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Journey through the Brain

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Recommended Citation

Cotter, David; Lopez, Lorna; Kelleher, Eoin; Coughlan, Helen; and Cannon, Mary, "Journey through the Brain" (2016). *Psychiatry Books*. Book 1.
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journey through the brain

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journey through the brain

a colouring book

Created by David Cotter, Lorna Lopez, Eoin Kelleher, Helen Coughlan, Mary Cannon
Illustrations by Eoin Kelleher

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Published in 2016 by the Royal College of Surgeons in Ireland.

Supported by

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Citation
Cotter, D.R., Lopez, L.M., Kelleher, E., Coughlan, H., Cannon, M. (2016) Journey through the Brain. Dublin, Ireland: RCSI. ISBN:978-0-9926911-2-7

Acknowledgements

Project Leader: Professor David Cotter
Concept & Project Management: Dr Lorna Lopez
Illustrations: Dr Eoin Kelleher
Content: Dr Lorna Lopez, Professor David Cotter, Professor Mary Cannon, Dr Eoin Kelleher.
Consultant: Ms Helen Coughlan
Design: Ms Olivia Browne
Thanks to all those who helped in the development of the book especially Sophie Sabherwal and Catriona O'Grady.

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The Health Research Board is supporting the development of this book through their Knowledge Exchange and Dissemination Award which aims to maximise the uptake of research findings into policy and/or practice (KEDS-2015-1628).

journey through the brain

a colouring book

Created by David Cotter, Lorna Lopez, Eoin Kelleher, Helen Coughlan, Mary Cannon
Illustrations by Eoin Kelleher

Welcome to the mysterious and magical world of our brain!

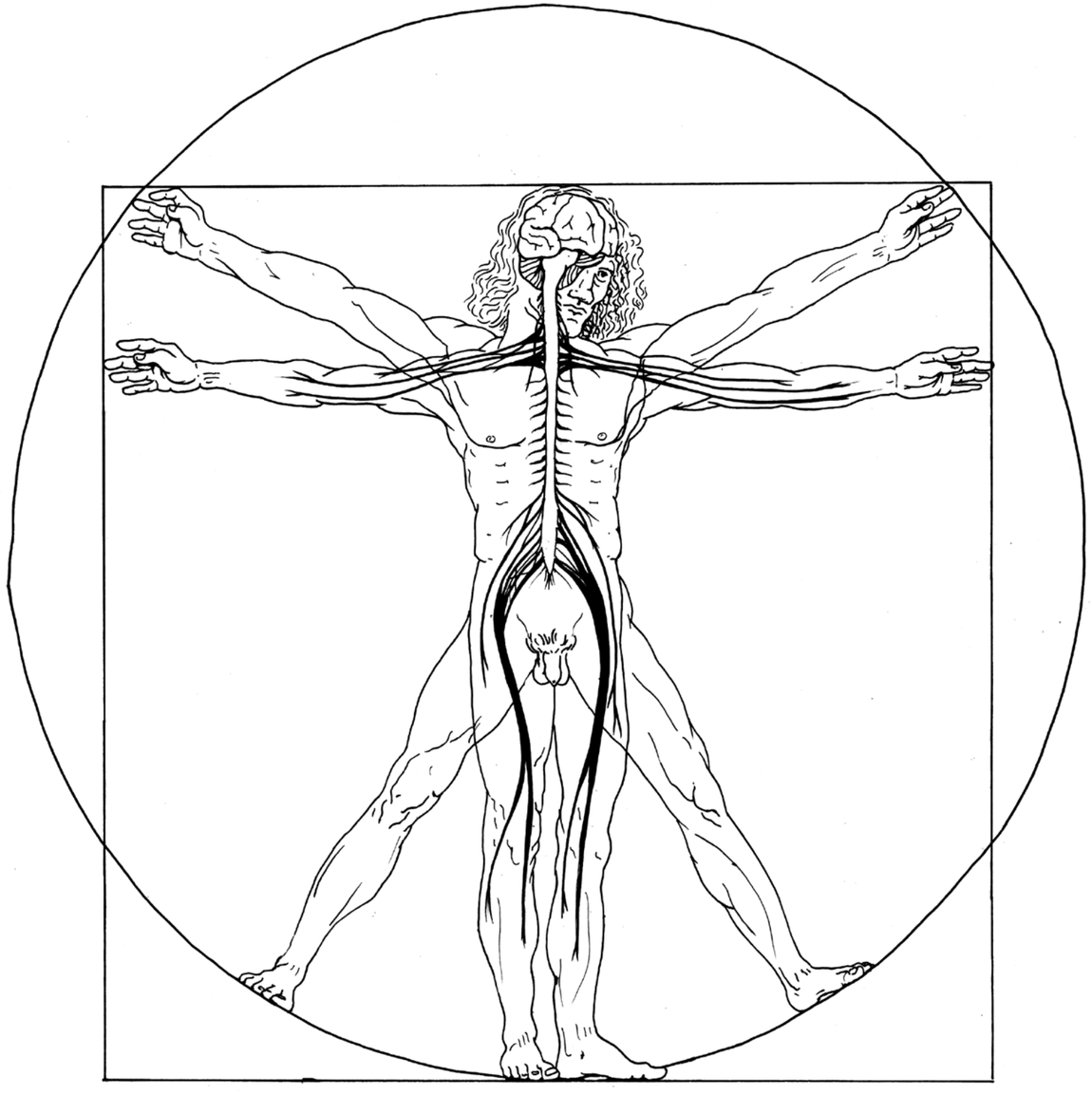
The brain is our most important organ and perhaps the least well understood. Our brain is the "command station" for our body. It controls what we think, what we feel and what we do. It is the home of our emotions and personality. It makes sense of our experiences.

But how does the brain work? The truth is that, after decades of research, scientists and doctors are only now beginning to figure out that question. We know that different types of cells in the brain work together to form certain areas which have specialist roles in memory, vision and logical thinking. We also know that hormones and chemicals influence our brain and our emotions and that we are very sensitive to changes in their levels. We know that the different brain areas mature at different stages and are connected by tracts, rather like railway lines, which can sometimes go astray and lead to illnesses. And finally we know that by looking in the blood we can find clues, called biomarkers, which may ultimately help us to understand and predict brain disorders.

Through this book we want to help everyone to understand the workings of the brain through pictures and cartoons. If you would like to learn more about these pictures go to our website rcsi.ie/brainjourney

Explore, enjoy, learn!

David, Lorna, Eoin, Helen & Mary,
RCSI

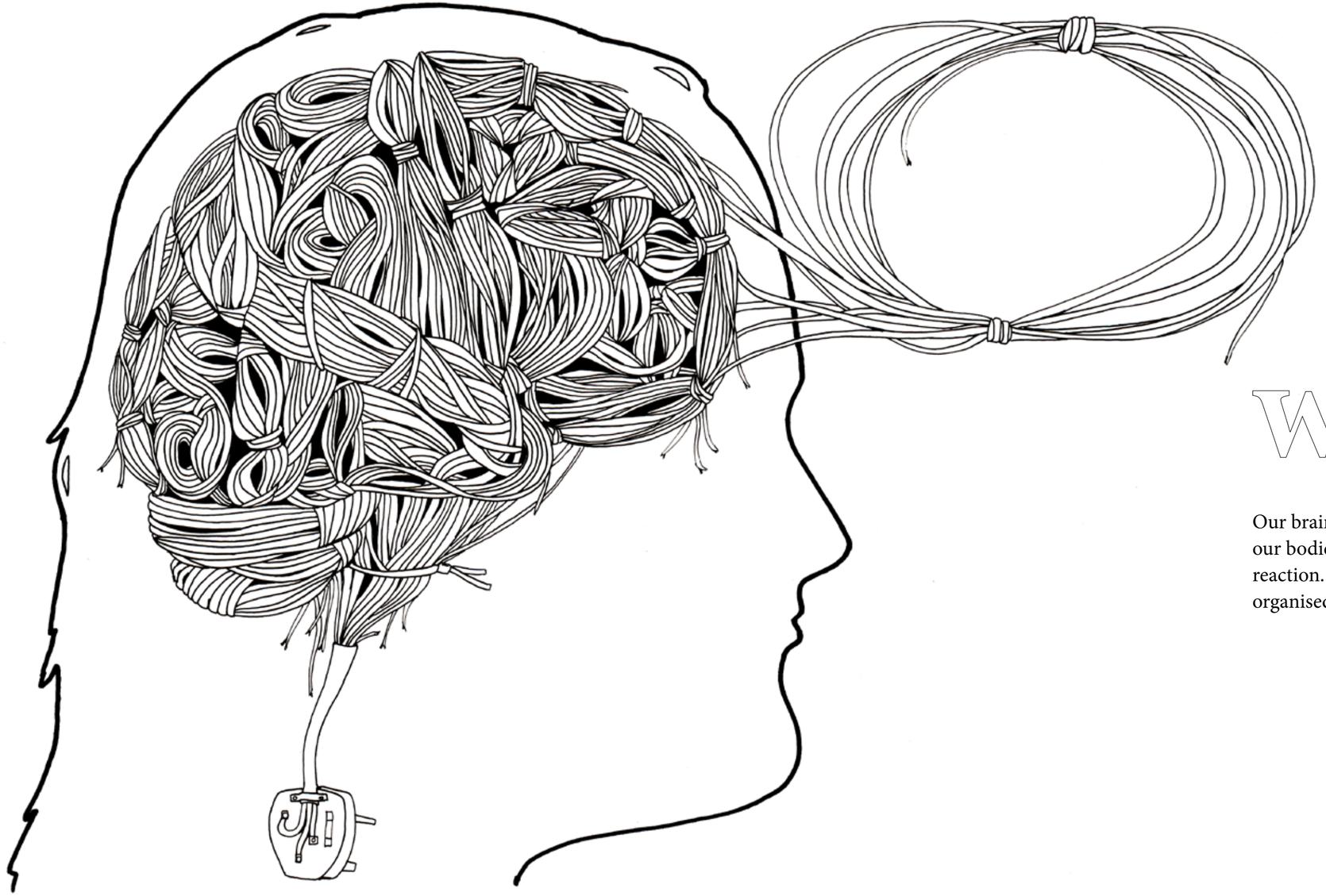


nervous system

Our bodies work through a complex communication and control network - the nervous system.

