Issue 6
Spring 2022

THE GREEN FUSE

A natural history magazine created by young naturalists for young naturalists

Welcome

Welcome to the Spring 2022 issue of The Green Fuse Magazine . It has been a busy time for the team and our new website has now been launched. You can now easily download any past issues from www.thegreenfusemagazine.com

This issue is in celebration of 'the little guys' as we wanted to do a special entomology inspired issue to celebrate the wonderful things invertebrates do for us. Invertebrates support life by processing waste, enriching soil, pollinating plants and playing an essential role in our ecosystems. People overlook 'the little guys' or, worse still, see them as pests or feel scared of them. We believe invertebrates are works of art on a micro scale that are essential for all of us to live and thrive! They hold the key to the future of the human race! After reading this issue, if you are inspired to find out more about entomology please download our past issues featuring entomological heroes such as Erica McAlister and George McGavin!

To contact us, please email us at:
thegreenfusemagazine@gmail.com

Photograph by Megan George
Cover photograph by George Fulton

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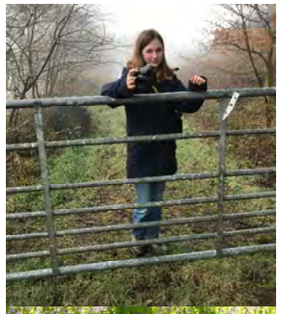
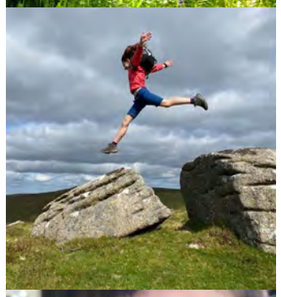


Rose Fulton (13)
Editor, Illustrator, Journalist, Graphic Designer

I am home educated and a keen naturalist. I have always loved nature and would like to pursue a carrer in zoology when I am older. I particularly enjoy birdwatching and woodland walks.

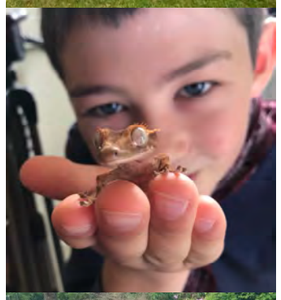
Megan George (12)
Photographer, Journalist

I am a young naturalist living on a farm in the beautiful countryside of Carmarthenshire and my favourite activity is horse riding. I love photography and watching wildlife, particularly birds.



Heidi
Writer, Journalist, Photographer

I love nature and capturing its beauty through art, stories, poems and articles. I enjoy finding out about all of the incredible species that are out there and why they do the things they do.



George Fulton (11)
Illustrator, Photographer, Journalist, Puzzle-master

I love entomology and aquatic life. I would like to work in conservation. I have my own museum with lots of natural history exhibits. I love drawing and creating things. I am currently trying to grow my own food and tropical plants.

Libby Greenhill (13)
Writer, Poet, Journalist, Web-designer
I am an enthusiastic naturalist who loves going on walks through the woods and spending time with my pets. I have always loved writing and have started writing more stories and poetry about nature.

Photograph by Megan George

Why Your Apple Tree May Not Bear the Type of Apples that You Were Expecting

Self–pollinating plants, non–self–pollinating plants and how to graft a tree.

By Heidi

When I was little, my next–door neighbours owned an apple tree that produced the worst fruit that you could ever imagine. They were brown with little red speckles on the outside and an odd yellowy–green on the inside. When you took a bite, it was like slugs were roll–ing around on your tongue and I spat it out immediately. There was none of the full, juicy sweetness to it, it was just a sour paste that pretended to be an apple. They were a real danger too because they were so disgusting that no one would eat them so they would just fall off onto the pavement and lie there, stinking. When I was jogging to the post office, I would always have to stop outside their house and avoid the mines. I'm surprised that no one broke an arm walking past that house, it was horrendous! I always used to wonder why anyone in their right mind would plant such a tree and now I know the answer…

It's not that they chose for their tree to bear fruit that tasted that way. They didn't munch away at one of those awful apples and say "ooh, I'd love to have a tree that gives me more of these!" No! Instead, they dived into their delicious, plump pink lady apple and thought, "I wonder if I planted the seeds from this apple, I'd get a tree that produces these beauties?" And the answer is? You guessed it: no! Why? Well, let me explain with another question: are you an exact clone of your mother? An apple tree is not a self–pollinating plant, this means that it requires the pollen from the stamen of a different plant to be carried by an insect to its stigma for it to reproduce. So, once it has been pollinated, it turns from a flower to, in this case, an apple which is then eaten by an animal and, because the seed has a hard shell to protect it against stomach acids, it is not digested and then it is planted somewhere else. Then it grows into an apple tree but, because it contains the nectar of another plant, it has some of that plant in it which means that its apples taste different. Usually, the combination is disgusting but every once in a while, and I mean very, VERY rarely, someone comes out with fruit that tastes delicious. For example, the Bramley apple was that lucky tree and so was the Pink Lady.

However, some plants that bear fruit, such as lemons and chillies, do produce other plants that produce fruits or vegetables that taste the same. This is because they are self–pollinating. This means that, because all plants have both a male and a female part, they can pollinate themselves and so the "genes" are the same, not a mixture. For example, if a Scotch Bonnet chili is pollinated by itself, then the seeds in one of the Scotch Bonnet chilies will grow into a plant that produces Scotch Bonnet chilies.

Photographs by Heidi

"So," I hear you ask, "how come I can buy loads of Pink Lady apples at the supermarket if it is just one tree that is producing them?" The answer is… grafting. Grafting is where you take the branch of that rare tree and you attach it to another tree and that other tree will grow into or incorporate that branch and start producing the rare fruit. For example, if I had my pink lady apple tree, I would cut a branch off that tree, get another apple tree that has started growing (and does not have a thick trunk) and slot the Pink Lady branch into the growing apple tree. Here's some instructions if you don't want to take a chance and see if your apple tree produces nice fruit:

1. Cut a branch off the tree that produces the fruit that you like (you can buy them on the internet).
2. Cut a slit in the tree that is growing.
3. Cut a wedge in the branch that matches the shape of the slit that is in the growing tree. Make sure the flesh inside the branch is showing, otherwise the branches will not connect because the bark will act as a barrier.
4. Slot the branch into the slot in the growing tree and bandage it up to keep it securely in place, making sure the bandage is not caught in the slot.
5. Keep looking after and watering your plant as usual and, when the stalks have joined together, wait a week and then take the bandage off.

If you are feeling lucky and think that you are going to produce the next brand of apples, then keep growing your tree. However, if you want to stay on the safe side and get a tree that produces the fruit you love, then grafting is the best choice for you.

We Are All Apple Trees

We are all apple trees.
We start off as small, fragile specks of life,
Slowly cracking open and unfolding,
Growing more and more complex as our roots spread out,
Growing and growing and we never stop growing,
As we spread out further and further away from where we began,
Exploring all different places, branching out,
We blossom, we thrive, we are colourful and beautiful,
And as our petals fall off to reveal full, shiny, red apples,
We are generous,
We give and we give and we keep on giving,
Until there is nothing left as our leaves turn,
Red and Orange and Yellow and Brown and sometimes even Pink,
But they fall off and we are still standing,
We battle our way through the harsh storms, the icy wind bites and slaps at our trunks,
But we survive, we endure, we last and we never give up,
We shove through the frosts and the dark nights,
And although the lightning may slash our branches,
Although the heavy snow may wrench off our branches,
Although the freezing air may steal our branches,
We will blossom again.

An interview with

Sarah Beynon

By George Fulton and Rose Fulton

Who was your role model or mentor when you were growing up?

I think probably my Gran and my Mum were my biggest role models. They supported everything I've ever wanted to do. When she was younger, my Gran wanted to be an academic but her father died and she had to earn money for the family. She became a secretary to bring money in, so she wasn't able to go to university. My Gran went back to college later in life when she was able to train to be a teacher. However, you could tell she wanted to be an academic, she always wanted to learn about everything: she was so fascinated by everything around her.

