



09	Mathematics and Beauty	142
	<i>Andy McIntosh</i>	
	The Nature of Mathematics	
	Patterns and Beauty in Mathematics	
	Mathematics and Music	
	Elegance in Mathematical Equations	

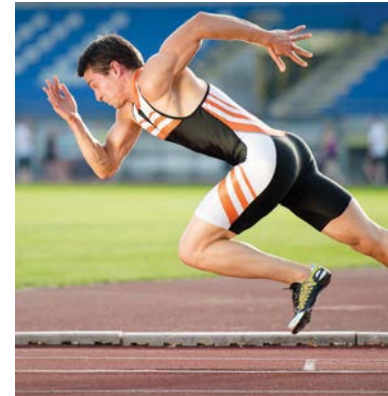
10	Materials	152
	<i>Stuart Burgess</i>	
	Inorganic Materials	
	Organic Materials	

11	Mankind	160
	<i>Stuart Burgess</i>	
	The Brain	
	The Nervous System	
	The Heart and Lungs	
	The Muscles and Skeleton	
	The Skin	
	The Eye	
	<i>Andy McIntosh</i>	
	The Wonder of Hearing	

12	A Changed World	184
	<i>Andy McIntosh</i>	
	Rock Layers	
	"Living" Fossils	
	Extinct Creatures	
	Dinosaurs	
	Radioactive Dating and What of Carbon 14	

13	The Six Days of Genesis	202
	<i>Brian Edwards</i>	
	Genesis and the Style of Writing	
	Genesis and Observational Science	
	Genesis and the Meaning of the Text	

14	What Happened?	206
	<i>Brian Edwards</i>	
	Something Went Terribly Wrong	



The Wisdom of God

Beyond the Book of Genesis, one of the most beautiful passages in the Bible describes, in the symbol of a person, the wisdom of the God who made everything.

“The LORD brought me forth as the first of his works,
before his deeds of old;
I was appointed from eternity,
from the beginning, before the world began.
When there were no oceans, I was given birth,
when there were no springs abounding with water;
before the mountains were settled in place,
before the hills, I was given birth,
before he made the earth or its fields
or any of the dust of the world.
I was there when he set the heavens in place,
when he marked out the horizon on the face of the deep,
when he established the clouds above
and fixed securely the fountains of the deep,
when he gave the sea its boundary
so that the waters would not overstep his command,
and when he marked out the foundations of the earth.
Then I was the craftsman at his side.
I was filled with delight day after day,
rejoicing always in his presence,
rejoicing in his whole world
and delighting in mankind.”

Proverbs 8:22–31 (NIV)

01 Since the Creation of the World

“Since the creation of the world God’s invisible qualities — his eternal power and divine nature — have been clearly seen, being understood from what has been made”
(Romans 1:20; NIV).

Everyone agrees that if the universe came into existence “by chance,” it did so against immeasurable odds. It follows that if every living thing evolved step by step over millions of years into the intricate, complex, and kaleidoscopic beauty and order that we see around us, this also was against these incalculable odds. We may go further and claim that if the vital interrelationships of the universe evolved — the precise movements of the planets, the regular seasons of the year, the reliance of all living things upon each other — they did so against the same unimaginable odds.

In other words, we must conclude either that everything — each individual detail — in the known universe, and especially planet Earth, evolved against a series of unimaginable and unbelievable odds — or we should look for an alternative and more reasonable explanation.

It is that more reasonable explanation which is presented in this book.

No human being was there at the start so, left to ourselves, we cannot know for certain how it all began. As one popular scientist frankly admitted, “There is no scientific mechanism to explain how the universe began.”¹ In other words, the honest scientist must concede that our current views about the origin of everything are often speculation — guesswork based upon the little that we actually know for certain and what we think might have been.

Continually representing this as fact does not turn speculation into reality.

In the pages that follow, you will experience a few of the incredible complexities of the world around us as you understand the things that are made. You will see, over and over, the meaning of “irreducible complexity” — that so much in creation is so complex that it must be complete at once to work at all. A rational mind will face the challenge of whether this is all the result of an unlimited number of immeasurable odds, or whether a more satisfying and reasonable explanation is that the invisible character and the eternal power of a Creator is clearly seen.

Understanding origins is much more important than conjecture and guesswork by some parts of the scientific community. If we know how everything began, that might give us an explanation of how it will all end, and equally important, how we explain where we are now. The knowledge of origin and destination will tell us much about the route between the two.

Sadly, that route is plainly not all that it might be. The beauty and order, the incredible harmony and diversity, is too often shattered by violence and pain, disorder and death. Before our journey in this book concludes, we will face this issue and the question posed by theologians, scientists, and philosophers for millennia: “What is the purpose of it all?”

But first, enjoy the panorama of a creation so beautifully detailed, ordered, and complex that it would be unbelievable if it were not there in front of us.

¹ Prof. Brian Cox in his BBC *Human Planet* series, October 2014.

“If we know how everything began, that might give us an explanation of how it will all end, and equally important, how we explain where we are now.”



02 Land Mammals — Horses

The horse has a super-sized heart and lungs that enable it to be fast, strong, and powerful. It is ideal for humans because it can be ridden, trained, and bred into many varieties and for many uses.



1 Wild horses in Patagonia, Chile

Most horses in modern times are domesticated and are used for work, sport, or leisure. However, there are still wild horses in many parts of the world. Figure 1 shows wild horses in the National Park of Torres del Paine, Patagonia, Chile. Large horses can be as tall as 18 hands (6 feet) at the “withers,” which is the ridge between the shoulder blades of the horse. Ponies are small horses, usually defined as horses that measure less than 14.2 hands (4.8 feet) when fully grown.