The brain and spinal cord work with the rest of the nerves through the whole body.

Do you recognize this picture? It was inspired by a Leonardo da Vinci drawing called “The Vitruvian Man”



wired

Our brains are like a bunch of wires. They connect our bodies to the outside world and create a reaction. It may look chaotic but in fact it's very organised, as we will see.

brain puzzle

Each part of our brain has a specific job.
There are six main areas.

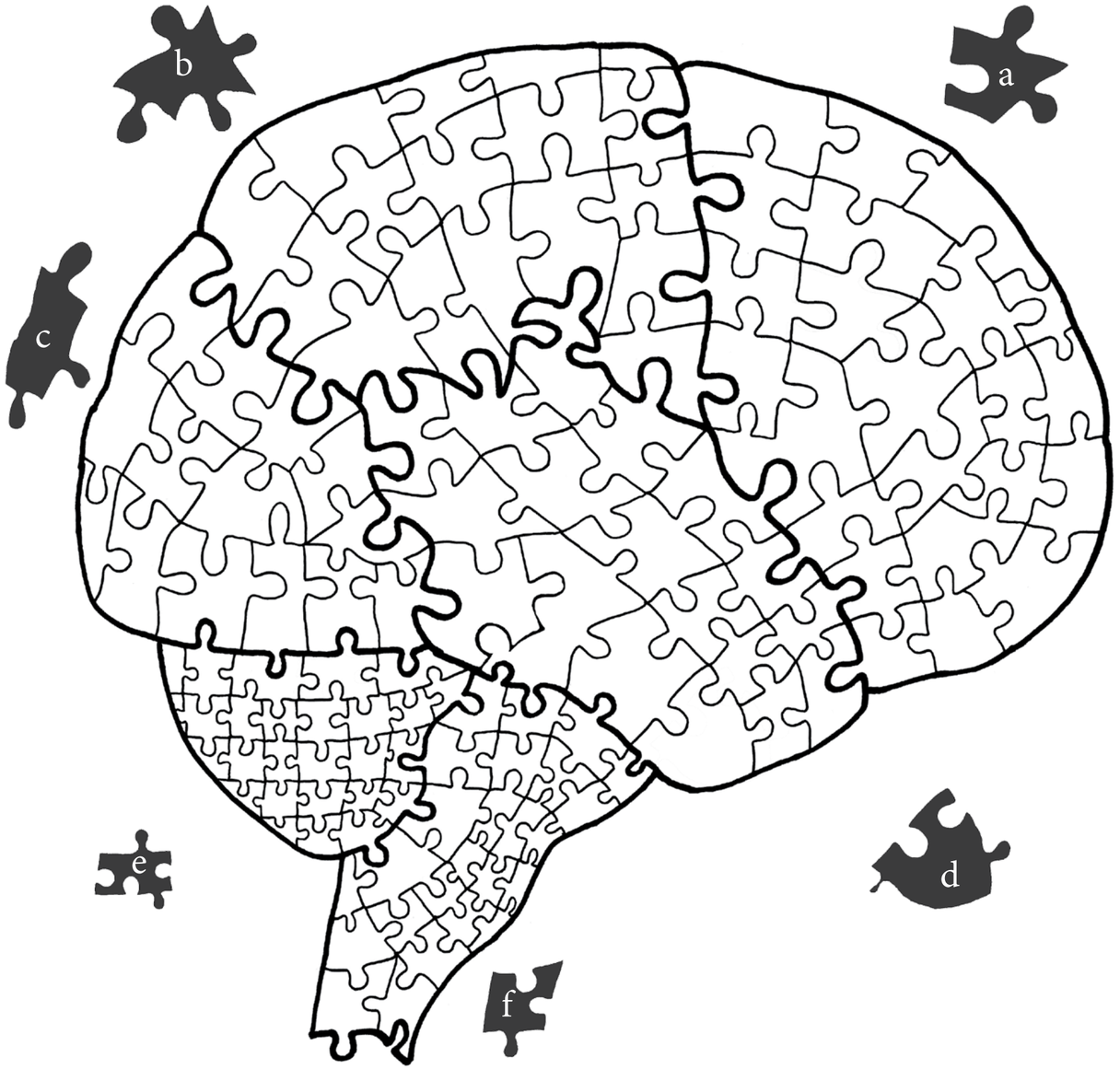
Here is a quick guide to the puzzle!

The Forebrain contains four lobes;

a. Frontal – for thought & planning
b. Parietal – for touch & spatial awareness
c. Occipital – for vision
d. Temporal – for hearing & memory

and there are two areas in the Hindbrain;

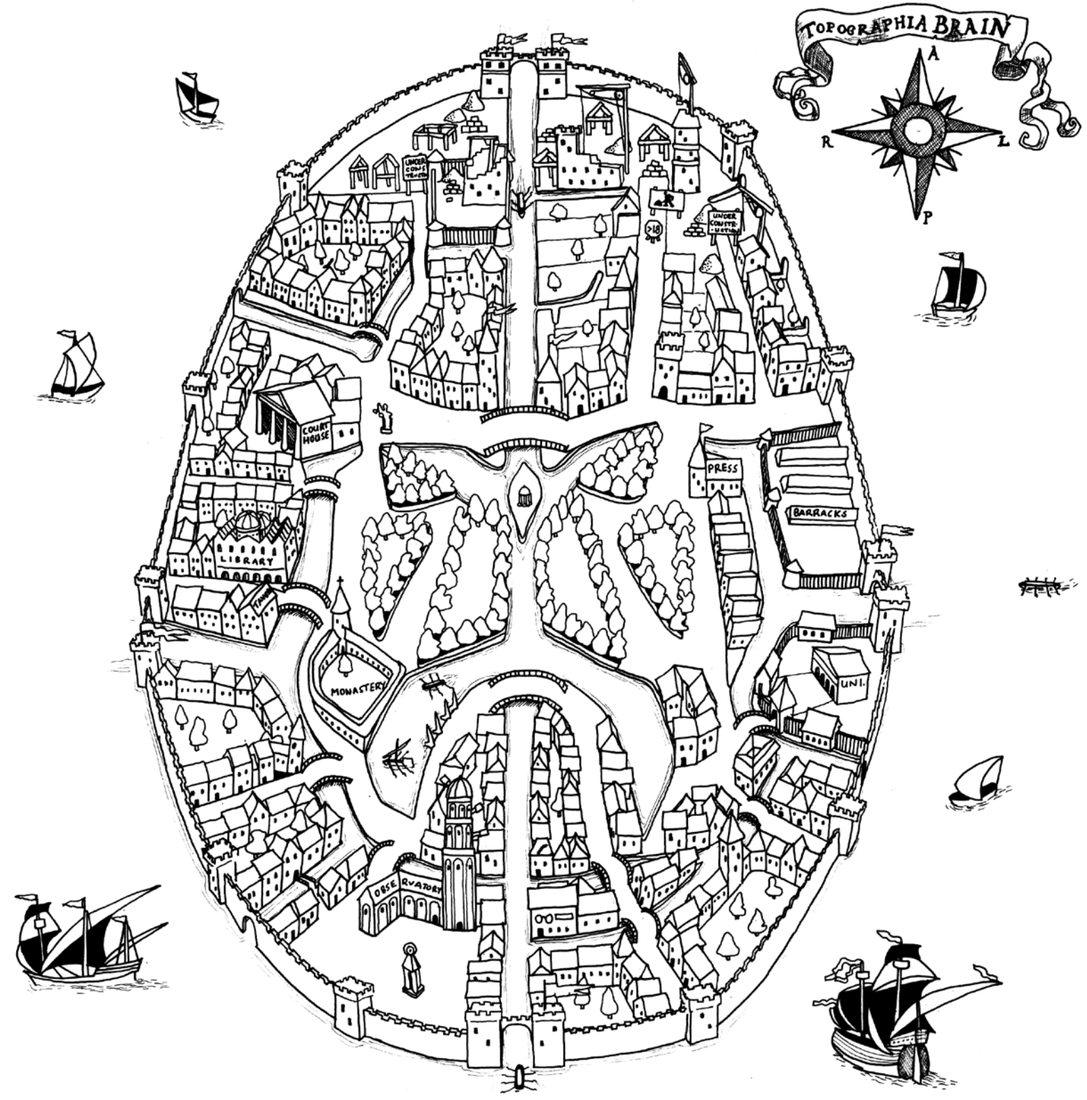
e. Cerebellum – for balance & posture
f. Brainstem – for connection to the rest of the body to control our heart and breath.



brain map

This is a view of our brain from above. We have imagined the brain as a connected city where different areas are important for how we think, communicate, learn and feel.