As I was growing up, it was almost like she had this opportunity to do research through me. When I was young, Gran and I used to go out with our bug box and we'd collect insects. We would look at the insects, we'd learn about food webs, we'd draw them, and then we'd always release them. Gran and I created these fantastic mini-projects that were almost like mini research projects.

As I went on in my life, she supported me every step of the way. When I went to university, my Gran was 80, and she essentially did an Oxford University biology course with me. I'd tell her the titles of all the essays I had to do and she would go and buy the textbooks herself. Both of us would write an essay and then we'd swap them, and we'd chat about them over the phone. I think having the support of a person who was just so interested in everything I was doing was possibly one of the main reasons that I became an entomologist. She just brought this life in the undergrowth alive. I can't say enough, how important it is having someone behind you to support you and say: 'yes, what you're doing is good', even if they're not interested in it themselves. I feel very lucky to have had these two very strong women in my life supporting me along the way.

Then there's also Darren Mann. When I went to Oxford University, Darren gave us a tour around the entomology department and he just brought this extraordinary world alive. I volunteered with Darren on the dung beetle collections and then I became obsessed with dung beetles and he's been my friend and my mentor ever since.

Photographs by Dr Beynon's Bug Farm Ltd.

What's your favourite invertebrate and why?

I think it's definitely got to be a dung beetle, I just love the fact that bugs that eat poo are so beautiful and that something that lives in a big pile of poo is so stunning, but also so strong and so important. Dung beetles have extraordinary behaviours as well. For my favourite, I would probably go with the Geotrupes spiniger dung beetle, because that was one of the first dung beetles I ever saw. I was born and brought up on a farm and we used to take our cows to agricultural shows. One time I was leading a big Welsh Black cow called Katherine round the ring and a big beetle came and landed on her. It bounced off Katherine's back and then just lay on the ground, exposing its amazing metallic underside. I remember looking at it thinking, "what on earth are you and what are you doing here in the UK? You're a really big beetle and you're this extraordinary metallic purple colour". This was the first time I realised that we had dung beetles in the UK! Who knew? And then, over the years, I learnt more about them and just how important they are in stopping the whole world being covered in poo and how they can push balls of dung that weigh over one thousand times their own body weight. Another species I really like is Onthophagus coenobita, just because they've got ridiculous characters, they're fantastic little round beetles that just pootle along like little robots.

What can you do to promote a more informed understanding and appreciation of invertebrates?

That's such a good question. Basically, everything we do here at The Bug Farm is to try and answer that question. I think the problem is that we, as humans, are often frightened of things we don't understand and we often show that fear through aggression. It's very easy, especially as a young person, to think you don't like something when actually you're just a little bit worried by it. In films and stories, often when there's a frightening situation, it's happening somewhere dark, in a place full of animals that we're taught to hate, such as spiders, cockroaches, snakes, bats and rats – all those things that conventionally make most people go 'urghh'. We've been brainwashed to believe that scary things happen when these animals are around. We want to turn that view on its head here at The Bug Farm.

I think the most important way to change opinions is to provide education. If we can change a fear into a fascination before people leave The Bug Farm, I think that's the first step to changing attitudes. As an example, many people who visit us are scared of spiders and we hope to show our visitors just how fascinating and beautiful spiders can be. Then off the back of that, next time people see a spider, for example, instead of just killing it they will say 'oh, remember those golden orb spiders we saw at The Bug Farm. Remember how we learnt that their golden web is stronger than steel?' And hopefully that bit of knowledge will make them take a step back and think, rather than treading on a spider they see running across their living room floor. Then the next step is saying: 'right, what can I do to help spiders in my garden?' You can't start that thought process until you've got someone's interest, and that's what we want to do here at The Bug Farm.

What advice would you give to a young naturalist?

I'd say, if you're lucky enough to live somewhere where you can get outside and go watching nature, get outside and just immerse yourself in nature. You don't need expensive kit. I think everyone thinks, 'it's not for me because I need to be able to go to the Amazon rainforest with a huge amount of kit'. You don't, you just need to go out to your local park or out into your garden. Even just walking down the street, you can start noticing nature and then looking at it and then trying to find out what it is you're seeing and then learning more about that.

It's really important to find people in your area who can enthuse and inspire you, whether it's getting in touch with your Local Records Centre (always a good way to find your local recorders) and asking if you can go on site visits with your county recorders, or whether you get involved with, say, the AES (Amateur Entomologists' Society) Bug Club or the Royal Entomological Society's younger members activities – just try and go to some of these events. There are bursaries and scholarships to help people who can't afford to go to these events, including for travel costs. Often, being a naturalist is seen as something you can only do if you've got family support and lots of money, and I think it's really important that we change that. Being a naturalist should be open to everybody because you don't need lots of kit to go and do it.

When you have got started and seen one insect, you then know where to look the next time. You'll go for a walk with friends or family and they'll say, 'oh, I can't see any wildlife', and you say, 'well, there's a beetle sitting on that leaf over there, and I know that because I know that beetle feeds on that particular plant, and if I turn it over at this time of year, I'm likely to see some eggs'. As soon as you've started looking, your brain focuses in on what you're looking at, whether it be birds, insects or any other wildlife.

Do you think invertebrates make good pets and, if so, why?

I think they make great pets for so many reasons! First of all, ethically, you can keep an invertebrate, depending on the species, in a small space without compromising their welfare. I think that's really important for a pet – we shouldn't be keeping animals as pets if it's going to have an impact on their welfare. Making sure they have the five freedoms of animal welfare is really important for every animal, whether it's a vertebrate or an invertebrate. It's easier to do that for an invertebrate, especially one that in the wild has a very small territory. That's why tarantulas can be great pets because certain species of tarantula don't move out from their burrow in the wild. I remember people coming here and seeing Rosie, my pet tarantula, in her small tank and saying, 'oh, but that's a really small tank for her', but it was ok because she just wouldn't go any further unless she was stressed or hungry, and of course we keep her well-fed.

The most important thing is, if you want a pet invertebrate, don't just go out into the wild and grab something unless you know everything about it and you are sure that you can give it a good life in captivity for a short period of time before releasing it where you found it. If you are sourcing a tropical invertebrate to keep in captivity for its whole life, ask the suppliers if the invertebrates are captive bred or wild caught. I don't think it's right to catch invertebrates from the wild to put in captivity just for us to look at, when there are already plenty in captivity. The key to keeping invertebrates as pets is doing your research first.

You need to know what to expect: for example, how many offspring are they going to have? If you don't want them to have that many offspring, what's the most ethical way of coping with that? Have a look at our stick insect care film if you are thinking about getting pet stick insects – https://www.youtube.com/watch?v=dlp0njnAyM4.

What inspired you to start The Bug Farm?

I've always wanted to have my own research centre. I'm passionate about research, about learning things that other people don't know the answers to, about making sure that I'm learning things that are useful. When I was in Oxford University, I loved being there, I loved being a researcher, but I wanted to do research that would make a difference, so I thought, maybe I should just start my own research centre. The kind of research I am interested in is where I can send the results out to farmers straight away to help them change the way they farm their land.

The Bug Farm at the beginning was always just going to be just a research centre. We were never going to be open to the public because, to be honest, I'm not always that sociable! I like hiding away and I like doing conservation work and research.

But I thought, you know what? I could make much more of a difference if we're open to the public, because they're the people who need to change their opinions on invertebrates and on sustainability. Therefore, we opened The Bug Farm as a visitor attraction as well, complete with a Tropical Bug Zoo, Museum, Art Gallery and a series of walks and trails. We have a wonderful team of people who work here who bring this life in the undergrowth alive for our visitors. We put our research into practice on our land to show that it does actually work. Farmers can come here and learn that wildflower meadows can be good for wildlife and you can also sell the hay and make a profit — hopefully they leave thinking: 'that's something I could do back on my farm'!