Lungs and heart for power

The fastest horses can run at speeds of up to 50 mph, which is around double the speed of the best human athletes. One of the reasons horses can run so fast is

their huge lungs and heart and consequent capacity to extract large quantities of oxygen for energy. Figure 2 shows how horses have enormous lungs compared to humans.

The whole cardiovascular system of horses is designed for power and speed. The lungs are so big that they can take in 15 l of air per breath, and an incredible 1,800 l of air intake per minute compared with 150 l per minute in humans. Horses also have a large heart and a large quantity of blood of around 50 l. This volume of blood enables vast amounts of oxygen to be carried around the body to drive the muscles. Even the action of running is designed to help automatically open and close the lungs.

Car designers commonly increase the power in a car by using a turbocharger to compress air and thus

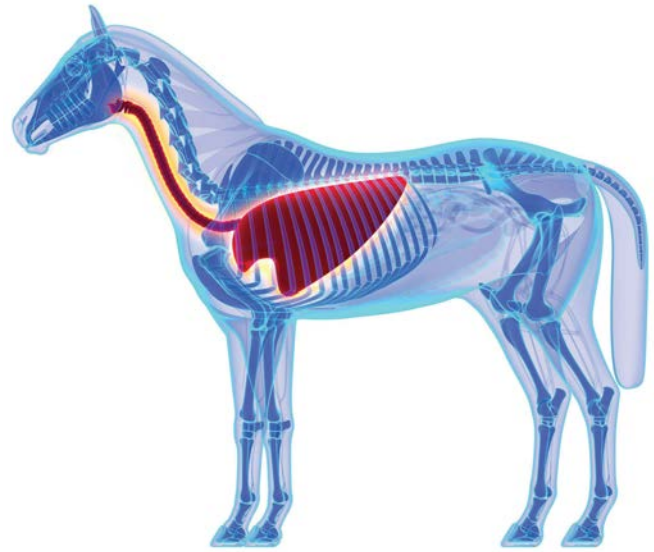


get more oxygen into the engine. In the same way that turbochargers require expert design, so does the cardiovascular system of the horse.

Designer suspension

One of the challenges of running and jumping is that a strong suspension system is needed in the front and rear legs of the horse to reduce shock loads and give stability. The rear legs have joints that are bent at just the right angle when standing so that any shock load immediately bends the joints rather than sending the shock load up through the legs.

Even though the front legs of horses are straight, they also have a special feature to reduce shock loads. The front legs do not directly attach to the spine (there is no collar bone) but are suspended in place by muscles and tendons. This means that the body is elastically slung between two pillars resulting in a soft suspension system. This is particularly important for jumping because horses land heavily on their front two legs as seen in figure 3. When a racing horse is galloping, its weight may be taken by just one or two legs at a time and in this case a single leg may have to support over 1,000 lbs. in weight.



2 The lung capacity of horses is around 10 times larger than humans.

3 Horse legs have a suspension system to avoid shock loads.





Multifunctioning hooves

The hooves of the horse (figure 4) have design features that produce just the right combination of strength, toughness, and cushioning. The foot bones give rigidity and strength, allowing a single leg to support very high loads. The horny hoof provides a hard, tough surface to protect the foot from knocks and scratches. The heel of the horse is highly elastic and is called a “frog,” due to its soft cushioning characteristics. The frog helps provide

grip and is also an aid to blood circulation. Shoe designers have spent many years developing new types of materials and layouts for shoes to improve the cushioning, grip and endurance. A well-designed hoof does not happen by chance.

Designer gears

Horses have a remarkable ability to walk and run with at least four different types of leg movement. This enables them to move with elegance and efficiency at different speeds. The most common “gears” of horses are referred to as walking, trotting, cantering, and galloping. As a horse speeds up or slows down it has the amazing ability to change smoothly from one gear to another and coordinate a different type of leg movement (figure 5).

Designed for endurance

The exceptional ability of the horse to run is illustrated by its ability to cover vast amounts of rough terrain in a day. Some horses compete in endurance events where they have to cover 100 miles in one day. In the Tevis Cup on the West Coast of the USA, the endurance challenge involves 100 miles of hilly and rough ground. Arabian horses are most often used in endurance races because they are the best at long-distance running.

4 The horse's hoof is carefully designed for multiple functions. 5 Example of trotting (left) and galloping (right).





6 Queen Elizabeth II was conveyed in a horse-drawn carriage during her Diamond Jubilee procession on June 5, 2012, in London.

7/8 Horses in the heat of battle. Figure 7 depicts Alexander the Great on his famous white stallion Bucephalus.

Horses for human use

God has tailor-made horses to be useful for people. They are perfectly designed for humans to sit on and they are valuable in many areas, including transportation, farming, policing, warfare, sport, and leisure (figures 6–8). When controlling crowds, a single police horse has the physical presence of about four policemen — and costs far less! Horses were once the most important form of transport and today they are still sometimes used to pull carriages (figure 6). During the industrial revolution horses were so well respected by engineers that the unit of power was called the “horsepower.” The term

“horsepower” is credited to James Watt in the late 1700s and is still used today.

History shows that horses have always been important to both armies and farmers. Historical pictures of wars often show horses as fearless creatures in the heat of battle. The bravery of horses is described by God in the Old Testament Book of Job: “He gallops into the clash of arms. He mocks at fear, and is not frightened; nor does he turn back from the sword” (Job 39:21–22). It is God who has designed the horse to be a brave, powerful, and valuable aid to humans.