Can you guess what happens in the different parts of the brain? The frontal lobe still develops until our mid-twenties and is shown as a construction site here.



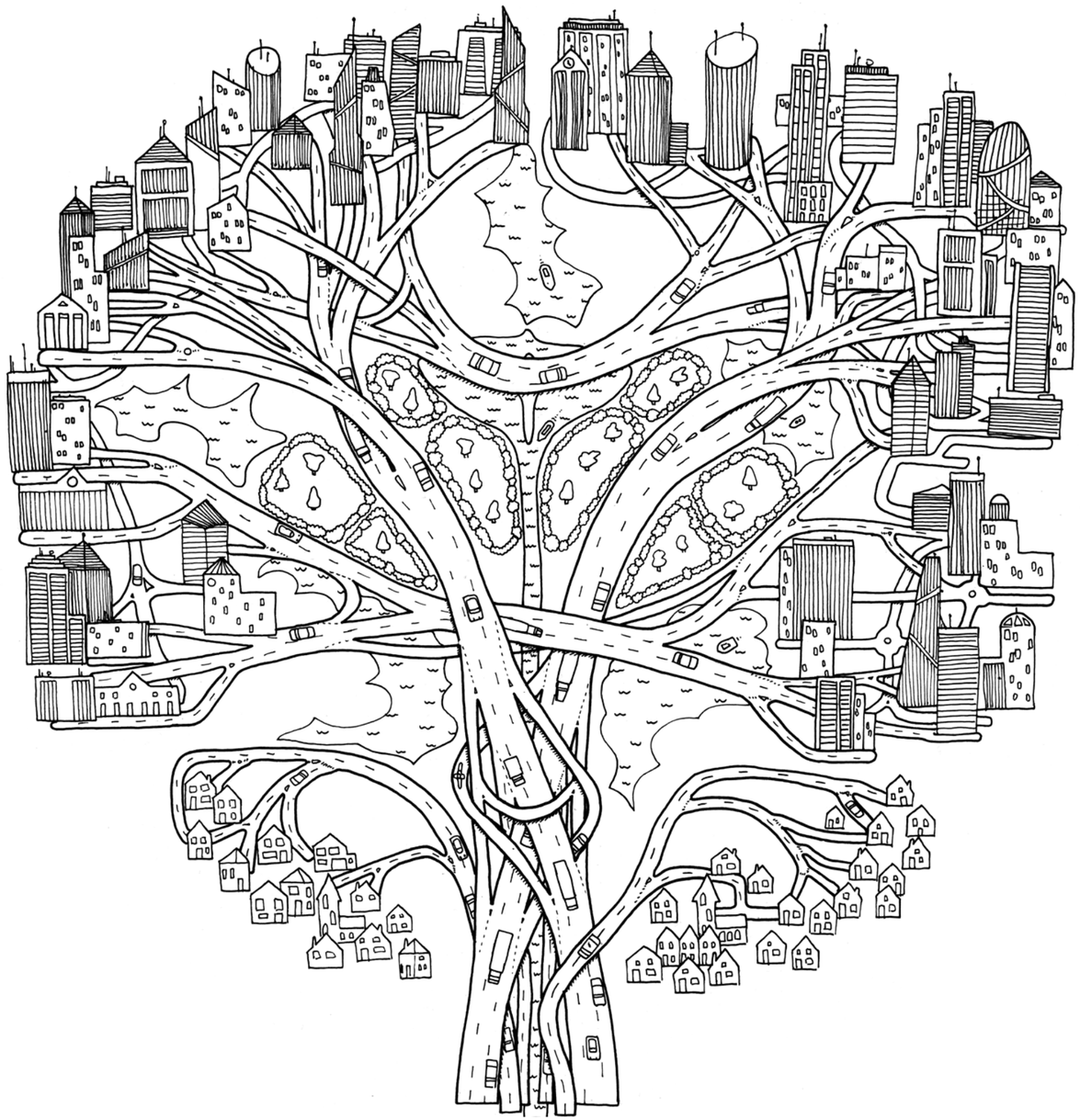
left brain | right brain

In general the right side of our brain is more creative, and our left side is more logical.

The right side of the brain (called the right hemisphere) deals with such functions as music, art, intuition and insight. The left side (called the left hemisphere) deals with language, reasoning and mathematical thought. Of course the two hemispheres communicate with each other all the time!

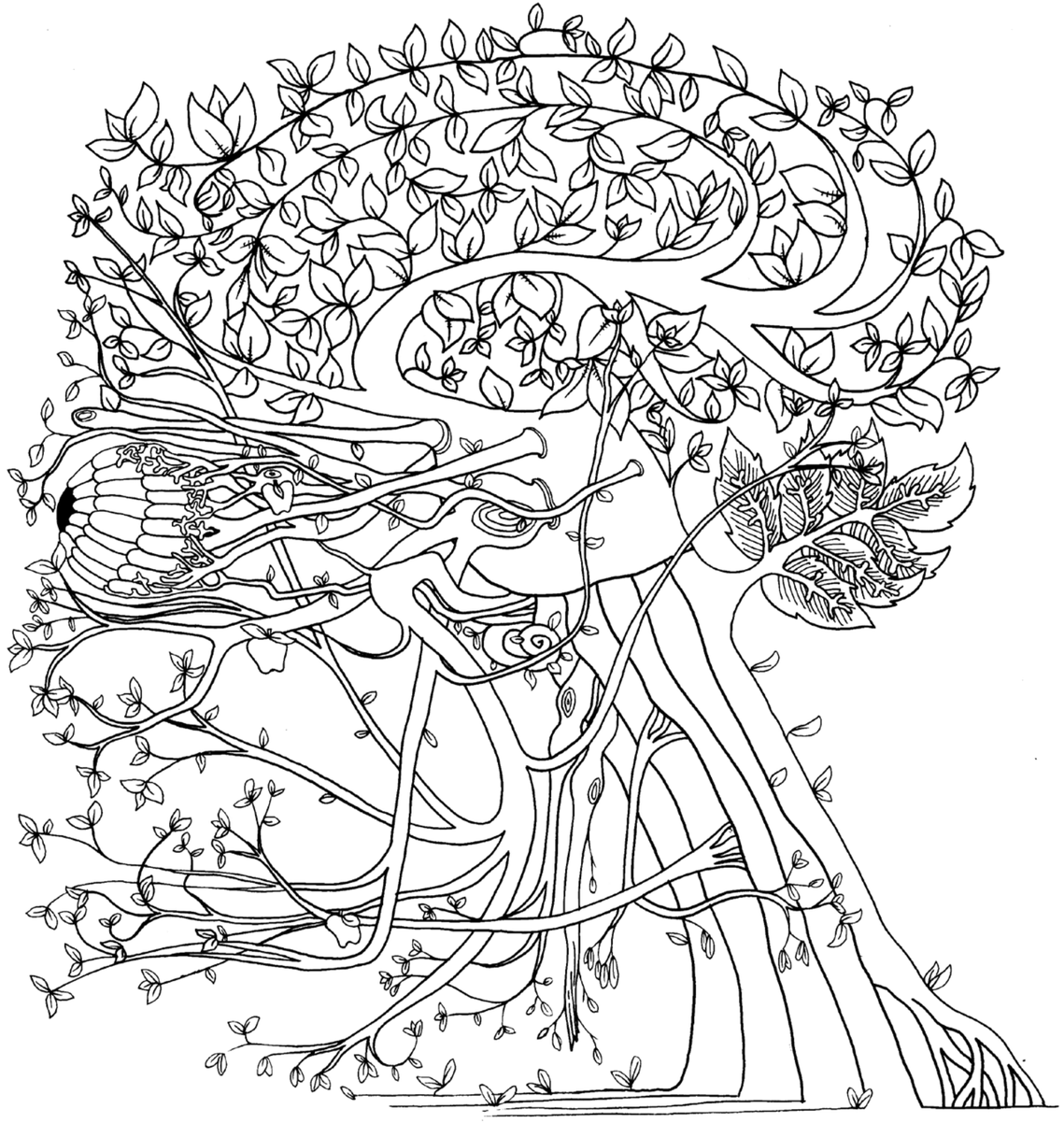
information highway

How does our brain send information to the rest of our bodies? Through bundles of nerve cells. These bundles travel from the brainstem in the spinal cord and connect with other nerve cells which carry the message to the rest of the body. They tell our bodies how to move, walk, write and much more.



cranial nerves

12 pairs of cranial nerves travel out from our brains and help us to connect to the outside world. These allow us to smell, see, taste, feel and to move our muscles in our face!