My long-term goal has always been to turn The Bug Farm into a nature reserve and we are now in the process of doing just that. We are protecting about 200 acres – that's about 200 football pitches worth of land – for nature. We're going to sign the land into a legal trust so that no one can do anything with it in the future and the nature reserve is safe for wildlife forever. We have worked with a solicitor to create the paperwork that we will share on our website to allow other people to do the same thing if they have land themselves — whether that is a garden or a farm.

Are there any opportunities for volunteers to support your work?

Yes, we offer voluntary placements throughout the year. We try to just have one or two volunteers here at any time. We offer volunteer placements to school-age pupils and then we have volunteer placements during school holidays that generally are for people of university age and above, who also get really involved in helping us run The Bug Farm visitor attraction. We also host research students who do projects with us. We interview for all our placements as we get quite a lot of people applying. In fact, we have a waiting list of people who want to come and volunteer with us. If you are interested in volunteering with us, you just have to drop us an email and then, if there is a placement available, we'll quite often just do an online interview. The purpose of an interview is to get to know people and see how they might fit in and when.

Photograph by Dr Beynon's Bug Farm Ltd

Can you tell us about the research you're doing at The Bug Farm?

We do lots of different research here at The Bug Farm. We did some work a few years ago looking at how much money dung beetles could save the UK cattle industry and it turns out that dung beetles can save the UK cattle industry around £367,000,000 per year. The great thing is that you don't have to pay them to do it — we're getting this service for free. By burying dung, dung beetles are not only stopping our countryside being covered in dung, they are also reducing greenhouse gas emissions from dung and, by pulling dung (which is fertiliser) down into the ground, they help farmers who then don't have to use as much chemical fertiliser. Unfortunately, despite dung beetles helping to keep our soils and animals healthy and our air and water clean, we treat our farm animals, horses and pets with chemical wormers and other parasite control treatments that kill them. The chemicals are passed out with their dung and many are toxic to dung beetles. We educate farmers and pet owners about how they can look after dung beetles through our business called Dung Beetles Direct. We worked out that if the UK Government gave farmers money to look after dung beetles by paying them to reduce the amount of toxic chemicals they use on their livestock, the UK cattle industry could save another £40,000,000 per year. We presented these findings to the Welsh Government and the UK Government and they're now hopefully being written into policy.

So that's the kind of research I like doing, because it's research that's saying: this is how awesome these invertebrates are, here is their financial value and this is how to help look after them.

We've got another project going on at the moment too. We're trying to bring back the locally extinct Marsh Fritillary butterfly to the St Davids Peninsula. We're working with the National Trust, the Wildlife Trust, the local council and the Pembrokeshire Coast National Park Authority to create a habitat corridor for the Marsh Fritillary butterfly. We're planting its food plant and we're monitoring how well that's establishing. If the butterfly is not going to come back on its own, then we're going to look at getting a licence to captive breed Marsh Fritillary caterpillars and then release them locally.

Can you define entomophagy?

It's the practice of eating insects by humans. A huge number of people around the world eat insects as part of their diet, it's just us here in the west who find it unusual. So it's a real odd one – when you mention eating insects, everyone in the UK thinks of "I'm a Celebrity, Get me out of here!", the TV programme where contestants have to eat insects for entertainment. And of course that's not what it's about, as entomophagy has evolved in a number of cultures over thousands of years.

I think if we are going to be looking at humans in the west eating insects, it's about looking at species that can be farmed very ethically in high welfare insect farms, that breed very quickly and then grow very quickly as well.

Certain species are thigmotactic – they actively try to touch something else. Species like crickets and mealworms are constantly trying to find an edge so if you put them in the middle of this room here and left them for a few hours or overnight, you'd find them clustered in the corner against an edge and against each other. We currently farm animals like cows and sheep that like to wander over vast distances in herds and have really complex family dynamics. We're trying to feed a growing human population by pushing these animals closer and closer together in smaller spaces on livestock farms, which is totally at odds with what they want to do.

These species are so intelligent yet we often don't take into account the living conditions they need. We're trying to force them into systems that work for humans but not for them. However, you can farm insects like mealworms and crickets in a small space without causing them stress. Having a simpler nervous system means their needs are much more easily met. And that to me is so important and that's pretty much one of the main reasons that I believe in insect farming, and obviously the environmental benefits.

Why is entomophagy so important for the future of the human race and the planet?

With a growing human population, we've got a few options as to how we feed ourselves. The first option is we just keep doing what we're doing and farming how we are. To produce more food in this way, we would need to keep more animals and grow more crops in the same space, which means that we have to intensify our production. There would be more chemicals pumped into the system because our animals and crops would be stressed and we would need to use more fertiliser to grow food more quickly. So that's one option.

Photograph by Megan George

The second option is that we could clear more wildlife habitat so that we've got more farmland – we would have to clear more rainforest, more moorlands and more flower-rich meadows. But that's not what we want to do.

Or the third option is that we start farming a bit differently, and that's where I think insects come in. Because the great thing about insect farming is, they can feed on things that we grow already that we don't need. If you're growing wheat, we take the grain because we can eat the grain and turn it into bread and so on, whereas we, as humans, are not very efficient at getting nutrients from the husk that surrounds the grain and the stems. Insects are much better than we are at processing cellulose and turning it into protein. It means that insects can feed on these sidestreams of foods that we're already growing and then we can harvest the insects as protein.

It's just mind blowing how much more environmentally sustainable insects are at converting their feed into edible protein when compared to our current livestock. Insects require a fraction of the water, land and feed and produce a fraction of the volume of greenhouse gas emissions to get the same amount of protein compared to, for example, beef or pork.

Which is more environmentally beneficial, a plant-based or an insect-based diet?

Personally, I think it's all about balance. I like to eat a predominantly plant based diet, and supplement that with something like insect protein, because you can get all the nine amino acids that our bodies need from insects. Generally, it's much easier to get many of these amino acids and certain fatty acids from animal sources, like insects or vertebrates, than from plants. I think it is a very individual question whether you are happy to eat vertebrate meat or not. I think some people are quite happy eating vertebrate meat once a week as long as they know that animal has lived a good life, whereas other people would prefer not to eat animals at all. However, the main thing is to think carefully about where your food comes from and to support farmers that are growing food in an environmentally sustainable way and looking after their animals well.

Photograph by George Fulton

Record Breaker Insects

By Heidi

Have you often dreamed about fantastical creatures that have seemingly impossi–ble abilities? Have you wished that an incredible being would jump straight out of your book? Well, there is no longer a need to hope because some of those magnificent living things are in your very world right now. When you take one step out of your front door, they'll be all around you, some waking up after a long rest and others seeing the world for the first time. There will be fluffy bumble bees humming as they dive into a sweet, velvety flower. A stream of ants rising and falling over bumps in the ground and swerv–ing around trees. The metallic back of a beetle, shining in the sheets of golden light that float down from the soft sun. The colourful, paper–thin wings of a butterfly as it flies through the buzzing air. They will be darting around the sky and running across the ground. They will be peeping out from between sparkling grass blades and swimming in pools of golden sunlight on bright green leaves. There will be insects of every colour and every size. So, are you ready to dive into reading about a whole bunch of them right now?

Common Froghopper – the highest jumper

As its name suggests, this incredible insect holds the world record for the high–est jumper. An adult is 5–7 mm long (around the width of a pen but definitely not the height!) which not only makes it cute but also makes it extremely impressive that it can jump 70cm high! That is around the height of 8 mugs stacked on top of each other and, to put that into perspective, it's like a 180cm (6 foot) person (around the height of a wardrobe) jumping 180 metres (600ft) which is around 24 two–storey houses! When it jumps, a G–force of over 400 gravities is created. In comparison, an astronaut rocketing into orbit experiences a G–force of around 5 gravities. This is possible due to its ex–tremely powerful hind legs where energy is slowly built up and the legs are fastened in place under the insect's body like a taut crossbow string ready to fire. The legs are then freed and the insect springs into the air away from any predators. In order to allow this to happen, when the Common Froghopper walks, its back legs drag across the ground.

