creation points

Hallmarks of design

Evidence of purposeful design and beauty in nature

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Dedication

This book is dedicated to my wife Jocelyn

and our children: Samuel, Naomi, Keziah, Tabitha and Josiah.

Acknowledgements

I am grateful for helpful comments from many friends on the manuscript. I am particularly grateful to my wife Jocelyn for doing another excellent editing job with the grammar and style.

Stuart Burgess
Bristol
2014

Contents

It gives me great pleasure to write a foreword to this excellent book *Hallmarks of Design*. From his experience in various aspects of design in engineering, Dr Burgess is well qualified to bring his expertise to bear on the subject of design in nature. I have always contended that the evidence for design in nature invalidates any theory of evolution and this book, particularly its consideration of the presence of 'complete optimum design', strongly supports this conviction.

I well remember, as a student of zoology, being faced with the teaching of evolution in a zoology course and the conflict this caused in my thinking until I recalled a biblical truth: 'By faith we understand that the worlds were framed by the word of God' (Hebrews 11:3). This helped me at the time but later, from my reading in philosophy and a lifetime of experimental science, I realized that 'Christian faith' was not a 'blind leap in the dark' but was founded on factual evidence. For instance, the second law of thermodynamics, the decay of radioactive molecules and the impossibility that complex structures in the plant and animal kingdom could be produced by thousands of minute gradual steps of ever-increasing complexity over millions of years, militated against the theory of evolution.

Evolution is a man-made 'theory' to explain the origin and continuance of life on this planet without reference to a Creator. For instance, Sir Julian Huxley in *Evolution: A Modern Synthesis* wrote: 'Modern science must rule out special creation or divine guidance.' But why? Science, by its conscious elimination of questions of final cause and purpose from its deductions, can never claim to be the only means of apprehending human experience and knowledge. Any theory must embrace the 'whole man', including feelings, emotions, pleasure, beauty, morals, motives, final cause and purpose and, not least, life after death.

It is my firm conviction that the Christian faith is no flimsy idea but a reality born of experience which bears no other interpretation. It is my earnest wish and prayer that this book will lead its readers to the same conclusion.

Alan Linton, PhD, DSc, FRCPath., Hon. Assoc. RCVS
Emeritus Professor of Bacteriology
Formerly Head of Department of Microbiology, Bristol University

Ever since William Paley used 'design in nature' to argue for the existence of the Great Designer, there has been fierce denial of such arguments. Possibly some may have been impressed by the fine language but left dissatisfied by the tortuous logic of *The Blind Watchmaker* and other books by Professor Richard Dawkins. How refreshing that in this book, *Hallmarks of Design*, Dr Stuart Burgess writes in plain, easy-to-understand terms of the complexity and beauty of living creatures all around us. He argues, with great insight from his expertise in mechanical engineering, that the interrelation of intricate mechanisms can make sense only by recognizing that, just like cars and planes, living creatures are designed.

Paley's argument from design in living creatures is in fact far from dead. Rather it is stronger than ever, and is very much at the forefront of the creation/evolution debate. The reason for this is that the argument concerning purposeful design in the world and universe is readily understood by young and old alike, whether scientifically trained or otherwise. Not only that, but the design argument is scriptural and powerful. We are created to appreciate design, order, pattern and beauty. If we choose to ignore this, we do so at our eternal peril. The Apostle Paul teaches that the invisible things of Him are clearly seen, 'being understood by the things that are made, even His eternal power and Godhead, so that they are without excuse' (Romans 1:20). God has placed His hallmark on creation, and it is this argument that Dr Stuart Burgess brilliantly expounds. Readers of this book will be intrigued by the delightful summary of example after example, showing the hallmarks of design in the natural world, and they will want to bring many of the well-laid-out facts of this book into conversation with friends and neighbours. Armed with this material, many scientists and non-scientists alike will, by God's grace, have their eyes opened as to the shallowness of evolutionary philosophy. May many see that the argument from design shouts powerfully of the Creator who spans the heavens and yet stooped to become Man, in order to be our Saviour.

Andy C. McIntosh, DSc, FIMA, CMath, FInstE, CEng
Professor of Combustion Theory
Department of Fuel & Energy, The University of Leeds

The Design Argument argues that design reveals a designer and the attributes of the designer. The Design Argument is very important because design provides positive evidence for a Creator and not just evidence against evolution. Following modern discoveries of the staggering complexity and beauty of nature, the Design Argument is stronger than ever before.