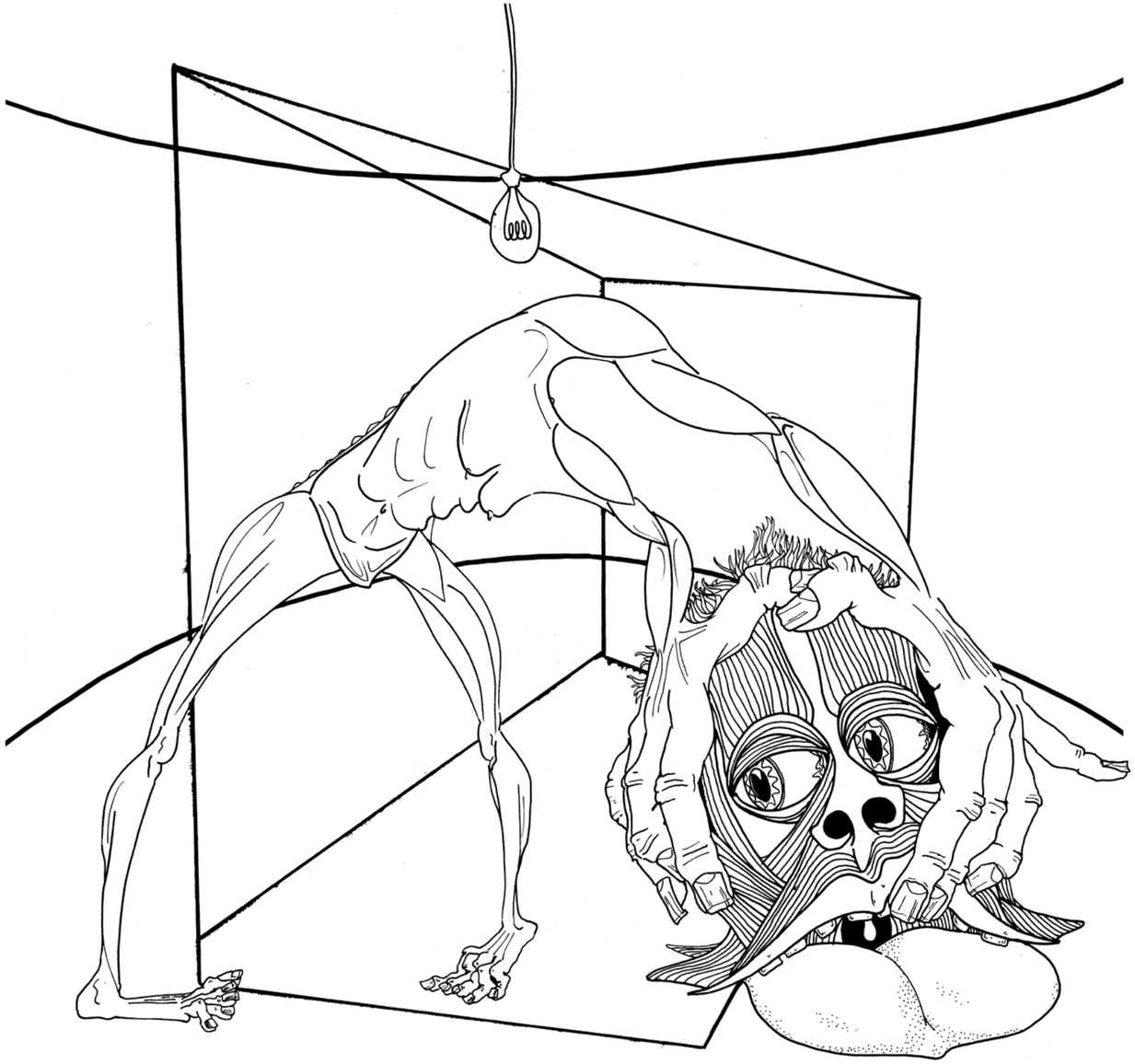
homunculus

Our brain imagines that our bodies look like this!

It's all out of proportion.

What looks bigger? The hands, lips and tongue. This is because there is a greater nerve supply here than to our toes!

This painting was inspired by the work of the famous painter, Francis Bacon, who was born in Dublin. His studio is now in the Hugh Lane Gallery in Parnell Square.

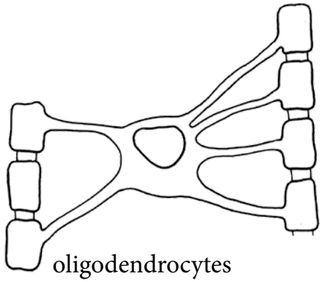


hippocampus

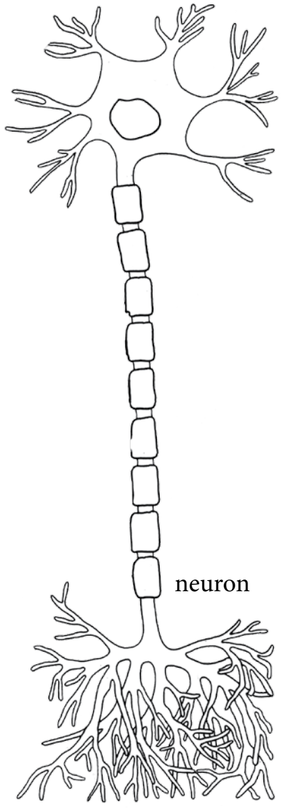
The hippocampus is important for memory and sense of direction. It's thought to look like a seahorse, and is so called from the ancient Greek hippos meaning "horse" and kampos meaning "sea monster".

brain cells

Our brain is made up of thousands of types of brain cells. There are neurons (about 86 billion) that signal to each other, and even more supporting cells that support the neurons – glial cells and oligodendrocytes.