Well, other than this superhuman ability to jump unbelievable heights, what other inter–esting facts do we know about the Common Froghopper? The larvae of the Common Froghopper are green like leaves as opposed to the brown, black, white or striped pat–tern of the adult. The larvae live on plant stems coated in a mass of froth (known as 'cuckoo spit' or 'spittle') which they produce by blowing air into a liquid that they expel. The spittle is for protection against any predators as they eat new leaves and shoots and to keep their bodies moist. As they are herbivores (plant eaters), the adult Froghop–per pierces plant tissue and feeds on the sap. If you are now itching to see this amazing insect, sadly, you have a bit of a wait ahead of you as they start to appear around June time and stay until September.

The Panamanian Golden Tortoise Beetle – a colour–changing insect

Usually, animals change the colour of their skin by tightening the muscles around their cells that contain coloured chemicals called pigments to make less of the pigment visible and then relaxing the muscles around those cells to make more of the pigment visible and therefore changing the colour of the animal's skin.

However, the Panamanian golden tortoise beetle changes the colour of its body from gold to red and back again in a different way. It grows to be about 5–7 mm long and has a transparent shell which usually reflects a metallic gold colour but, when the beetle feels threatened, it turns a dull red. Scientists do not know why the beetle changes col–our but some suspect that the red colour is to ward off predators and look dangerous or poisonous to them, while the gold colour is to attract mates. Their shell has three layers beneath which is a layer of red pigment. These layers contain grooves that, when filled up with the beetle's body fluids, the surface becomes smooth and so reflects light as a mirror would, turning their body a shiny, metallic gold. Then the beetle is able to dry up these fluids which makes the layers act more like windows results in the shell losing its shine and the red pigment showing through. This insect is native to America (lucky you if that is where you live!) and can be found from May to July.

The Desert Locust – the most destructive insect

These unbelievable insects can eat their own weight in food every day and, in a single day, a "small" swarm of about 50 million locusts can eat food that would sustain 500 people for a year! When weather conditions allow huge swarms of them to gather, they destroy almost everything in their path. This can be bad news for farmers in the dry and semi–arid regions of Africa, the Middle East and western Asia as the insects will eat all of the farmers market crops as well as those meant for their livestock. This can lead to food shortages and famine in the area and a loss of income for the farmers, mean–ing that they potentially do not have enough money to plant more crops or sustain their livestock. This single most destructive insect in the world is only 4.5—6 cm (1.8—2.4 in) long (about the length of your little finger) and is often a browny–yellow or bright yellow colour, coming from the same family as a grasshopper, Acrididae. They have a serrated jaw that moves side to side to cut through plants and a bottom jaw and lip to keep it in the mouth. The Desert Locust can change to being social and solitary, unlike grass–hoppers which are solely solitary, and this is called a phase change. They change from being solitary to social under suitable conditions of drought followed by rapid vegeta–tion growth where they gather in swarms, producing lots of offspring with low mortality rates and therefore leading to huge population growth. They can live up to eight weeks and during that time undergo a complete metamorphosis (the process of transformation from an immature form to an adult form in two or more distinct stages). Insects that undergo complete metamorphosis are called holometabolous and typically go through four stages of metamorphosis: egg (what the mother lays), larvae (what hatches from the egg), pupa (when the lava moults for the final time and larval tissues and organs break down entirely then reorganise into adult form) and adult (when the insect has reached sexual maturity and full function of its body (i.e. wings). The Desert Locust goes through a three–stage metamorphosis, however, skipping the pupa stage.

The Saharan Silver Ant – the fastest ant

This lightning–fast ant will pass you in the blink of an eye. You'd be lucky to spot it not only because this speedy insect lives in the Sahara Desert in northern Africa, but because it has been recorded to run at 855mm (85.5cm, around the width of a door) per second! Now, this may not seem like much at first to you with your long legs and the average person's walk–ing stride (one step) being 76.2cm (30 inches), but imagine the size of this insect: Saharan Silver Ants are around only 8mm in length!

To more easily understand just how fast Saharan Silver Ants can go, let's base it on body lengths per second. Measured like this, a Saharan Silver can zip across the sand at 108 times its body length per second! Comparing this to a cheetah (the fastest land mammal over short distances, achieving 16 body lengths per second when reaching its top speed of around 100km/h [60mph]) or Usain Bolt (the fastest man on earth, who ran at 5.35 times his height per second during his 100–metre sprint in 9.58 seconds in 2009), Saharan silver ants really can run! The ant takes 47 strides per second instead of Usain Bolt's 4 strides. Saharan Silver Ants rely heavily upon their ability to reach break–neck speeds owing to the climate they live in. They live on sand dunes where the ground can reach scorching highs of 70˚C and these carnivorous ants usually venture out at midday when the sun is at its hottest to scavenge for small animals that have been weakened or killed by the heat.

Photograph by Rose Fulton

They also leave their underground nests at midday to avoid predatory lizards that are usually staying out of the heat at this time of day. In order to keep contact with the sand to a minimum, these ants stay out of their nests for around 10 minutes and have developed a run where there are short interludes in which all of their 6 feet are off the ground. Another way in which they cope with the heat is by producing heat shock pro–teins (HSPs) (which allow cells in the body to continue to function even at very high temperatures) before they leave the nest so that they do not suffer the initial damage when their body temperature rises quickly. This contrasts with other animals that only produce HSPs once they have come into contact with the heat. If they did not produce these proteins in preparation for the extreme heat, Saharan Silvers would die before the proteins had a chance to take effect. They cannot, however, survive extreme heat as, when the temperature reaches 53˚C, it is capable of killing them. Therefore, when the ants go out in search of food and a few ants stay behind to alert the colony if ant–eat–ing lizards take shelter in their burrows, the ants must get back before the temperature rises to lethal levels. A few more adaptations to cope with the blistering desert heat are silver hairs across their bodies to deflect the intense sun (hence the name Saharan Silver ants) and long legs to keep their body off the ground. So, as well as beating Usain Bolt and a cheetah in a running race, this ant is also among the most thermotolerant (able to cope with heat) animals on the planet!

It's goodbye for now...

The more you carry on learning about and exploring the amazing creatures that are all around you, the more you realise just how precious, magical and incredible our home planet is and how we must do everything that we can to protect every bit of it. Just because insects are small does not mean they are insignificant. Insects are a vital part of the delicate web of organisms that make up our world and you saw what breathtaking things they can achieve.

Photograph by Rose Fulton

Pooter

By Megan George

A great way to study insects up close and personal is to make yourself a pooter.

A pooter is a container that you can use to safely collect small insects without having to handle them.

To make one, you will need:

- A small, clear container with a lid
- A drill or something to make small holes
- Two bendy straws or pieces of flexible tube
- A small, thin piece of material such as muslin or tights
- Elastic band or tape
- Modelling clay or blue tack

1) To begin, poke or drill two holes in the container the same diameter as your straws. You want one hole in the lid and one near the bottom.

2) You then insert the straws into the holes. Add the blue tack around the holes to make them airtight.

3) Attach your piece of material to the lower end of the top straw, securing it with tape or elastic band. This ensures you don't accidentality suck up any insects into your mouth!

4) Screw the lid back on the container and your pooter is complete.

Test your pooter by sprinkling out some dry rice on the table and suck air through the top straw of the pooter while aiming the bottom straw at the rice. You should find the rice is sucked up through the straw into the pot.

Now it's time to go and find some insects to study. Don't forget to release them back where you found them!

Photograph by George Fulton

An interview with

Mick Phythian

By Libby Greenhill

Could you describe the Tansy Beetle?

Chrysolina graminis, more commonly known as the Tansy Beetle, is a chrysomelid leaf beetle that feeds predominantly on the tansy plant Tanacetum vulgare but can also use other wetland plants. The species' world distribution ranges from south–eastern Europe through to central Asia and China. The beetle is an irridescent green and around 10mm long. It is sometimes confused with the much smaller Dock Leaf Beetle (Gastrophysa viridula) or the invasive Rosemary Beetle (Chrysolina americana).

Is it true that the Tansy Beetle is only found in York? And if so, what makes York such an ideal habitat?