Camels

Camels have some amazing features that are designed to help them cope with harsh desert environments, and they have been important domesticated animals for thousands of years.



1 Camels at a watering hole in Sede Boker Desert, Israel 2 Even the nose of a camel is designed to aid its survival in the desert.

Camels can cope with the extreme conditions of high temperatures, lack of water and vegetation, and a tough terrain. During the winter they can survive several months without drinking water, and even in the heat of summer they can go for several days without water. There are two types of camel: the Arabian camel with one hump and the Bactrian camel which has two humps.

Water system for the desert

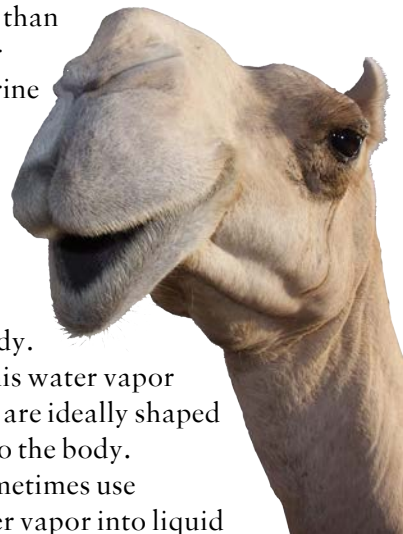
Camels have a remarkable ability to find water through their fine sense of smell. When Earth is damp it produces an “earthy” scent caused by a chemical called *geosmin*. The camel can sense this damp earth from several miles away and, having found water, it can quickly drink and store up to 40 gallons in a single drinking session (figure 1)!

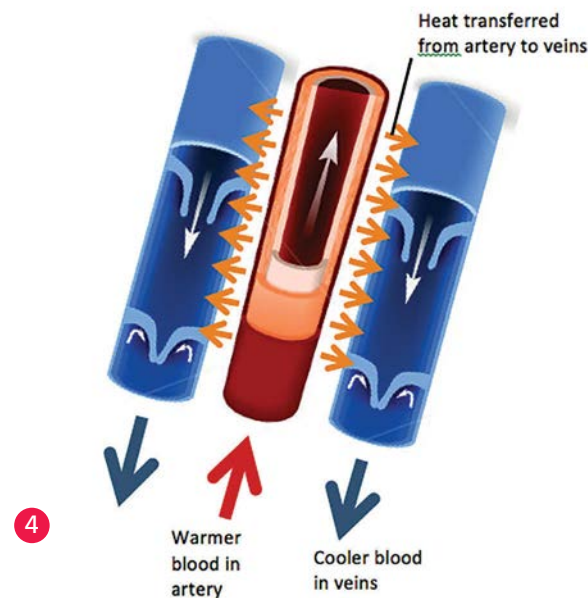
Camels even have special design features to conserve water. To reduce water loss they do not

sweat until a higher temperature than most other mammals. Also, their kidneys produce concentrated urine and their urinary system is able to pass thick urine to minimize water loss. Camel dung is also very dry.

When an animal breathes out, the exhaled air contains water vapor that has come from the body. However, camels trap some of this water vapor with protrusions in the nose that are ideally shaped to condense water and return it to the body.

In dry countries, engineers sometimes use condenser machines to turn water vapor into liquid water for human use. The condensers consist of many intricate components in a complex assembly. Both man-made condensers and the camel’s nose (figure 2) bear hallmarks of design.





- 3 Camels have unique oval-shaped blood cells.
 4 Counter-current cooling systems in blood vessels

Camels can survive extreme dehydration and cope with losing up to 40% of their bodyweight in water. This is due in part to oval red blood cells which can travel along the smallest of blood vessels (figure 3), even when blood thickens during times of dehydration. During rehydration the camel's red blood cells are also capable of expanding by up to 240% of their original volume without rupturing, whereas most animals' cells can expand only 150%.

This makes it possible for the camel to drink large amounts of water to recover from dehydration.

Cooling system for the brain

Unlike most other mammals, the body temperature of the camel can vary by several degrees without the camel suffering any ill effects. For this to be possible, a camel must have a high-performance system for cooling the brain to keep it at a more constant temperature.

This brain-cooling system — called a *rete mirabile* (wonderful net) — works like this: many of the arteries and veins are located next to each other so that the hot arteries are cooled by the veins that are cooler because they are near the surface. Also, by flowing in the opposite direction, the cooling of the arteries is more efficient — this is called a counter-current system. And by having two veins next to the artery, the efficiency is higher still, as shown in figure 4.

Car engines are prevented from overheating by water that is continuously pumped through a circuit of channels that pass through the engine and a radiator where it is cooled down before it returns through the engine. This is far simpler than the camel's cooling system because the hot and cold pipes are kept separate and there is no counter-current system. One day engineers may attempt to copy the advanced design features of the camel.

Shaped for keeping cool

Animals generally have fat that is evenly spread over their body. However, the camel has most of its fat located in one or two humps on its back. One advantage of this is that the overhead sun does not have much area to heat. Another advantage is that the hump provides a layer that insulates from the fierce sun. As well as an insulating layer of fat on top of the body, camels have a thick fur coat. A fur coat is normally associated with insulating from the cold; however, the principle works exactly the same way when insulating from heat.

Non-sinking feet

The camel's foot is made up of two large toes with webbing in between to create a broad contact with the ground, as shown in figure 5. The toes are



5 Camel feet are designed not to sink in soft sand. 6 A camel eye 7 A camel train or caravan

designed to spread apart under load to ensure that the foot does not sink into the soft sand. This is an important design feature because camels can weigh up to 2,200 lbs., and can carry loads of over 990 lbs. The foot also has a thick padded sole which protects it from being burned by the sand.