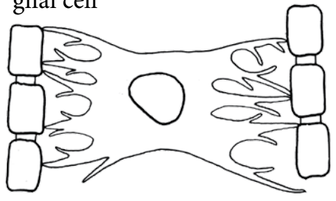


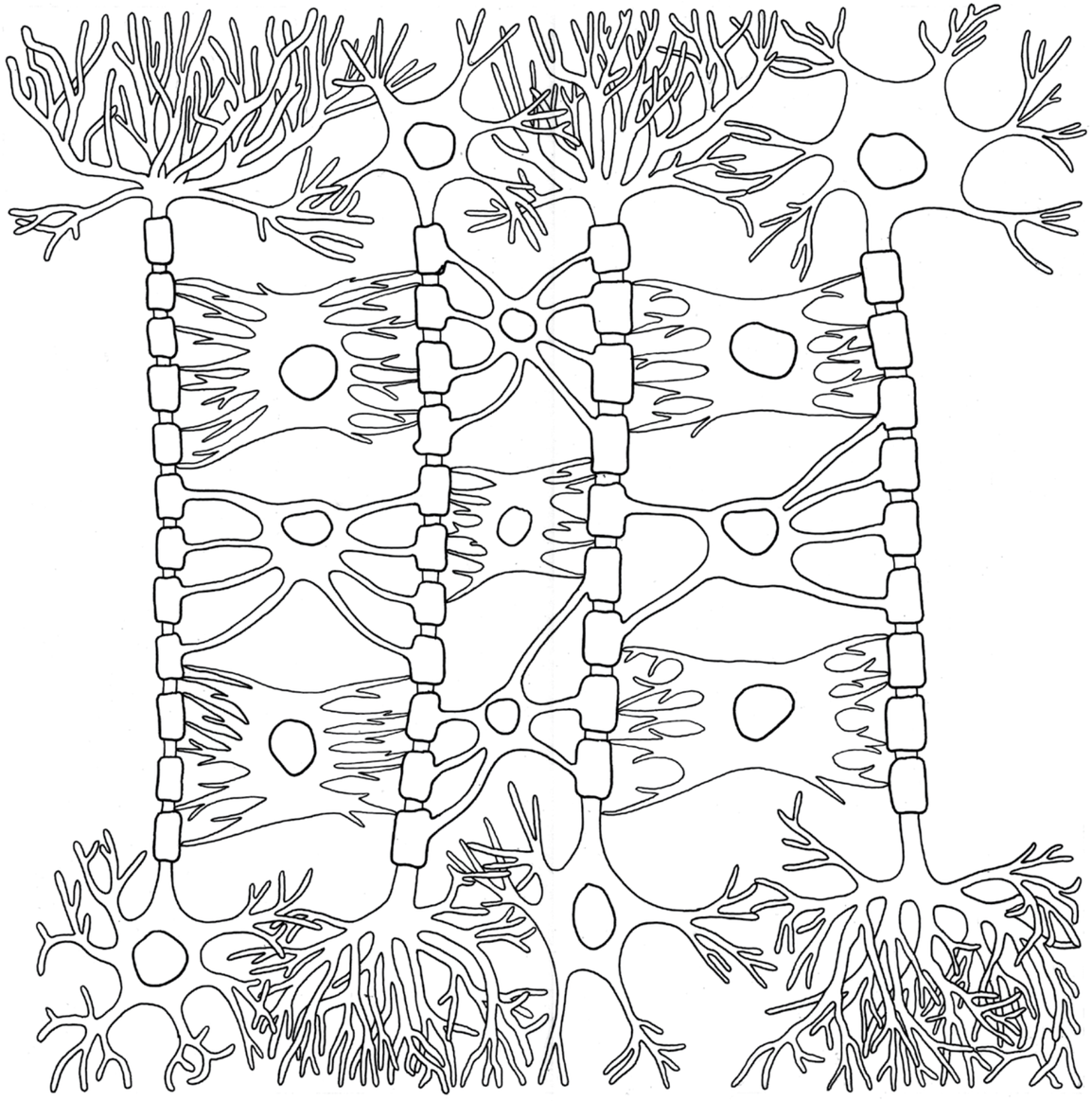
oligodendrocytes



neuron

glial cell

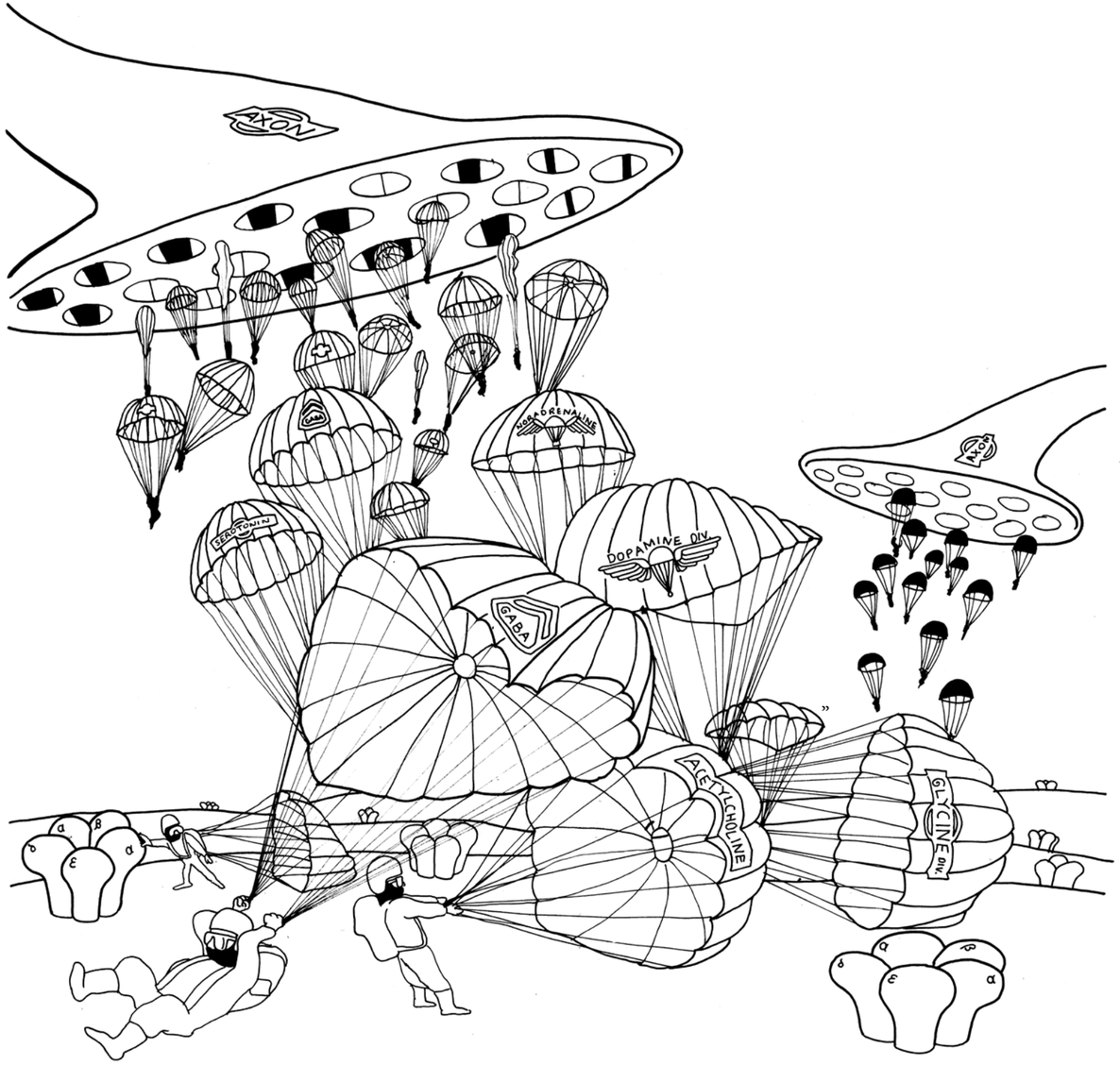




synapse

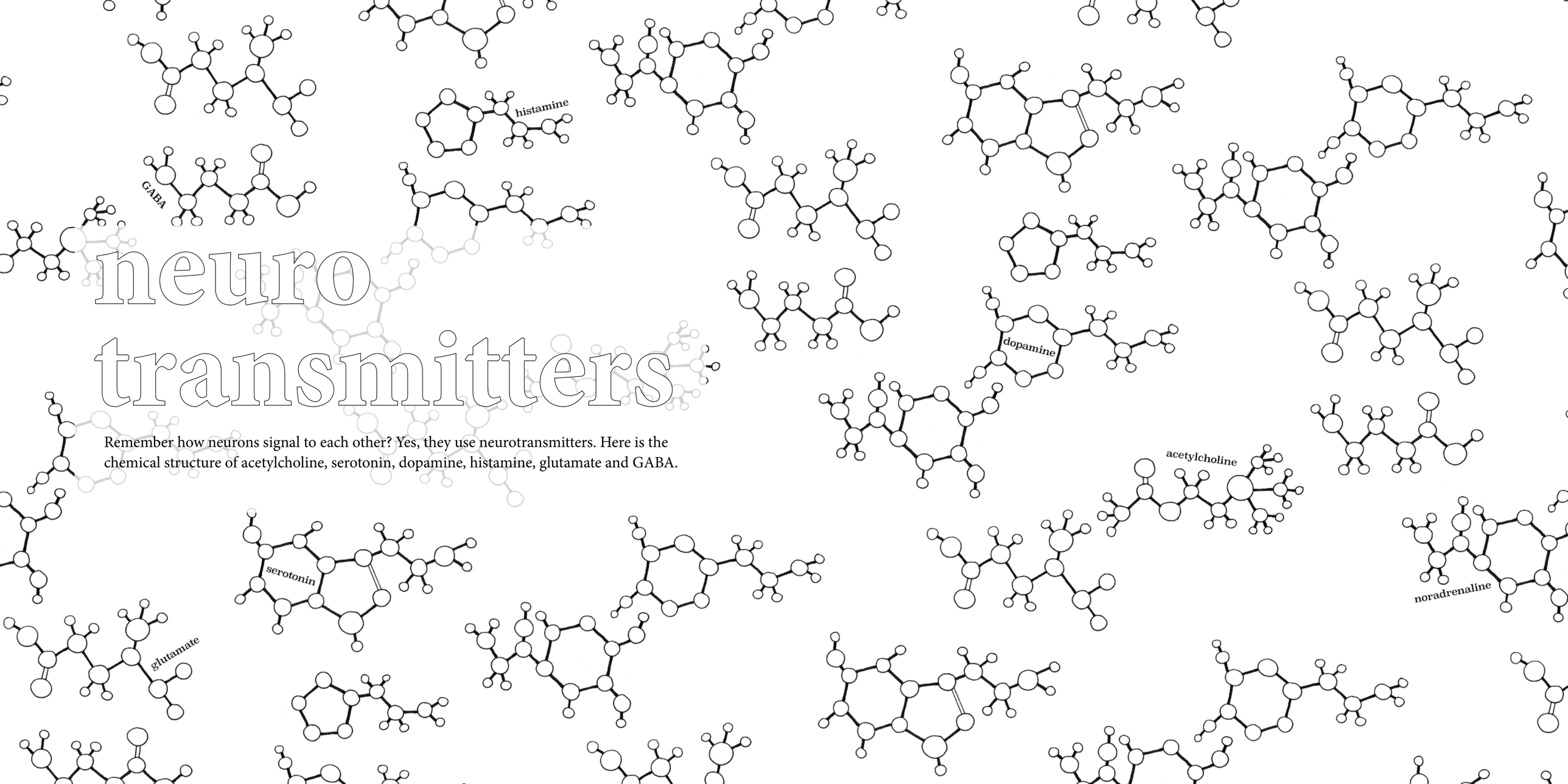
Our billions of neurons pass messages to each other through junctions called ‘synapses’. This happens through the axon part of the neuron. Signals – which are called neurotransmitters - are released at these synapses like little parachutists. These land on other neurons and attach to receptors. This is how the neurons talk to each other.