The only known British populations are along a 45km stretch of the River Ouse in central Yorkshire and at Woodwalton Fen, Cambridgeshire, where it was rediscovered in 2014 after a forty–year absence of records. The York one is the bigger of the two. There is no certain answer as to why they are found here but it is most likely that the two groups are remnants of a national population that was lost due to removal of the tansy plant from its riverside habitats elsewhere. Tansy is often confused with common ragwort which is often removed as it's seen as poisonous to livestock. It may be that a number of York's ings (flood meadows) have remained home for the plant and beetle due to lesser changes in flood management than elsewhere in the UK.

Is the Tansy Beetle endangered, and if so what is being done to protect it?

The Tansy Beetle is listed on Section 41 of the Natural Environment and Rural Communities Act 2006 and in 2014 it was classified as Endangered in the UK Red List review, establishing the beetle as a species of national conservation concern. It is worth noting that if the tiny Woodwalton population hadn't been rediscovered just prior to the publishing of the revised Red List, the designation would have been Critically Endangered since the Ouse sub–populations are effectively one population with respect to the threat of a major summer flood. In 2008, the Tansy Beetle was recognized as a UK Biodiversity Action Plan species and the Tansy Beetle Action Group was formed to coordinate conservation efforts in the York area. It continues to do so by educating people about the beetle and to ensure its protection, along with trying to maintain and extend its habitat. A small number of ark sites (refuge sites where new populations can be established) for beetles have been established to provide secure populations close to the Ouse but unaffected by summer flooding. In addition, sites have been set up specifically for educational purposes. As a result there are two small sub–populations of beetles at Askham Bryan College, York, on the Selby Canal (Canal and Rivers Trust) and in the York Museum Gardens (York Museums Trust).

Photographs by Dr Mick Phythian (The Friends of Rawcliffe Meadows)

When is the best time and where is the best place to try and spot the Tansy Beetle?

As the beetle normally only has a 12 month life cycle and only a few of those are spent above ground, the ideal time to see them is late August to mid–September when that year's hatchlings are above ground and feeding up before descending underground for the winter. Then from mid–March onwards through to approximately May, the beetles climb above ground to mate. At this that point, the tiny eggs and larval stage can be observed before the larvae go underground for the summer. In York the beetles can sometimes be seem on the plants in the Museum Garden or along the River Ouse at places such as Fulford where there are established clumps of tansy (see list of ark sites above).

What sparked your interest in the Tansy Beetle?

I've been interested in nature since I was a child and have a long history as an environmental campaigner. When York Natural Environment Trust, a voluntary organisation of which I was and still am a director, started managing an area of the York Ings (flood meadows) in 1990, we named it Rawcliffe Meadows. During the time we were monitoring the wildlife, we discovered a small population of the beetle and subsequently built it into our management plan to plant more tansy and hope the Tansy Beetle would follow. The population has changed over the years as the flooding since 2000 has become more unpredictable, but was still strong when we relinquished management of the site due to an Environment Agency multi–million pound flood prevention scheme.

What advice would you give to a young naturalist?

Nature is all around us in many strange and wonderful ways – keep your eyes, ears and mind open and be prepared to absorb that wonder!

An interview with

Alessandro Giusti

By Rose Fulton

My brother George and I went to the Natural History Museum in London to visit Mr Alessandro Giusti, one of the curators in the Lepidoptera section of the Insects Division, to interview him for The Green Fuse Magazine.

After following Alessandro through the staff entrance to collect our official passes, we made our way into the Darwin Center's famous Cocoon. Upon entering the vault where specimens are stored, I was struck by the sheer size of it! The floor–to–ceiling stacks that lead off the main corridor slide effortlessly to one side at the turn of a wheel, revealing drawers and drawers of delicate specimens, each as beautiful as the next, just waiting to be discovered. Indeed, Alessandro has been curating these collections for over ten years and he says there are some cabinets that he hasn't even opened yet! Every day, he looks forward to exploring the collection and enjoys the excitement of not knowing what he is going to find next. Some of the drawers are mixed and contain many different species so it isn't always easy to find the one you are looking for.

We asked Alessandro how he first became interested in Lepidoptera. He told us how he had been fascinated by the natural sciences since he was young and that growing up in Tuscany (Italy) gave him plenty of opportunities to pursue this interest as he was surrounded by nature. He would often go out with his family, his father teaching him about mushrooms, insects and plants whilst Alessandro documented everything about the natural world through drawings and writing. Alessandro was particularly interested in the interactions between insects and other organisms, including the relationships between plants and the so–called 'pests'. He studied at an agricultural college before going to university to study natural sciences, which included the study of parasitic wasps and flies, which he found fascinating. He then landed a volunteer opportunity at the Natural History Museum in London which led, eventually, to him becoming a curator in the Lepidoptera section.

We asked Alessandro for a definition of Lepidoptera and he explained that it is derived from the Greek for scaly (lepis) and wing (pteron) because, when viewed under a microscope, Lepidoptera wings show lots of microscopic overlapping scales covering their surface. Lepidoptera is an order of insects that includes butterflies, moths and skippers. When we asked Alessandro what the differences between the three are, he replied that Lepidoptera is a diverse order of invertebrates and it is difficult to identify a particular characteristic that would define each of these three groups specifically. He went on to explain that, while he could identify differences between the groups, for each difference there would be multiple exceptions.

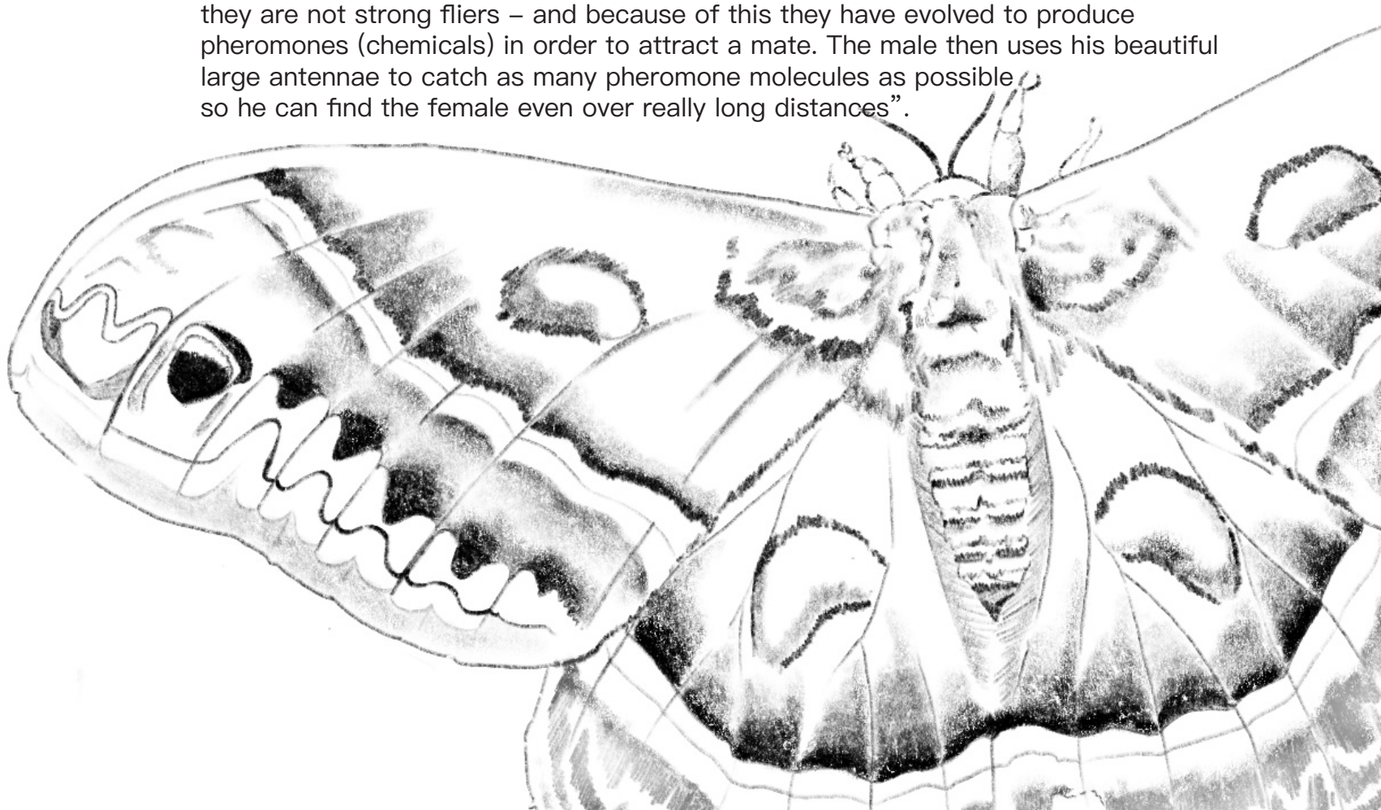
For instance, people often say that one of the differences between moths and butterflies is that butterflies have 'clubbed' antennae, but many moths also have 'clubbed' antennae, an example being the Burnet Moth in the family of Zygaenidae. Tropical Sunset Moths (family Castniidae) also have a very distinct club on the tip of their antennae, so clearly this characteristic is not a valid method for differentiation between moths and butterflies. Nonetheless, the clubbed antennae does work as a basic rule in Britain and Europe but doesn't always apply if you are trying to identify specimens from the tropics.