Engineers use continuous tracks (caterpillar tracks) to enable a vehicle to travel over soft sand. Caterpillar tracks could not have evolved from wheels but had to be specially invented by human ingenuity. In the same way, camels' feet were consciously designed.

Eyelids for a sandstorm

Camels have three eyelids. Two of the eyelids have eyelashes which help protect their eyes from sand

(figure 6). The third eyelid is under the other two and goes from side to side like a windscreen wiper to remove sand from the eyes. This inner eyelid is clear, enabling the camel to see even when it is closed (also true of eagles – see p. 67). The camel can therefore keep its eyes open — even in a sandstorm!

Lips for tough vegetation

The thick rubbery lips of a camel enable it to eat hard prickly plants like cacti. Desert plants often have hard leaves with sharp spines in order to prevent animals from eating them; food is so scarce in the desert that plants would not survive unless they had such protective mechanisms. However, camels are one of the few animals that can eat such plants (figure 8).



Camels for human use

From very early times camels have been used for transportation. Tied together to form a “caravan,” a dozen camels can be guided by just one or two people (figure 7). In addition, camel’s hair is used to make carpets, rugs, and garments, and their skin is used for sandals, leggings, and water bottles. Camel milk is often an important source of liquid and nutrition for herders. Even the dung of camels is commonly used for fuel. Such wonderful provision is what would be expected from a Creator who designed everything on Earth for us.

Camels and the Bible

Camels were used widely in Bible times and were a sign of wealth. One of the earliest records of domesticated camels is found at the time of Abraham around 2000 B.C. (Genesis 12:16) and a seal depicting a Bactrian camel carrying a load has been found dating from around 1800 B.C. (figure 9). In the New Testament, Matthew records that John the Baptist wore a garment of camel’s hair (Matthew 3:4). Camels may have been used by the wise men when they traveled to see Jesus. Jesus mentioned camels in His teaching that riches can be a stumbling block that keeps people from serving God: “It is easier for a camel to go through the eye of a needle, than for a rich man to enter into the kingdom of God” (Matthew 19:24).



8 A camel eating coarse desert vegetation

9 A seal dated around 1800 B.C. depicting a Bactrian camel carrying a load. One camel here has been highlighted to identify it. (Courtesy British Museum)



Elephants

Elephants are the largest living land animal, weighing up to 7 tons. Despite their great size they can perform delicate tasks with their unique trunks



1 A herd of African elephants drinking at a waterhole 2 An elephant using its trunk for a shower

There are two types of elephant today — African and Asian. African elephants are the larger, standing 10 to 13 feet high and weighing 8,800 to 15,400 lbs. African elephants also have larger ears. Elephants can live up to 70 years in the wild and are still widely used as working animals.

A unique trunk

Elephants are so tall and heavy that it would be very difficult and tiring for them to reach the ground with their mouth to eat food. Therefore they have a unique trunk that enables them to collect food and water from the ground with little effort (figure 1). The trunk is both skillful and powerful — it can crack open a peanut without breaking the seed, but it can also lift enormous loads of up to 770 lbs.

This unique trunk is a masterpiece of design consisting of around 40,000 muscles, together with a blood supply, nerves, and sensors. Even with the best current technology, engineers cannot

fully replicate an elephant's trunk. Apart from collecting food and water, the elephant's trunk is so versatile that it can act as a snorkel when swimming, spray water over its body for cooling (figure 2), communicate by trumpeting, and smell and feel things through sensory hairs.

Ears for cooling and communication

Elephant ears have a large surface area with many blood vessels for cooling (figure 3). The cooling function is vital because elephants are huge animals and live in hot climates. When there is a cool breeze, they will spread their ears out into the wind to cool themselves down, but if there is no breeze they can flap their ears to create a cooling flow of air. Elephants also communicate with their ears — for example, vigorous flapping is a warning sign!

Long-distance hearing

Elephants can hear the call of another elephant up to 6 miles away because they are optimized for

long-distance hearing. Their ears are tuned mostly to low frequency sound called “infrasound,” which travels much farther than sounds humans can hear. They even use their feet to “hear” sounds by detecting seismic vibrations in the ground. When agitated, elephants stomp their feet to warn the whole herd.