Can you spot six common neurotransmitters?



neuro transmitters

Remember how neurons signal to each other? Yes, they use neurotransmitters. Here is the chemical structure of acetylcholine, serotonin, dopamine, histamine, glutamate and GABA.



biomarker sea

Our brain needs blood to survive - delivering it's fuel - oxygen and sugar.

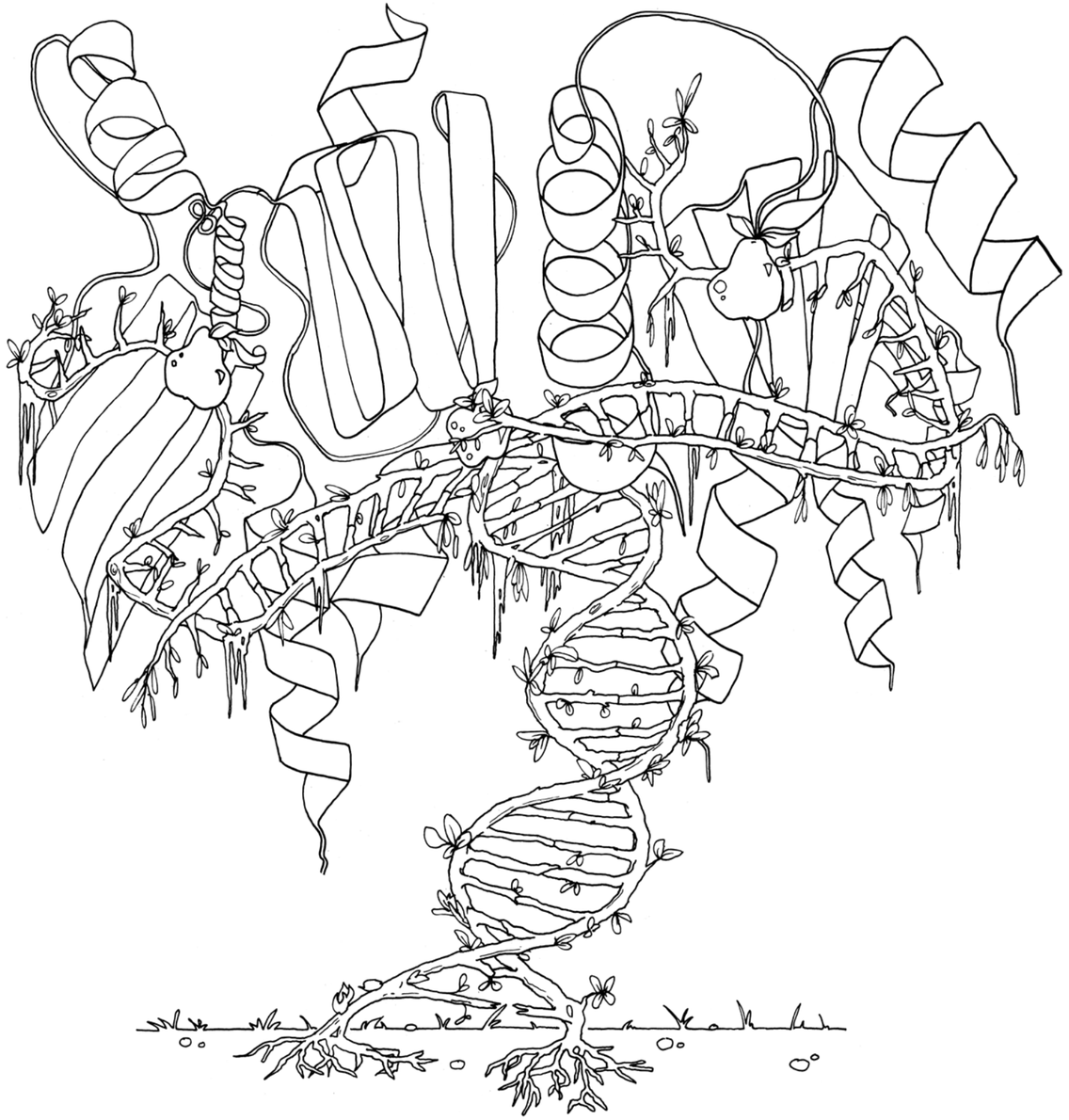
Our brain also releases chemicals into the blood which we can detect in blood samples.

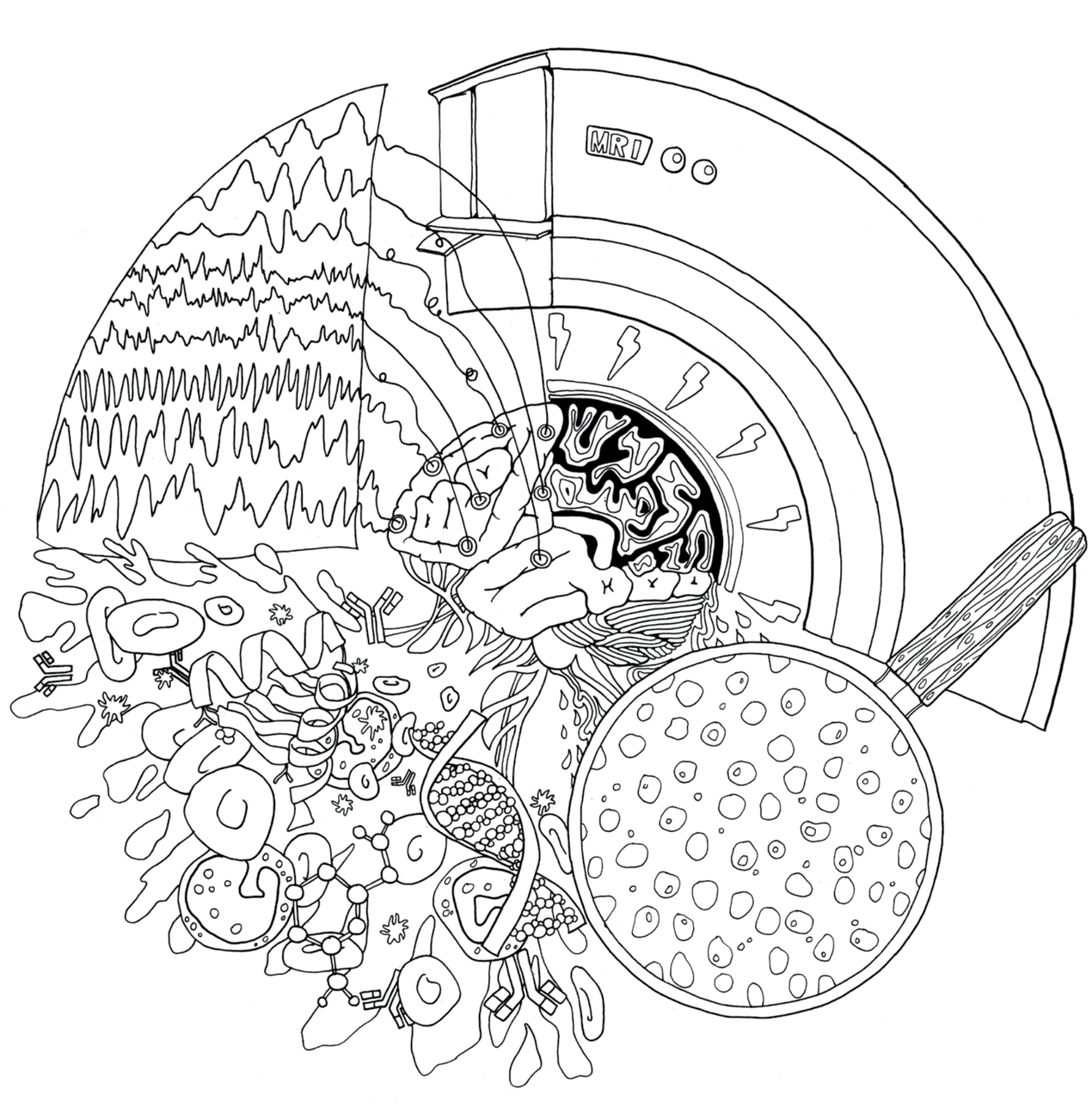
Researchers measure these chemicals to check if they can give clues to illness. And if they do, we call them a biomarker. This is important for medical research and diagnostics because it's much easier to get a blood sample than a brain sample!

translation tree

In our blood there is an instruction manual for our whole body, including our brain. We can measure the code for our genes (DNA), how the code is expressed (mRNA) and what it makes (proteins). This is called translation.

We inherit our DNA from our parents, just like they did from their parents. Reading these instructions and codes (DNA, mRNA and proteins) can give us clues on how we inherit different features including illness through our families.