Alessandro explained that another challenge when attempting to identify Lepidoptera are the many 'cryptic species' found in this order (species that are very difficult to separate from each other). He said that, while you can generally find some morphological characteristics that differ from one species to another, some specimens cannot be identified from their appearance alone. Sometimes you need to look at their genitalia to differentiate between species, but even genitalia – typically the main feature that separates one species from another – can be quite similar at times. In cases when there are no perceptible differences between two species, the only way to differentiate between them is to compare their DNA.

I can't even begin to describe all of the amazing specimens we were privileged enough to see with Alessandro, but I can tell you about a couple of our favorites.

Madagascan Luna Moths

Alessandro showed us a magnificent specimen of a Madagascan Luna Moth. He explained how, because they don't feed as adults, their mouth parts are reduced and atrophied: "[t]hey are very beautiful but they don't do much! The females emerge from the cocoon and they just sit there. They don't go that far, sometimes laying their eggs just outside the cocoon. They don't fly much either – they could if they wanted to but they are not strong fliers – and because of this they have evolved to produce pheromones (chemicals) in order to attract a mate. The male then uses his beautiful large antennae to catch as many pheromone molecules as possible so he can find the female even over really long distances".



Photograph and illustration by Rose Fulton

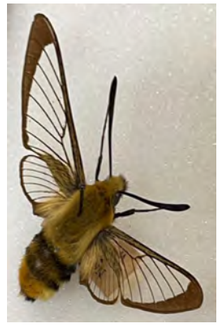
Darwin Predicter Moth

Next, Alessandro opened a drawer containing a moth with an extremely long proboscis. He then related to us the extraordinary tale of its discovery: “in 1862, [a] botanist in Madagascar sent Darwin an orchid with a very long spur and at the end of the spur was nectar. Darwin predicted that there would have to be a moth with a very long proboscis to feed on it, and it would pollinate the flower at the same time. When he said this, the moth had not yet been discovered. Eventually it was discovered in 1903, as predicted by Darwin”. He said that “for a long time after its discovery, no–one knew how it fed but, being a sphingid, the moth hovers in front of the flower and then unrolls its proboscis with amazing precision and accuracy into this tiny little hole!”

Nearing the end of our visit, we asked Alessandro what advice he would give to a young naturalist. He answered, “[t]o have passion is incredible. The passion to try to fix the chaos the adults have created. Thank you very much for doing that. We’ve been so guilty, because we should have thought about it before. Having a real passion to respect the natural world, to seek answers because there’s so much still that we need to learn. In entomology and other sciences there is so much that we don’t know. Often we know the species name, but not more than that. We don’t even know what they feed on or the interaction that they might have with the environment around them, the pollination they do or the predators that eat them. Sometimes we don’t even know this for species in the UK, let alone in the tropics where the diversity is even greater. For a young naturalist, there’s also an element of luck, of being in the right place at the right time, so it’s good to think about starting to volunteer.”

Photographs by Rose Fulton



















The Wild in Our Reach

By Libby Greenhill

Butterflies fluttering through the air,
Stag beetle pincers prideful– strong,
The ladybird's poison feet scuttle away.
Bees flit, with pollen coating their bodies.
Insect wings fill this sun filled day.

A thousand butterflies fill air with chaos,
Each one unique in their own perfect way.
Oranges and blacks dye the air with beauty,
Turning everything into a sunset glow.

A coating of beetles line leaves,
Sharp blacks and deep emerald greens,
Shining shells on their backs glisten with sunlight,
Turning everything into dawn glow.

Ladybird lies on deep red rose,
Spread wings, softly fly.
Charcoal black imbedded in ruby red.
Turning everything into joyous glow.

Bumble bees buzzing through air,
Honeycomb sent wherever they go.
Musical notes sing out from their soul,
Turning everything into freedom glow.

Look out and see
That the insects are free,
About their busy day.
Honour is theirs and will always be so.
Joy laughs as the insects sway.

Photograph by Megan George

An interview with

Sam Bosanquet

By The Green Fuse Magazine Team

What is a moth trap?

A moth trap is a light that attracts moths to a box filled with eggboxes where they can rest until the morning and the trapper can then identify and record them. It is completely harmless to the moths.

Why do you moth trap?

I have loved identifying wildlife since childhood: birds and flowers since I was aged three, butterflies soon after, then moths as a teenager, and bryophytes, lichens, fungi and various invertebrate groups as a grown-up. Moth trapping is particularly exciting because it gives you a chance to encounter beautiful creatures that you would otherwise not see. You can see moths by walking at night with a torch and net or by looking at nectar sources after dark, but a moth trap is the easiest way to see good numbers of moths.

What does your role as a moth recorder involve?

As Carmarthenshire County Moth Recorder I coordinate and verify records from the county's moth trappers and then once a year send the complete dataset to the National Moth Recording Scheme and the West Wales Biodiversity Information Centre. On average, I receive about 18,000 records a year and the complete county dataset now holds nearly 340,000 records of over 1,300 moth species.

Why do people moth trap?

Most Moth'ers (note the apostrophe to distinguish us from mothers) trap to see what species visit their garden and to enjoy the beauty of moths. Some are more keen and take portable traps out into the wider countryside to see what moths live in other habitats, or go searching for micro-moths or caterpillars. Moths wander, so a garden trap will catch species from the surrounding area and even wanderers from other countries, so you never know what you are going to find.

Can our readers make moth traps at home? If so, how?

Making your own moth trap is not too complicated, but it is important to get the correct electrics and ensure they are put together in a waterproof way so that rain doesn't mix with the electricity. It is probably best to buy the electrics from a Lepidopterist supplier and build the box to house them. Normal lightbulbs don't attract nearly as many moths as special MV or Actinic bulbs. There are instructions for building traps on the internet. I have just built a cheap, portable battery-powered UV LED trap to take on holiday.

Photograph by Sam Bosanquet

What's the most exciting moth you have found?

The two Striped Hawkmoths that visited my garden moth trap one night in 2006 were probably the most exciting because they had flown here from southern Europe and they are utterly stunning! Much rarer, and also very exciting, was a Shining Marbled that visited my moth trap near Monmouth during a heatwave in June 2020. This was only the twentieth Shining Marbled to be recorded in Britain and the first ever for Wales.

Why do we need to look after moth populations?

Moths are really important pollinators for flowers: just as important as bees and butterflies, but hidden from us because they fly at night. They are also crucial in food-chains because their caterpillars eat plants and are then eaten by other animals. Adult moths are also a significant food source for birds and bats.

What are the differences between butterflies, moths and skippers?