I have presented the Design Argument by concentrating on hallmarks of intelligent design. The supposed process of evolution is inherently severely limited in the amount of order that it could produce because of the huge restrictions of incremental change and natural selection. In contrast, an intelligent designer has no such restrictions and can create extreme levels of order, beauty and purpose. This book describes six *hallmarks of design* that can only be produced by an intelligent designer:

1 Irreducible mechanisms
2 Complete optimum design
3 Added beauty
4 Extreme similarity in features
5 Extreme diversity of kinds
6 Man-centred features

At the beginning of each chapter I describe how these are important and common hallmarks of intelligent design in engineering. Each chapter then describes how the hallmarks are very clearly seen in nature. I also explain how nature contains a far superior level of design than man-made design.

I have concentrated on mechanical (macro) design rather than biochemical (micro) design in nature because this is my field of expertise. One advantage of macro design is that it is more familiar and understandable to the general reader. Macro design also has the advantage that it includes the hallmarks of added beauty and man-centred features. These hallmarks are not so relevant at the biochemical level.

I have not tried to argue that organisms are unchanging from one generation to the next. A particular kind of creature such as the dog kind has great genetic potential and this has produced a great variety of dogs over the course of history. What I have argued is that there are such

profound differences between the different kinds of organisms in nature that they cannot have evolved from a common ancestor. I also have not tried to argue that nature is perfect and beautiful in every respect. Nature has been affected by the Fall of Adam and Eve in the Garden of Eden and this has produced undesirable aspects such as disease, violence and death. However, despite these blemishes, there is still clear evidence of design in nature.

Note on second edition

The whole book has been completely revised in this second edition. There are three new chapters on the subject of beauty: the beauty of the peacock tail, the beauty of birdsong and the beauty of the human body. Beauty has not been used much before as evidence of design. However, in engineering and architecture it is well known that beauty is a very important hallmark of design. In addition, modern research has shown that the human being has a real capacity for appreciating beauty. For example, it has been found that the human brain has specific areas which are dedicated to appreciating beauty in music. It is very difficult to think of any evolutionary reason why the human brain should have the ability to appreciate music since this gives no survival advantage. I believe that the beauty of nature, and man's ability to appreciate that beauty, presents one of the biggest challenges to the atheist and one of the biggest encouragements to the believer.

The issue of origins is very important because it greatly affects the answers to other ultimate questions such as the purpose of life and what happens after death. Considering this importance, it is vital to be aware of the evidence for a Creator rather than just blindly accepting the theory of evolution. I hope that this book encourages many people by showing that there is overwhelming and positive evidence for a loving Creator.

Irreducible mechanisms: The irreducible knee joint

Then God said, 'Let the earth bring forth the living creature according to its kind: cattle and creeping thing and beast of the earth, each according to its kind'; and it was so (Genesis 1:24).

The Bible teaches that all the different kinds of creature in nature have been directly created by God and have not evolved from a common primitive ancestor. For example, the verse above from Genesis 1 describes how God created different 'kinds' of land creature on the sixth day of creation. Examples of kinds include the horse, cow, dog and cat. Irreducible mechanisms such as the mammalian knee joint[1] provide powerful living evidence that creatures were indeed created as distinct kinds.

1.1 Hallmark of design: irreducible mechanisms

An irreducible mechanism is a mechanism that must have several parts simultaneously present and assembled to perform a useful function. In addition, each part usually has several essential characteristics. A mechanical watch is an example of an irreducible mechanism because it requires several separate parts such as gears, spring and clock hands to function. Also, each of these parts has several essential characteristics such as gear teeth and connecting holes. If a mechanical watch is missing an essential part such as the spring, it cannot perform any useful function. Also, if one of the essential details of one of these parts is missing, such as a connection between a gear and a shaft, then the watch cannot function.

An irreducible mechanism can only be created by an intelligent designer because only an intelligent designer can plan ahead and design all the parts and characteristics simultaneously. An irreducible mechanism cannot be produced by a process of evolution because evolution is limited to

incremental change. The existence of an irreducible mechanism provides powerful evidence for intelligent design, whether the mechanism is man-made or natural.