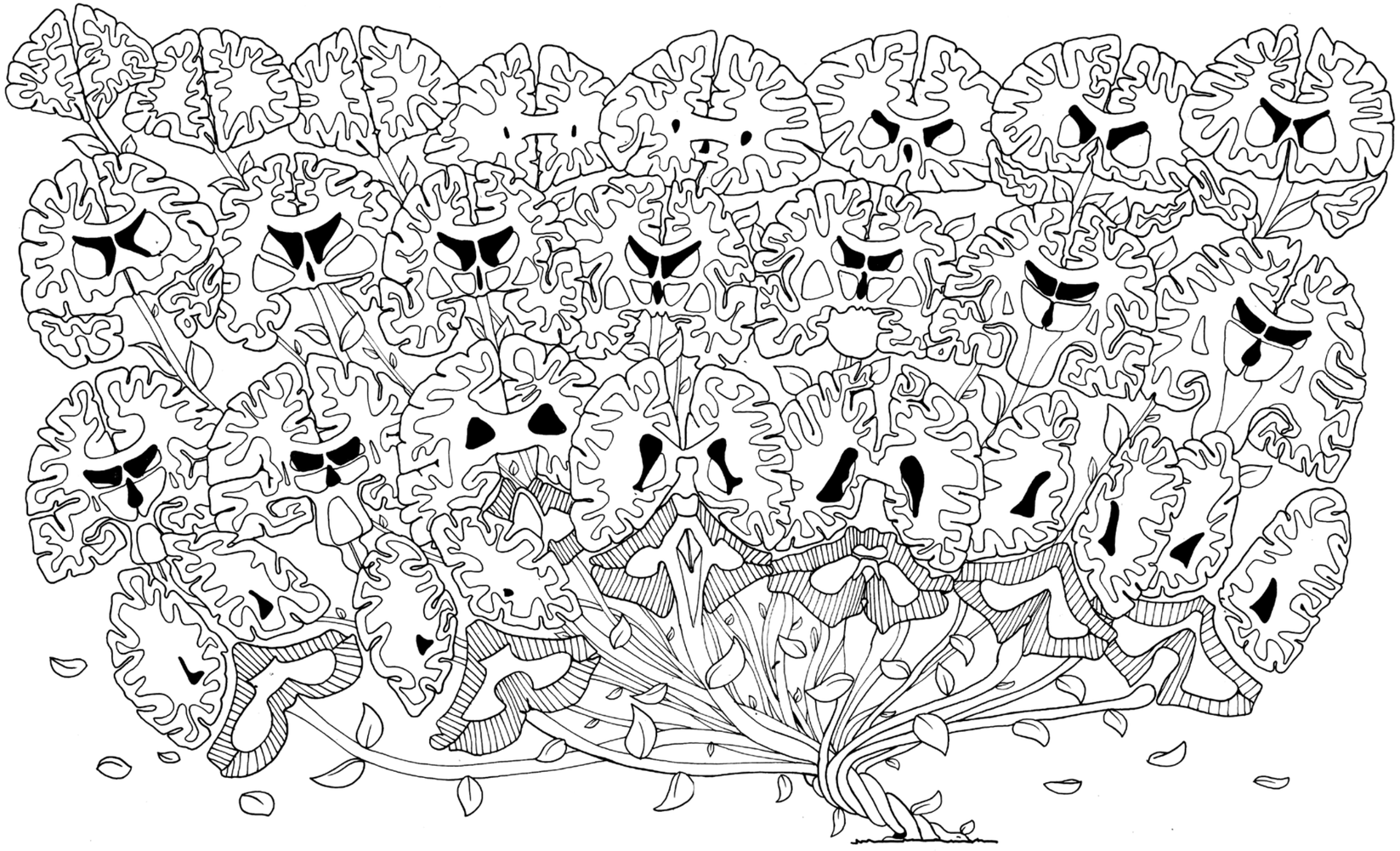


investigating the brain

How can we figure out what's happening in our brains?

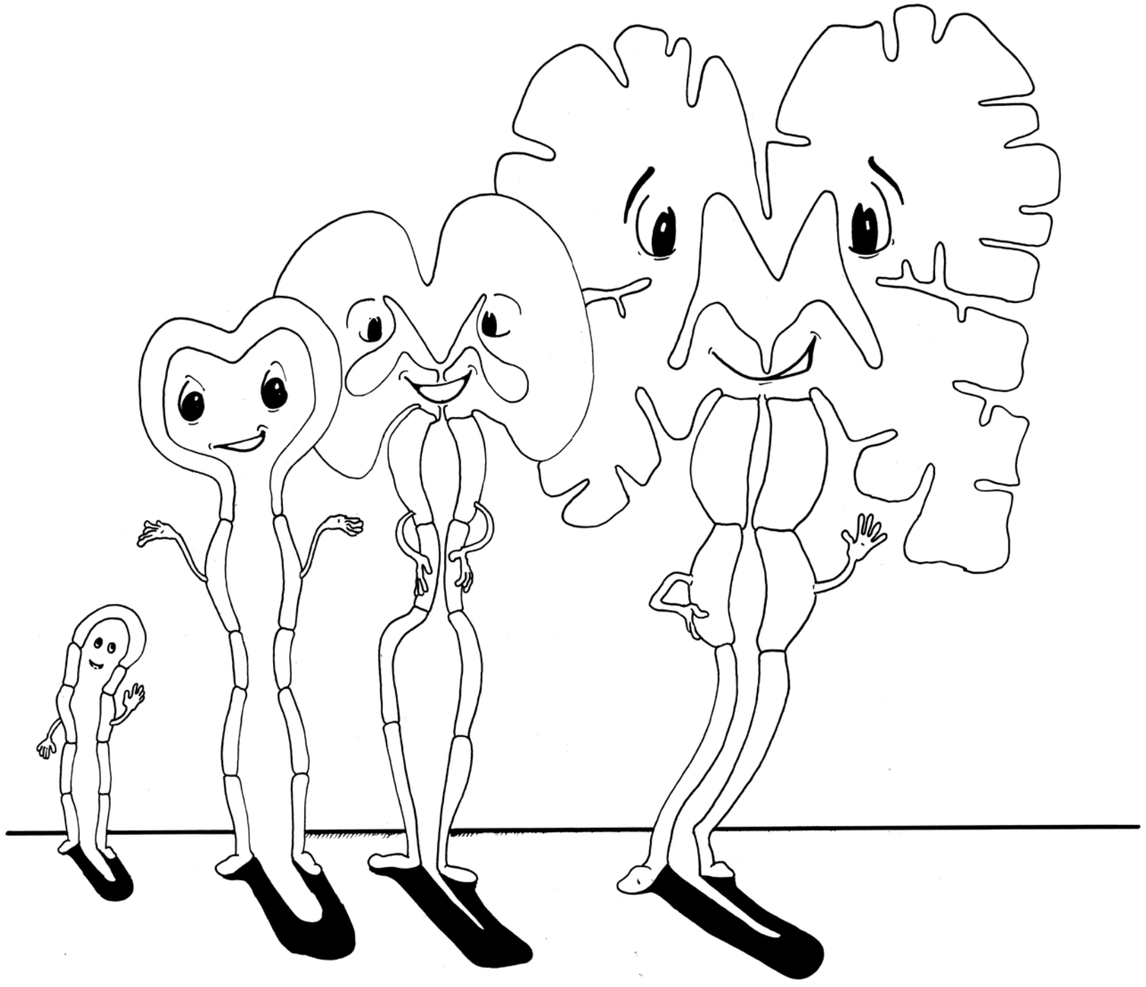
We can take pictures with an MRI (Magnetic Resonance Imaging) or CT (Computed Tomography) scanner. We can record the electrical signals from our neurons with an EEG (electroencephalogram).

We can take a small sample of the fluid that surrounds our brain, or the blood that supplies it, and look for microscopic clues such as biomarkers in our DNA, mRNA or proteins.