Designer feet

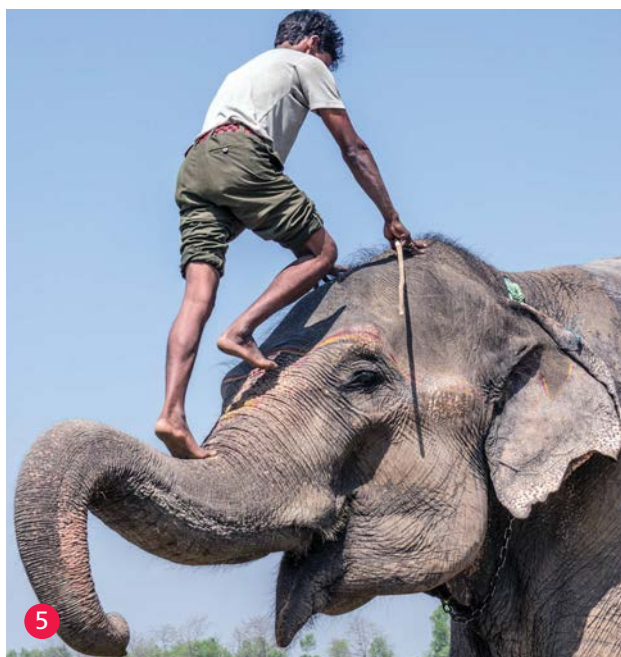
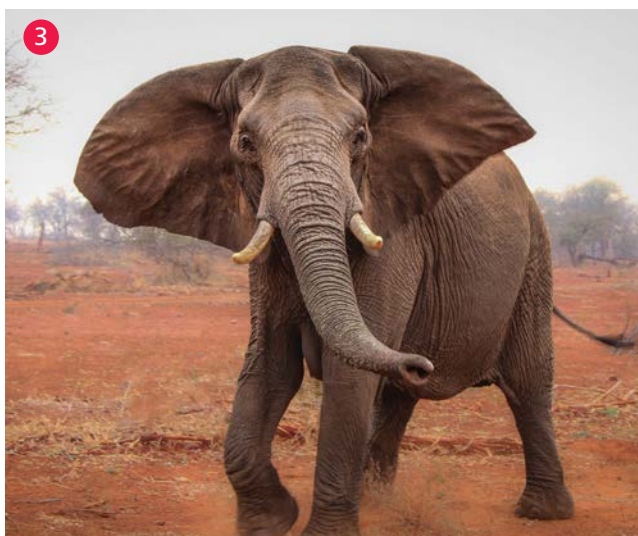
The tough fatty tissue that makes up elephants’ feet acts as a strong, soft lining like a tire. This enables them to walk quietly in spite of their size and weight. Equally, they are able to walk in mud without getting stuck, because as the elephant lifts its foot out of the mud, it contracts, reducing suction. The sole of the foot has ridges which help the elephant grip muddy terrain in the same way that tractor tires grip the mud (figure 4).

Big stomach for a big appetite

An adult elephant has a huge stomach that can hold over 220 lbs. of food in a single meal! Elephants are able to live in harsh environments because they can digest low-quality vegetation that is high in fiber and low in protein.

Elephants for human use

Elephants have been excellent working animals for humans throughout history, and they were sometimes used as a “tank” in ancient warfare. They can be trained to follow over 30 commands, including lifting their leg or trunk to enable people to climb up onto their back (figure 5). They are useful for hauling heavy loads in remote areas and for transporting people. An elephant ride is not only smooth, but there is also a great view from such a highly elevated position (figure 6)!



3 The large ears of this South African elephant aid its cooling.

4 An elephant’s foot showing the tread pattern

5 Mounting an elephant using the trunk

6 An elephant ride is a high-level experience.

Giraffes

The giraffe is the tallest land animal in the world with an adult height that can be over 16 feet. There are some very specialized design features in a giraffe's body that enable it to be so tall.



1 A group of reticulated giraffes in Buffalo Springs National Park, Kenya



2 The giraffe neck can bend right around to reach its body for grooming.

Giraffes live primarily in African savannas, which consist of rolling grasslands with scattered bushes and trees. Their extreme height allows them to eat leaves and food located much higher than other animals can reach (figure 1). They also use their height to watch out for predators.

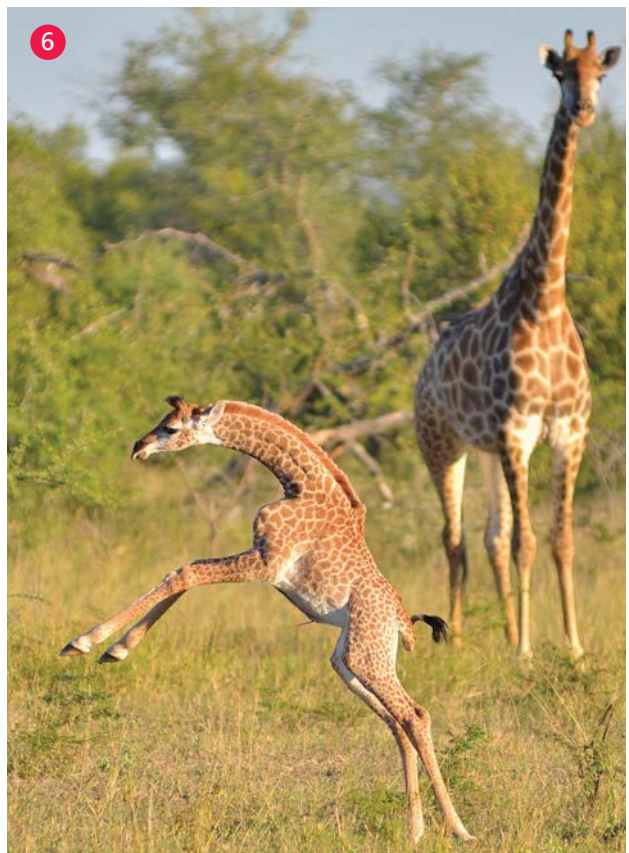
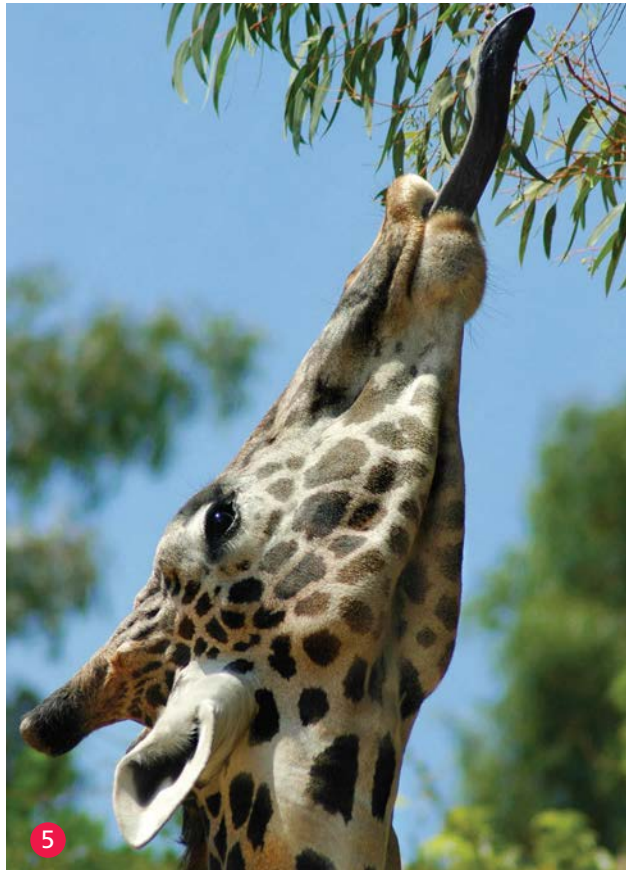
Unique neck for reaching high and low