Butterflies, moths and skippers are just part of the big family tree of Lepidoptera. There are some structural differences, for example with their antennae, between the Lepidoptera families that we call Butterflies and those we call Moths, but the differences are not simple. All European butterflies fly by day, but there are also many day-flying moths.

What should a young entomologist have in their bag?

The most crucial things to carry are small tubes to put each invertebrate in and a notebook to record what you think you have found. You won't necessarily know what it is, so just write "small orange moth, tapped from Alder by Nant y Caws, 26th June 2022, tube D" in your notebook and then put the moth into your tube labelled "D". I use glass tubes because plastic ones can damage moths and go opaque very quickly. You can also carry a pooter, sieve, magnifying glass and so on. My net is too big to carry in a bag and my binoculars (especially important for dragonflies and butterflies) are always around my neck.

What are the challenges of moth identification and how did you learn the different moths?

Moth identification is much easier now than when I started in the early 1990s. Back then there were just two identification books for Britain, but now there are plenty as well as good websites like UKMoths. It's easiest to start with macro-moths because they are bigger, have English names, and are covered by one book. About two thirds of our moth species are micro-moths, which are smaller and don't have English names. You can identify some of them with basic books, but some of them are much more difficult. I learned my moths by matching them to pictures in the macro-moth book I was using at the time and then reading the text to make sure I was correct. Reading the text is really important to make sure the moth you think you have identified is not found only in Scotland, or only flies in October when you are trapping in May.

What can the readers do to support moth populations?

Moths need foodplants for their larvae, so don't be too neat and tidy and allow some 'weeds' to grow. Moths also need nectar sources for their adults, so grow pollinator-friendly plants in your garden (best grown from seed or bought from a local plant swap so as to avoid the insecticides used by many garden centres). Also tell grown-ups that most moths don't eat clothes: only two small species of Clothes Moth have larvae that eat clothes, so you can reassure your grown-ups that the big, beautiful moth which flies in through the window at night is something to admire and not worry about!

An interview with

Peter Randall–Page

By Rose Fulton

When did you first know you wanted to become an artist?

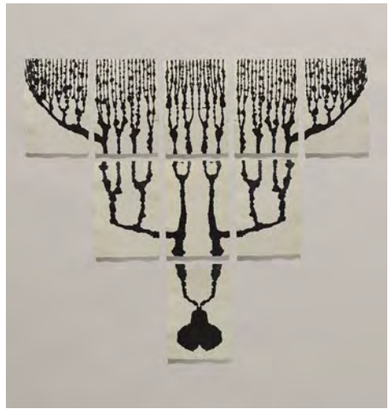
My father was a model–maker who made dioramas for museums. I used to work with him, so I sort of grew up making things with my dad in the garden shed, things like scale models of tea plantations. I was very dyslexic as a child, extremely dyslexic. Now I'm grown up and actually quite old, I have taught myself to read and I read a lot, but when I was a child, I had real literacy problems. I was very interested in things such as natural history but I couldn't access information in the usual way through reading. I lived in the country so my way of understanding the world was through observation, pick–ing up shells, stones and bones and things on my walks in the countryside. I always did lots of drawing and making things. I can't really remember when I didn't want to be an artist.

Who were the artists that inspired you as a young person and did their influence find its way into your work?

My primary influence, actually, is probably the natural world: just looking at things and seeing how patterns appear, similar patterns in different contexts, and just understand–ing how things fit together through observation and drawing and picking things up and looking at them.

In terms of art influences, I spent a lot of time as a teenager going to places like the British Museum and what was then the Ethnographical Museum, looking at things which are all pretty much 'anon', they're not attributed to any particular artists. They are an–cient things from all different cultures throughout the world, such as wonderful prehistoric figurines, pre–Columbian South American art, artefacts from India and from sub–Saharan Africa. All those kinds of things I was fascinated by and that was a really important primary influence.

In terms of actual individual artists, a defining moment for me that made me sure that I absolutely wanted to be a sculptor was when I was about 16. I was on a college trip to Paris and I saw the reconstruction of Brancusi's studio. Constantine Brancusi was a very important early 20th century sculptor, he was Romanian and he walked all the way to Paris. They had a reconstruction of his studio, at that time it was in the basement of the Musée d'Art Moderne in Paris and not many people went down there, and it was like he'd just walked out to get a cup of tea or something, there were tools and benches and part–finished pieces of work. I was completely smitten and I just thought, well, this is definitely what I want to do.



Photographs provided by Peter Randall–Page

What is your favourite medium to work in and why?

I think I'm probably best known for working with stone, although I do work with lots of different materials and always have done. I've always done lots of drawing and print–making and I've worked with clay and with wax and casting into cast iron and bronze, and I've done lots of ceramic work as well. I think stone is probably my favourite medium. That's partly because a piece of stone is already a thing which has got its own sort of presence and its own 'thingness', if you like. So it's not like it's a blank sheet of paper – it's not like that really scary moment where you're looking at a blank sheet of paper and you think, "gosh, what am I going to do? What's my first mark going to be on this piece of paper?". A stone is already a thing, and even before you've decided what you're going to do, in a funny way, you're already kind of changing it in small ways, just rolling it over and maybe taking a corner off, which makes it easier to turn or something like that. And I love the fact that it's a finite thing, it's just a piece of dumb material. It's not like wood, which was a growing thing, an organic thing.

Stone, it's the ultimate, quintessential sort of stuff, if you like, it's what the earth is made of and what the planets are made of. I love the idea of using this stuff that human beings had no influence on at all, it's just a result of completely natural processes over a geological time scale, it's what we consider to be ultimately dead, not living, not organic stuff.

I love the challenge of trying to imbue something that is just stuff, to give it some sort of sense of life and vitality, because of course, if one thinks about history in a big sense, I mean the history of the universe, there must have been a moment when things that we consider to be inorganic actually made that transition to becoming organic things which were capable of self–replicating. So in a sense, there's less of a division, I think, between organic and inorganic in our universe than we perhaps usually imagine, because at some point, things which we consider to be very much dead things became living things.

When you think about it, self–replicating, which is the signature of living things, of or–ganic life, things that can reproduce themselves, in a way you already get that in inorganic phenomena . If you think about crystalline structures, or molecular structures or atomic structures, they're all things which, in a way, have to do with patterns and with self–replicating.

On your website, it says that your practice is informed and inspired by the study of natural phenomena and their subjective impact on our emotions. So first of all, can I ask what it was that originally made you interested in natural phenomena?

How can you not be interested in natural phenomena?! I was just always completely astonished by the world and interested in learning about how things fit together and why we find similar patterns and similar structures produced by processes which are often diametrically opposite. So you might find, for example, the hexagonal stacking of basalt columns in something like the Giant's Causeway in Ireland, and you get exactly the same hexagonal pattern in a honeycomb – the same geometry, exactly the same geometry, but the processes that produced those shapes couldn't be more opposite. One is formed through inorganic processes of cooling and shrinking and cracking, in ways that are determined by physics , and the other, the honeycomb, is produced by the instinctive behaviour of these highly social creatures that, just by instinct, produce this extraordinary geometry.

Another example: if you look at river systems that are determined by gravity – by the water being pulled downhill by gravity and by the topography, the lie of the land, the hills and the valleys and so on – it's to do with water draining from little tributaries into bigger streams and then into larger rivers, into an estuary and then out into the sea. And if you look at that sort of pattern from an aerial picture, it's exactly the same kind of pattern you get, for example, in the way plants and trees grow, but in the opposite direction. The river–system pattern is formed by entropy, by things draining down, by everything trying to find its level, so the water's always flowing downhill, whereas the tree branching pattern, which looks very similar, is produced by the little filaments in the wood of the tree trunk which, by capillary action, draw water up to each individual leaf, actually pushing against gravity. And it's this, the vitality of organic form, which can , for a limited period of its lifetime, actually resist the forces of entropy. That's what's extraordinary about life.