It is important to realize that evolutionists fully agree that evolution cannot produce irreducible mechanisms. For example, in his *Origin of Species*, Charles Darwin said:

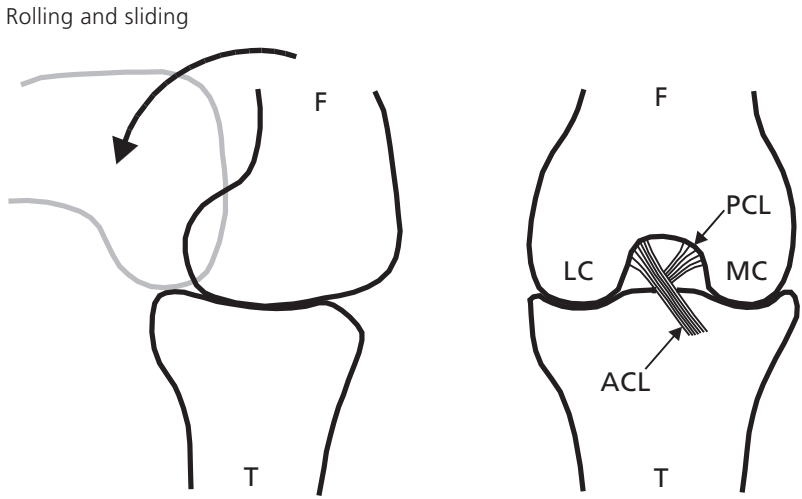
> If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down.[2]

Modern-day evolutionists also agree that evolution cannot produce irreducible mechanisms.[3] Like Darwin, modern-day evolutionists believe that there are no irreducible mechanisms in nature, and that every mechanism in nature has evolved by 'numerous, successive, slight modifications'. However, there is tremendous evidence that there are many irreducible mechanisms in nature, both at a macro (mechanical) level and at a micro (biochemical) level.[4] This chapter shows that the mammalian knee joint is a clear example of a mechanical mechanism that could not have evolved. Chapters 2 and 3 will give other examples of irreducible mechanisms in nature.

1.2 The mammalian knee joint

The main types of limb joint in mammals are the ball and socket joint (hip and shoulder) and the hinge joint (elbow and knee). The main function of the knee joint is to form a hinge between the lower leg and the upper leg. The majority of biology textbooks describe the knee joint merely as a 'hinge', giving the impression that there is just a simple pivot between the upper and lower leg bones. However, this is a gross over-simplification because the knee joint is actually a very sophisticated mechanism and a masterpiece of design.

A schematic of the knee joint is shown in Figs. 1.1 and 1.2. The pictures show a human knee, although it should be noted that many animal knees have a similar basic structure. The knee is called a condylar joint[5] because of the rolling and sliding action (articulation) between the upper leg bone



(a) Side view of knee **(b)** Front view of knee

F Femur
T Tibia
LC Lateral condyle
MC Medial condyle
PCL Posterior cruciate ligament
ACL Anterior cruciate ligament

Fig. 1.1 Anatomy of the knee joint (peripheral ligaments and knee cap removed)

(the femur) and the main lower leg bone (the tibia). The femur bone has two protrusions (called condyles) and these have a convex curvature in order to roll and slide against the tibia bone. The tibia bone has two concave grooves which match the condyles of the femur bone. The two central ligaments which connect the tibia to the femur are called cruciate ligaments because of the way they form a cross. The cruciate ligaments fit neatly inside the space between the two condyles. The main function of the cruciate ligaments is to guide the motion of the knee joint.

The two cruciate ligaments and the two leg bones form a very sophisticated and precise mechanism, called a 'four-bar mechanism'.[6] The four-bar mechanism of the knee is shown at various stages of rotation in

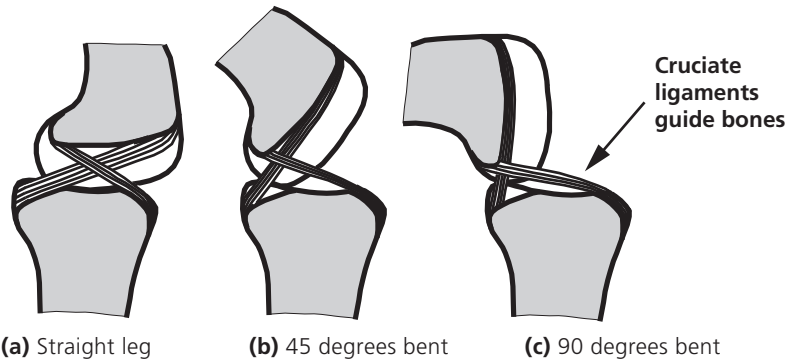


Fig. 1.2 The irreducible mechanism of the knee (bones cut to show ligaments)