The giraffe has a unique and powerful neck that can reach 8.2 feet in length. Like most mammals, giraffes have around 7 vertebrae in the neck, but these bones are unique in both size and design in the giraffe. The vertebrae join to each other with a ball and socket joint so that the neck has a combination of smooth motion and a large range of movement. The neck enables the head to be lowered to the ground and also to bend sideways (figure 2). For its head to reach the ground, a giraffe either does the splits (figure 3) or bends the knees of its front legs.

High performance cardiovascular system

The giraffe's heart has to have enough power and pressure to handle more than 16 feet of gravitational resistance. To overcome this challenge, giraffes have a large heart of up to 2 feet in length and a blood pressure about twice that of humans. Giraffes also have narrow capillaries and small blood cells that allow for faster absorption of oxygen.

When the head is lowered, this creates a tendency for blood to rush to the head. To prevent this, special shunts in the arteries supplying the head restrict blood flow to the brain, diverting it into a web of small blood vessels (the *rete mirabile* or “marvellous net”). Also, valves in the jugular veins prevent returning blood from flowing backward into the head while the head is lowered.



Tough and tight skin

The giraffe's skin is thick to allow it to run through thorn bushes. The skin is also very tight, especially around the legs, and this aids blood circulation in the same way that compression tights improve circulation in humans. The giraffe has been studied by engineers trying to produce better astronaut suits for space where the lack of pressure creates a need for tight-fitting spacesuits.

A tough tongue

The giraffe's tongue can be up to 19 inches long and it is very prehensile, which means it can wrap around leaves to tear them from the branch (figures 4 and 5). The tongue is a dark purple color, which helps protect it from sunburn. A full-grown giraffe can consume almost 100 lbs. of leaves and twigs a day. The lips, tongue, and inside of a giraffe's mouth are covered in small, tough growths called *papillae*, enabling them to eat thorny plants. Thick saliva also helps protect the mouth.

Growing up fast

A giraffe can be 6 feet tall at birth and can double in height by its first birthday. It can stand within a few minutes of birth and walk within an hour. After just 24 hours the young giraffe can jump and run (figure 6). Such an amazing creature bears testimony to a Creator of infinite wisdom.

3 A giraffe often spreads its front legs out to reach the ground.

4 A giraffe's tongue can wrap around leaves to gain a good grip for pulling.

5 A giraffe uses its tongue to reach even higher leaves.

6 A calf jumping a few days after birth

Kangaroos

Kangaroos are the only large land animal that moves mainly by hopping. They live in Australia and some of the surrounding islands, and are able to survive intense heat and long exposure to the sun.



1 An Australian gray kangaroo

Elastic joints for hopping

Kangaroos live in dry, open landscapes (figure 1) and need to be able to travel long distances in order to find food and water. Hopping is an efficient means of travel because the joints in the kangaroo's legs act like springs. When the kangaroo lands on the ground during hopping (figure 2), the tendons in the hind legs stretch like an elastic band. Just after landing, the tendons contract to release energy to help power the next hop (figure 3). The movement of the body as it hops helps the kangaroo breathe, making it even more efficient. Engineers have created hopping robots using some of the best technology available in

engineering — and yet these robots are far inferior to a real kangaroo.

Strong tail for balance and standing

Kangaroos have a very large tail which is used for balancing during hopping by forming a counterweight to the body as shown in figures 2 and 3. A kangaroo can stand upright because the large rear feet and large tail form a stable tripod structure (figure 4). Standing up enables the kangaroo to get a better view. It also enables male kangaroos to box each other! The tail is so strong that the kangaroo can even support itself momentarily on its tail in order to kick an opponent (figure 5).

A cozy pouch for the young

A kangaroo is a *marsupial* mammal, which means that the offspring live in a pouch for some time after birth. When the “joey” is born, it climbs to the teat in the mother's pouch where it stays for around nine months before starting to leave for short periods until it is weaned. When one joey is out of the pouch but not weaned, the mother can have another joey still attached to a teat, and an embryo not yet born. She is able to delay the development of that embryo until the older joey leaves the pouch; or if there is a drought, until there is more food available. At the right time, her body sends hormones to restart the growth in the womb.

Evaporative cooling

Kangaroos have a remarkable ability to survive in temperatures of up to 122° Fahrenheit. One way they cool down is by licking the skin on their legs to create evaporative cooling. When water evaporates



it uses up latent heat which cools the skin. Kangaroos have a network of blood vessels in their legs that make this efficient and, when the temperature is high, more blood flows to that area. They also lose heat by panting and sweating.