I wanted to understand things about natural history and things about physics and about biology. As I say, because I was so dyslexic, I couldn't get anywhere with anything at school and I was told the whole time that I was either stupid or lazy, and I used to go for the stupid option, because that meant it wasn't your fault, whereas lazy, it kind of was your fault. I suppose it's a combination of wanting to understand the world and just being completely consumed by a kind of reverie in the extraordinary complexity and beauty of the natural world.

The second part of the question is, what impact do you find that natural phenomena have on your emotions?

When we think about natural history or the categorization of things and labelling everything, it's very easy to go around just recognising stuff and putting it into words and not really looking at it, not becoming really absorbed in the reverie of actually looking at the world and how it affects how we feel.

Different places make us feel differently. I mean, the world enters our consciousness as emotion but also as emotion. This subtext, if you like, of the way in which the world impacts us in terms of emotions is something that we don't talk about very much because, in a way, there's very little to say about it and it's quite hard to put into words. Poets attempt to put this sort of thing into words and artists attempt to express it in other ways.

If you really allow yourself to go there, then different shapes, different forms, different colours, different patterns, do have an emotional impact for us, they can have a very strong impact, so I try to focus in on that aspect of our experience of the world – what it's making us feel, as well as what it's making us think and understand.

Do you think art can play a part in addressing the environmental challenges we are all currently facing, and if so, how?

I do. It makes me think of that wonderful Joni Mitchell song [Big Yellow Taxi] which actually comes back to me more and more as the environmental crisis becomes more acute, where she sings 'they paved paradise and put up a parking lot'. I think, although it may sound a crass thing to say, I think that an important aspect of care for the natural world can actually be seen on an aesthetic level.

Of course, the real reason we should be protecting the environment is because it is wondrous and good and – I'm not religious at all in a conventional sense – but the earth is kind of holy in itself, just for itself. I mean, the reason we should be saving the envi–ronment is because it is intrinsically worth saving and important in itself, not because it can help us to develop new medicines or new technologies or all these kinds of reasons.

I do think that, when we see a beautiful valley being concreted over and a supermar–ket, a nightclub and a car park in its place, I mean, that offends me, and I'm sure lots of other people, not only on an environmental level but on an aesthetic level. You know, nature and the evolutionary process which produced it are so much more rich and beautiful and powerful and unfathomably complex and absolutely beyond any imagin–ings.

I don't need to feel that there's some kind of omnipotent Creator who created it all, because what really happened, this extraordinary process that Darwin first started to elucidate, is so much more magical than anything that one could dream up in terms of gods and goddesses creating the world. Of course, those stories are very powerful and interesting in terms of how they reveal the workings of the human mind and the human imagination, which I'm also extremely concerned with in my work.

What advice would you give to a young naturalist who enjoys making art?

My work straddles research and inquiry into things because I'm just so fascinated by them and I want to understand how things work and fit together and how the natural world works and how, in fact, you can see all the forms in the natural world as being infinite variations on a surprisingly small number of themes. And of course, those themes are rooted in the laws of physics, just the way things are in our universe. The interesting thing about geometry is that it's something which doesn't exist, it's predicated on the idea of flat planes and perfect circles and so on, things which don't exist in the real world.

One of the wonderful things about the human imagination is that we can look at, say, pebbles on the beach – they're all different, you never see two the same, just like you never see two human faces the same nor two leaves the same. Our imaginations are able to extrapolate, from numerous variations, what is the underlying model on which all pebbles are based, the shape that all pebbles are 'trying' to be. Of course, the conclu–sion you come to is they all want to have a minimum surface area to volume. Actually, the smallest possible surface area to volume is a sphere, but you'll never find a perfect–ly spherical pebble, which is what happens when you knock corners off things like what happens with pebbles in the sea. Even the planets and the Sun are not totally spherical, but because we can imagine and we can extrapolate from imperfect examples in the real world what the fundamental model of the ideal leaf or the ideal pebble would be, that takes us into the realms of geometry, which actually only exists in our imagination.

My advice would be to study and research and understand how the natural world works and, simultaneously, to throw yourself into the reverie and enjoyment of the magical, unimaginably wonderful world that we live in and all the beautiful things that we see around us. I have spent my life doing both those things, trying to understand things and just surrendering myself to the beauty of it.

Photographs provided by Peter Randall–Page

The Bug Club

By George Fulton

The Bug Club is run by the Amateur Entomologists' Society. It is their young entomologists' membership scheme. As a member of The Bug Club, six times a year you receive a magazine full of interesting articles and facts about invertebrates. There are events to attend and competitions to enter. You also get access to a members' area of the website (https://www.amentsoc.org/bug-club). George, a Bug Club member on the Green Fuse team, contacted Dafydd Lewis and Victoria Burton to find out more about The Bug Club.

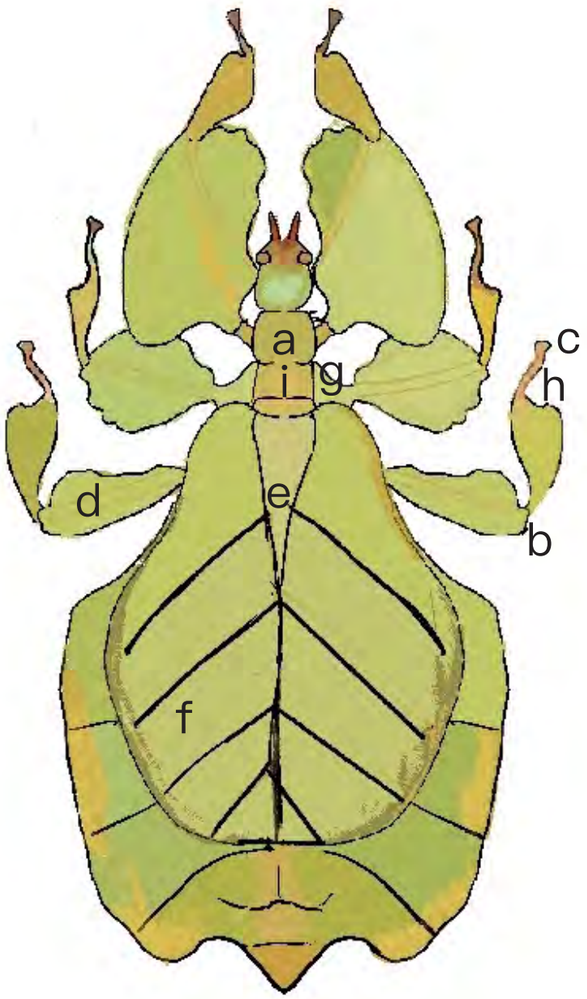
Victoria told George about how, when she was young, there weren't ways of connecting with others and sharing her interest in entomology. She didn't know about The Bug Club, even though it did in fact exist back then. When she was a child, Victoria was inspired by exploring nature in the woods near where she lived and bringing home her natural history finds including all sorts of different animal skulls. Victoria used to keep her natural history finds, such as her collections of skulls and pressed flowers, in her 'museum' at home. She didn't collect insects at that time, finding them fragile and tricky to collect. To learn more, she read books, her favourite was The Amateur Naturalist by Gerald Durrell, which has recently been updated by Nick Baker under the title of The New Amateur Naturalist. Dafydd recommends Gerald Durrell's other books, including My Family and Other Animals. Dafydd's interest in the natural world was sparked by his friend Freddy showing him a jam jar full of butterflies. Freddy lost interest but Dafydd wanted to find out more. When Dafydd was young there was no internet and the books that are now available to us to identify moths and butterflies simply didn't exist. If there were illustrations, they weren't very good at helping with identification. The practice then was to build your own collection and pin your own specimens. Dafydd says there is no longer any need to build your own collection as so much information is now easily available in books and on the internet.

Photograph by George Fulton

Anatomically Incorrect!

Match the terms to the body parts then check your answers on page 42. Enjoy!

1. Prothorax
2. Mesothorax
3. Trochanter
4. Metathorax
5. Tarsus
6. Tibia
7. Femur
8. Coxa
9. Wings



1/a, 2/i, 3/g, 4/e, 5/c, 6/h, 7/b, 8/d, 9/f

Photograph and quiz by George Fulton

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