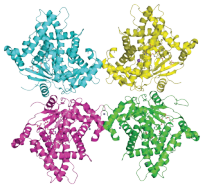
Quinine-Cytochrome Protein Complex

The anti-malarial drug quinine is extracted from the bark of the Cinchona plant and is broken down in the body by Cytochrome P450. The quinine-cytochrome complex is presented here in place of a newly-opened cinchona flower petals, with soft pastel used to reflect the soft, powdery texture of the authentic flowers.

Paper and pastel
By Anna Valchanova



About the artists

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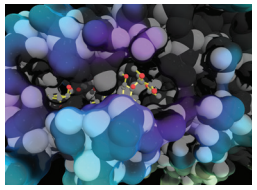
David Armstrong

David is an annotator at PDBe and has a background in solving protein structures by NMR. He is involved in teaching and outreach at PDBe.

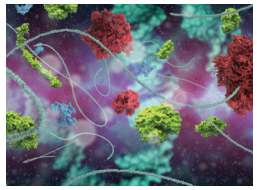


Alice Clark

Alice is an annotator at PDBe and has a background in solving protein structures by X-ray crystallography and CryoEM. She is involved in PDBe outreach and is working with local schools to engage art students to use structural biology.

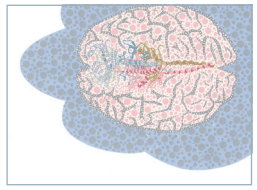
John Clark

John is a retired entomologist, who lives in New Zealand. He specialises in mites, and often draws the mites and studies the behaviour to understand them, which is particularly important when he is describing a new species.



Spencer Phillips

Spencer is the Senior Graphic Designer at the European Bioinformatics Institute (EMBL-EBI).



Zeena N. Thompson

Zeena is a Cambridge artist and came quite late to the world of art. When she is able to do art, it is always an expression, be it a statement about the losses of our animal brethren or highlighting engaging science.

Anna Valchanova

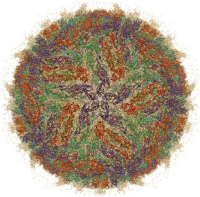
Anna is a 6th form art student at Stephen Perse School in Cambridge. At school she is taking science and art subjects. In the future she hopes to have a career that combines both of these interests.

About the proteins

January

PDBe.org/2M5F

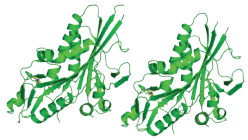
Ebolavirus Entry Requires a Compact Hydrophobic Fist at the Tip of the Fusion Loop. Gregory *et al.* J. Virol. (2014)



February

PDBe.org/5IRE PDBe.org/EMD-8116

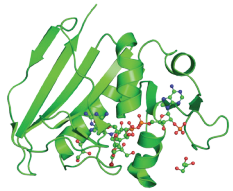
The 3.8 Å resolution cryo-EM structure of Zika virus. Sirohi *et al.* Science (2016)



March

PDBe.org/2VVG

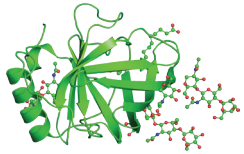
High-resolution crystal structure and in vivo function of a kinesin-2 homologue in *Giardia intestinalis*. Hoeng *et al.* Mol. Biol. Cell (2008)



April

PDBe.org/1DG7

Three-dimensional structure of *M. tuberculosis* dihydrofolate reductase reveals opportunities for the design of novel tuberculosis drugs. Li *et al.* J. Mol. Biol. (2000)



May

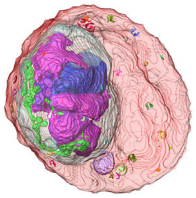
PDBe.org/5EPQ

Structure of a heterogeneous, glycosylated, lipid-bound, in vivo-grown protein crystal at atomic resolution from the viviparous cockroach *Diploptera punctata*. Banerjee *et al.* IUCrJ. (2016)

June

PDBe.org/2KLR

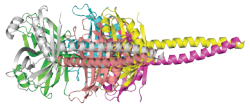
Solid-state NMR and SAXS studies provide a structural basis for the activation of alphaB-crystallin oligomers. Jehle *et al.* Nat. Struct. Mol. Biol. (2010)



July

EMPIAR.org/EMPIAR-10054

SBF-SEM of early schizont-stage malaria parasite infected red blood cell. Sakaguchi *et al.* Dataset DOI:10.6019/EMPIAR-10054



August

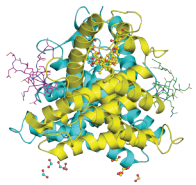
PDBe.org/4CKP

Structure of the SAS-6 cartwheel hub from Leishmania major. van Breugel *et al.* Elife (2014)

September

PDBe.org/2VIM

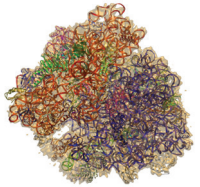
The Fasciola hepatica thioredoxin: High resolution structure reveals two oxidation states. Line *et al.* Mol. Biochem. Parasitol. (2008)



October

PDBe.org/4WVD

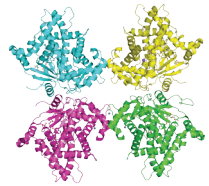
The antiparasitic drug ivermectin is a novel FXR ligand that regulates metabolism. Jin *et al.* Nat. Commun. (2013)



November

PDBe.org/4V5H PDBe.org/EMD-1657

Structural insight into nascent polypeptide chain-mediated translational stalling. Seidelt *et al.* Science (2009)



December

PDBe.org/4WNV

Contributions of Ionic Interactions and Protein Dynamics to Cytochrome P450 2D6 (CYP2D6) Substrate and Inhibitor Binding. Wang *et al.* J. Biol. Chem. (2015)

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