Self-repairing skin

Kangaroos have a special enzyme that repairs DNA in the skin that has been damaged by being exposed to bright sunlight for long periods. This means that the risk of skin cancer is reduced. Research is being carried out to see whether these enzymes could help reduce skin cancer in humans. The kangaroo shows that God can create an animal for the most extreme environment. It also reveals God's incredible variety of design solutions to the particular needs of animals.

2 During landing, the large rear legs store elastic energy.

3 Elastic energy is released during takeoff to help power the next hop.

4 With long feet and a long tail, kangaroos are perfectly balanced for standing.

5 Kangaroos have a unique ability to (momentarily) stand on their tail.

6 A female can have more than one joey in different stages of development.



Sheep

Sheep are one of the most common domesticated animals with a world population of around one billion. They can be kept almost anywhere where there is grass, including mountain locations.



1 A sheep on the Great Ridge in the Peak District, England
(Photo: Brian Edwards)



2 Sheep are normally shorn once a year in the spring.

There are several hundred breeds of sheep that have been developed for different uses. Some are bred mainly for wool (figure 1), others mainly for meat or milk or simply for managing grass.

High-performance wool

Sheep can be bred to produce wool fiber from very fine to coarse. The fine wools tend to be used for clothing, while coarse wools are used for carpets. Despite decades of research on man-made fibers like polyester, wool is often considered a superior material for clothes and carpets due to its better insulation and better moisture absorption and the fact that it is more durable, more fire resistant, and more wrinkle resistant.

Sheep's wool grows fast enough to give a sizeable annual crop of wool (figure 2). Cutting the wool once a year is very convenient in countries where there is a cold winter because the sheep can have a

thick coat in the winter months and then be shorn in the spring. This means they can live in cold and remote mountain areas (figure 3).

Staying fresh

Wool is less prone to giving off smelly odors than man-made materials like polyester and nylon. This is because a natural wool fiber is highly textured with scales whereas a man-made fiber like polyester has a much smoother surface. The intricate surface of wool creates stronger bonds with odor molecules and stops them escaping from the surface and creating an unpleasant smell.

Eco-friendly grass management

Some breeds of sheep are ideal for keeping grass short and controlling weed growth between trees in orchards and tree plantations (figure 4). These sheep also help to reduce the spread of fungal diseases

by consuming fallen leaves. Whereas many breeds of sheep strip bark and foliage from trees, some breeds, like the Shropshire, have a well established reputation for being “tree safe.”

Sheep products

It is well known that lamb is a popular red meat around the world. What is not so well known is that sheep’s milk is ideal for making cheese (figure 5) that is generally more nutritious than cheese made from cow’s milk, because sheep’s milk normally contains higher levels of calcium and vitamins A, B, and E than milk from cows. Famous types of sheep’s milk cheese include French Roquefort, Greek feta, Spanish manchego, and Italian pecorino romano.

As well as providing us with wool, meat, and cheese, sheep are used in the manufacture of many other products (figure 6). Sheep gut can be used to make tough fibers for applications like tennis racket strings; tallow from sheep’s fat is used to make candles and soap; and lanolin, a moisturizer extracted from wool, is used to help make cosmetics and skincare products.

Sheep and humans

In Psalm 50:10 God told his people that “Every beast of the forest is mine, and the cattle on a thousand hills,” which reminds us that not only are the wild animals created by God, but the domesticated animals are purposefully designed for human use.



3 Some breeds of sheep are hardy enough to live in rough mountainous areas. (Photo: Brian Edwards)

4 Sheep can be a better solution than a mower for managing grass. 5 Cheese made from sheep’s milk

6 A few of the products that use materials from sheep.



Dogs

Dogs are very intelligent creatures and have one of the best senses of smell of any land animal. They carry out many important jobs for humans and also make great pets.

Although dogs are found in the wild, most dogs alive today are either working dogs or pets. Over hundreds of years they have been bred into a variety of sizes, abilities, and temperaments. Working dogs include sheepdogs, guard dogs (figure 1), sniffer dogs (figure 2), sledge dogs, and guide dogs.

Designed for smelling

The sense of smell is called “olfaction” and happens through sensory cells in the nose. When odorous molecules (pleasant or unpleasant smelling) make contact with scent receptors in the nose, a signal is sent to the brain and a smell is sensed. The area in a dog’s nose with scent receptors is more

than ten times larger than the equivalent area in humans. A dog also has up to a hundred times more receptors per square centimeter. Its nose is wet, which makes smelling more efficient by trapping airborne particles.

Remarkably, when dogs breathe in, a fold of tissue just inside their nostril splits the airflow into two different pathways — one for smelling and one for breathing. Dogs can wiggle their nostrils to determine which nostril a scent arrived in and this helps locate the source of smells. The part of the brain that processes smells is 40 times larger in a dog than in humans, showing that they have the computer processor, not just the sensors (hardware), to detect and analyze smell.



1 Dogs were domesticated early in the history of the human race and with good reason they have been called “man’s best friend.”
(Photo: Brian Edwards)

Sniffer dogs

Dogs are widely used by police and other security forces for sniffing out specific items like explosives, firearms, drugs, and illegal foods. They are also used to find valuable foods in the wild like truffles, which are the fruiting body of an underground fungus and an expensive food delicacy.