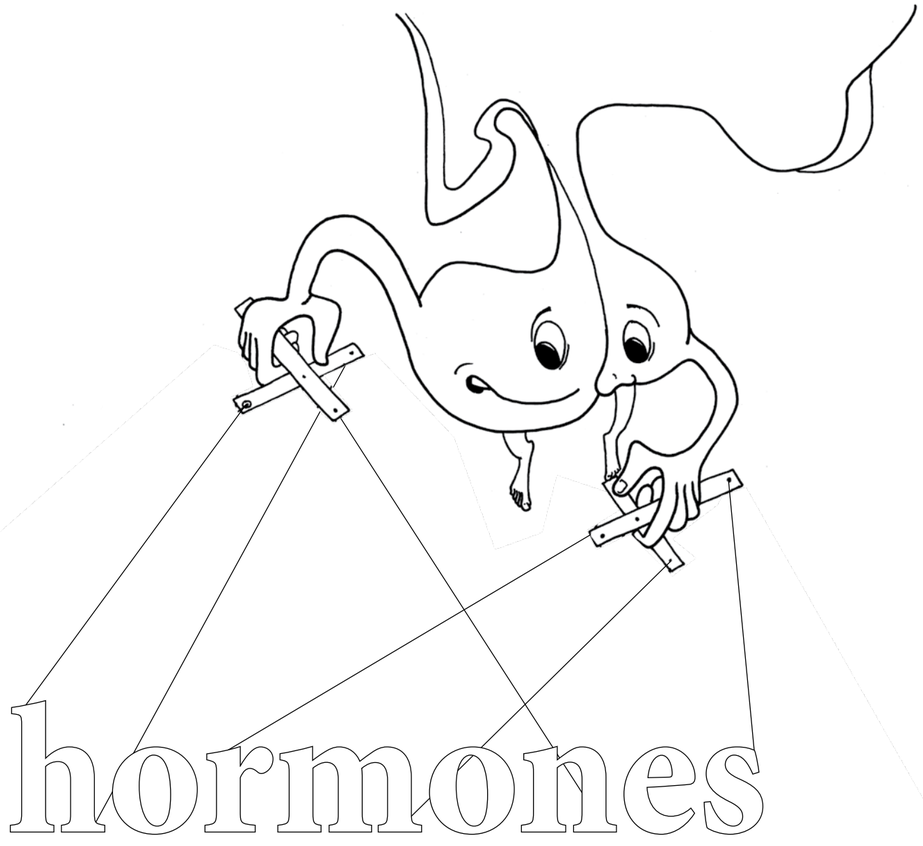
inside the brain

How do we know what our brain looks like on the inside? When we get a scan of our brains, it will create pictures like this by MRI or CT. The pictures are like slices through the brain from the front where our eyes are, to the back of our heads. Brain scans are an important way to look at the structure of the brain and detect any problems.



brain growing up

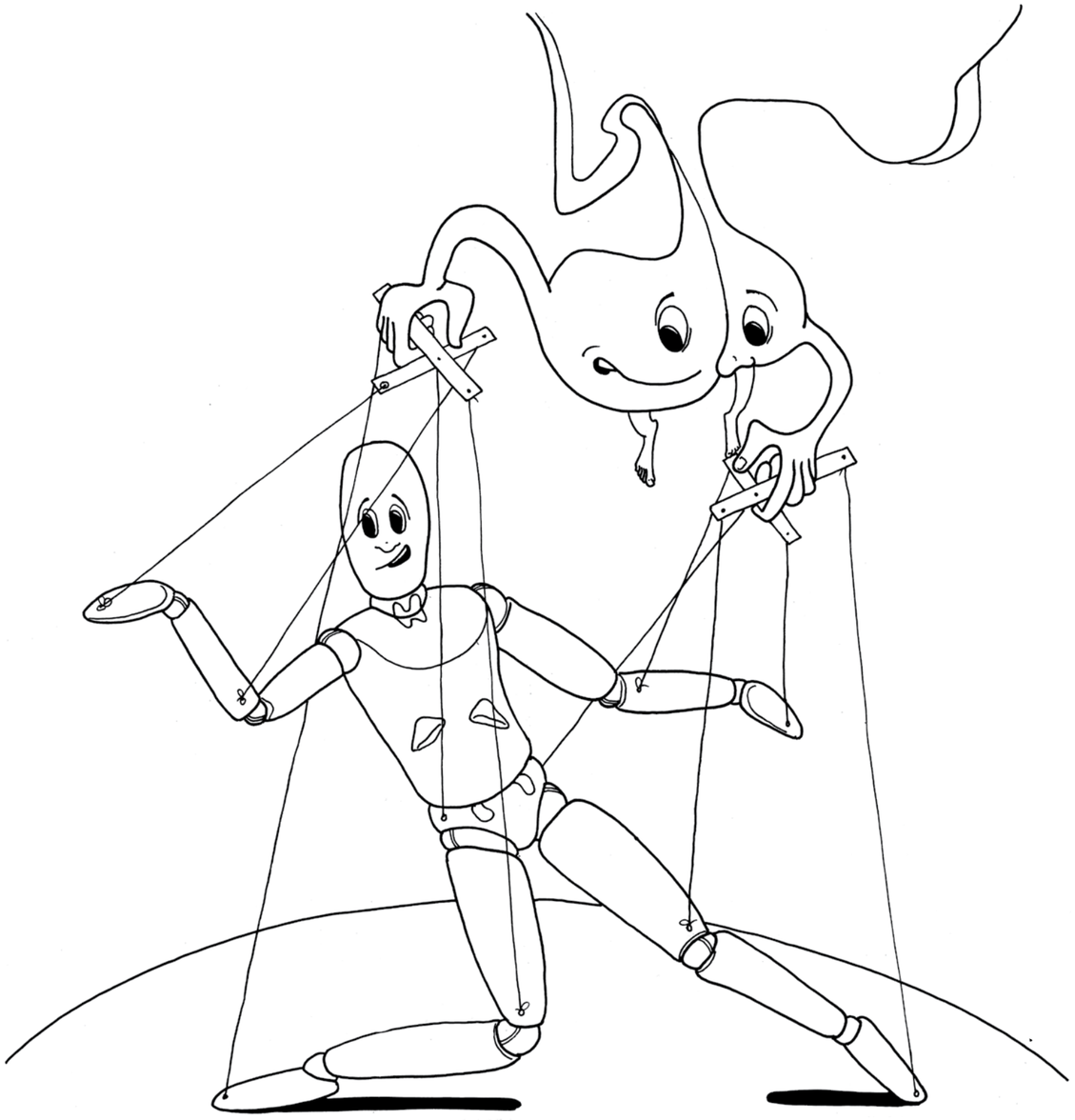
Before we are born, our brains grow, becoming bigger and more complex. It starts off as a simple tube, but by the time we are born it looks a lot like it does in an adult. But it doesn't stop growing there, our brain is still developing well into our twenties and beyond! The last part of our body to fully develop is our frontal lobe. This is important in judgment and not fully mature until our mid-twenties.



hormones

Hormones control most of our major bodily functions such as sleep, growth, reproduction and metabolism. For instance, oestrogen and testosterone control puberty and what makes us male or female.

The pituitary gland is the “master gland” and controls the other glands – just like a puppeteer!



emotions

Our emotions reflect how we are feeling, what happens to us and what is going on inside our brain. Sometimes, when things go wrong, our brain comes under stress and our emotions become upset.

Dr Eoin Kelleher

artist note

Dr Eoin Kelleher is an illustrator, junior doctor and a medical graduate of RCSI.

It's not often you get an opportunity to combine your hobby and profession. When it happens, it is best to take advantage of it and have some fun. This book provided me with much welcome diversion outside of the hospital for a few months, and that is before I have even had a chance to colour in the drawings.

The brain is a fascinating organ. Unlike the rest of the body, it can be difficult to match our understanding of how it works (electric signals between cells) and the end result (consciousness and all that goes with it). Many metaphors for the brain invoke computers and software, which gives a rather mechanistic vision of what the brain does.

There is a nod to certain artistic styles sprinkled throughout the drawings: the surrealist homunculus, the swirling bloodstream in the theme of Japanese Ukiyo-e woodprints. Most important, I hope this book piques your interest, and as you while away a few hours completing the drawings with some colour, you remember that creativity is an important part of our brain.

Eoin Kelleher

eoinkelleher.com

Professor David Cotter

Dr Lorna Lopez

Professor Mary Cannon

Ms Helen Coughlan

scientist note

David is a psychiatrist and a Professor of Molecular Psychiatry in RCSI and Vice Dean of the College of Psychiatry of Ireland. David leads a research team on biomarker discovery for mental illness and has published widely on synaptic changes in the brain in schizophrenia and bipolar disorder. He is enthusiastic about understanding mental illness though neuroscience and he loves gardening in his spare time. David cannot decide which his favourite picture is! But he loves the biomarkers floating in the sea, the brain as a tree and the image of the synapse where little men with parachutes carry messages from the pre to the postsynaptic membrane.

Lorna is a researcher in RCSI and investigates the biological basis of mental illness. She has a particular interest in looking at our biological machinery – our DNA and proteins –to understand why the brain doesn't always work properly. Lorna studied genetics in Trinity College Dublin, and has a PhD on the biological basis of mental illness from The University of Edinburgh. Lorna has written many research articles, has been awarded her own independent research funds and dreams of winning in Wimbledon! Her favourite pictures are the translation tree and biomarker sea – which show exactly what she does – looking for blood biomarkers of mental illness.

Mary is a psychiatrist and Professor of Psychiatric Epidemiology in RCSI. Mary runs a HRB-funded research programme on youth mental health, the effects of stress on the brain and identifying early life risk factors for later adult psychiatric disorders. In 2014, she was listed as one of the most highly cited researchers in her field internationally. She enjoys spending time with her children. Mary also likes travelling in Europe and loves the brain map picture because it reminds her of Venice.

Helen is a HRB funded Clinical Research Fellow with the Psychiatric Epidemiology Research across the Lifespan (PERL) Group in the Department of Psychiatry, RCSI (www.rcsi.ie/perl). Before joining PERL, Helen worked as a social worker for over fifteen years in mental health. She's also very involved in the youth mental health movement. Helen loves film and music so, when she's not working, you might find her at the cinema or singing with her choir. Helen's PhD research is about understanding how people's early life experiences affect their emotional and mental health so her favourite picture is the one showing some of our human emotions.