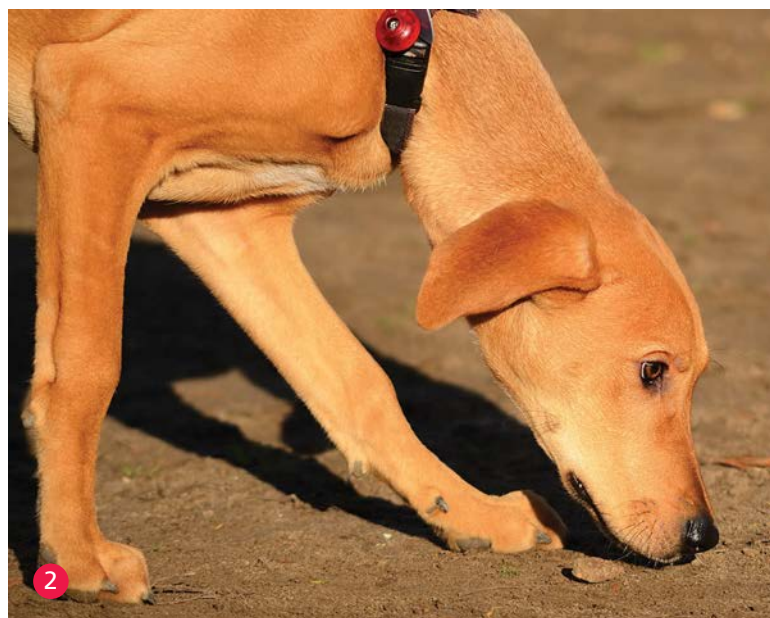
Bloodhounds have around 300 million scent receptors which is more than any other breed. They not only can follow a scent on the ground (figure 3), but they can also follow it in the air. Their whole head is specifically designed for tracking: they have a long head, a nose with large nostrils, long ears that sweep the scent up from the ground, and a cape of loose skin around the head and neck to trap and retain the scent.

Designed to run fast

Unlike humans, dogs have no collarbone, which gives more flexibility to the shoulders and hence allows them to have a greater stride length. Dogs also have a spine that is flexible, allowing them to bring their back legs forward when running (figures 4 and 5). The powerful muscles in their back legs enable fast running and high jumping. Some dogs can jump three times their own height.

Designer insulation

Every part of the body of Siberian huskies is well insulated (figure 6). They have two coats of fur with an undercoat of warm dense fur and an overcoat of longer fur that is water-resistant. They have hairs inside their ears and almond-shaped eyes to allow them to squint in order to shut out the cold winds. Their long and bushy tail can curl around the nose to warm the air around the face while the dog sleeps.



2 A dog's sense of smell is more than a thousand times more sensitive than that of humans.

3 Bloodhounds are among the best scent-trailing dogs.

4 Greyhounds are the fastest dog breed and can run up to 40 mph.





5 Malamutes are powerful dogs that can be used to pull heavy sledges.

6 Siberian huskies can withstand temperatures as cold as -58° Fahrenheit.



They also have thick, furry footpads that keep their feet insulated.

Designer strength

In areas with a lot of snow, dogs are used to pull people and other loads on sledges. Huskies and malamutes are powerful dogs that are commonly used for sledge-pulling (figure 5). A single adult male Alaskan malamute can pull over 2,200 lbs. of weight across snow.

Medical assistance dogs

The calmness, intelligence, and alertness of trained dogs make them very good at assisting people in need (figure 7). Dogs can be trained to be guide dogs for the visually impaired, and for the hearing impaired they are trained to react to certain sounds such as alarms, telephones, or the doorbell. Dogs can also assist people with mobility problems. These dogs are taught to do practical jobs like picking up objects that have been dropped, or getting help in an emergency.

An instinct for herding

Dogs can be used for herding sheep (figure 8), cattle, goats, reindeer, and even geese. Some breeds, like border collies, have a natural herding instinct and are easy to train. For herding, it is estimated that a sheepdog can do the work of three humans. The handler uses whistles, words, or hand signals to instruct the dog. These sheepdogs can perform complex tasks such as splitting a group of sheep in two and going back for a lost animal.



7 Pets As Therapy (PAT) is a U.K. charity providing therapeutic visits of dogs to hospitals, hospices, nursing, and care homes.



8 Dogs are particularly suited to herding sheep. 9 There are estimated to be over two hundred million pet dogs in the world.

Police dogs

As well as searching for dangerous items like explosives, police dogs are trained to track and chase crime suspects. They can disarm violent suspects and help control hostile crowds. They can also be trained to search for missing people. After the World Trade Centre attacks in September 2001, dogs were used to locate trapped people.

A brain for learning

Some of the reasons why dogs are so useful to humans are their intelligence and ability to be trained. Dogs have been known to be able to follow over 100 different commands. Some dogs learn to carry out a command after only five repetitions. They can respond to spoken cues, whistles, or hand gestures. Some breeds are easy to train because training can be included in their play, or because they are food-focused and so are motivated to obey. Many dog owners train their dogs as a hobby because they and their dog enjoy the stimulation. A well-trained and obedient dog is an asset to any owner.

Designer pets

Dogs make wonderful pets due to their intelligence and willingness to please. They can be chosen on the basis of size or temperament or the amount of exercise or grooming needed. Whatever the age and family situation, there is usually an appropriate breed of dog for a particular home (figure 9).

The remarkable intelligence and trainability of dogs show that they were purposefully designed to be a special help and friend to man. Even though all dogs (e.g., wolves, coyotes, dingoes, and domestic dogs) appear to be descended from an ancestral type of dog that looks like a wolf, it is nevertheless true that God designed the great genetic diversity in the first dog kind that enabled human breeders to produce a great range of dog breeds. So it is still appropriate to give thanks to God for all the different breeds of dog that are a help and comfort to mankind today.