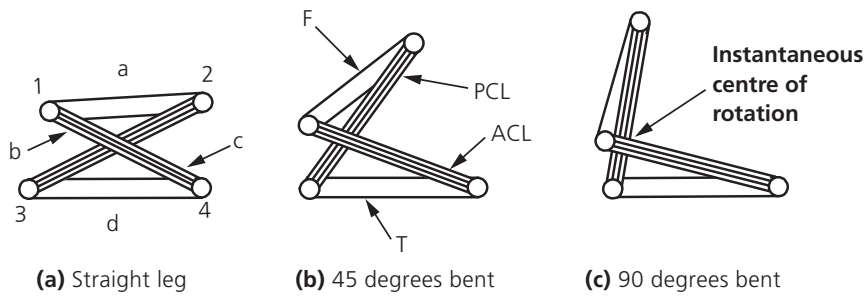


Fig. 1.3 Schematic of the four-bar mechanism in the knee joint

Fig. 1.2. These stages of rotation are schematically presented in Fig. 1.3 to show clearly how the four-bar mechanism produces a hinge movement. The cruciate ligaments form the two crossed bars (b and c), while the upper and lower bones form the other two bars (a and d). The cruciate ligaments are able to pivot where they are attached to the bones (points 1, 2, 3 and 4) because they are made of a flexible material. In a four-bar mechanism, the length of each of the four bars remains approximately constant but the angle between each bar can change in order for the upper and lower bars to rotate relative to each other.

One important feature of the four-bar mechanism is that it does not have a fixed point of rotation in the way that a pivot hinge does. The knee joint is

a particularly sophisticated kind of four-bar mechanism because the cruciate ligaments are kept taut by the rolling action of the bones. In order for the cruciate ligaments to be kept under the right tension, the four-bar mechanism must produce a motion which is exactly compatible with the curved profile of the bones.

When a mechanical engineer looks at the anatomy of the human leg, the four-bar mechanism in the knee stands out as one of the most important and impressive mechanisms. Despite this fact, the four-bar mechanism in the knee joint is rarely explained in school and university-level biology textbooks. While the ball and socket joint is taught at primary-school level, the four-bar mechanism is often not taught to biology undergraduates. One reason why the four-bar mechanism is rarely mentioned in biology textbooks could be that the authors do not understand mechanical mechanisms. However, it is also possible that the authors realize that sophisticated mechanical mechanisms bear the hallmarks of design and there is a reluctance to present such mechanisms to students.

1.3 Irreducible number of parts in the knee joint

According to the theory of evolution, the knee joint has evolved one part at a time. However, the four-bar mechanism in the knee joint requires four parts to exist simultaneously and in a precise assembly to be able to perform its basic function. The two bones are essential because they perform the rolling and sliding motion. The two cruciate ligaments are essential because they perform a vital guiding function in the joint, as shown in Fig. 1.2. The four parts are interdependent with one another and must always exist together to be of any use. If just one cruciate ligament is removed, then the joint cannot function as a hinge and the joint has no other useful function.

The importance of having all the parts of the four-bar mechanism in place simultaneously is demonstrated by the serious nature of knee injuries. When a cruciate ligament is snapped, the knee cannot function unless major surgery is carried out to repair the ligament. The fact that the mammalian knee requires a minimum of four complex parts provides powerful evidence that it did not evolve and that it was created as a fully functioning mechanism.

1.4 Irreducible number of characteristics in the knee joint

The four essential parts of the knee joint also contain an irreducible number of 'essential characteristics'. According to evolution, all the characteristics of the knee have evolved one at a time. However, there are at least 16 essential characteristics in the knee joint, as shown in Table 1.1. It could be argued that the knee joint also requires characteristics to describe the leg muscles that are needed to make the joint move. However, these have been left out because the evolutionist might argue that these happened to exist in some 'primitive joint'. Therefore, the 16 characteristics represent a conservative estimate of the minimum required characteristics in the knee joint.

If one of the characteristics shown in Table 1.1 is missing, then the knee cannot function at all. The 16 characteristics must not only be present but must also be precisely compatible with one another in order to produce the right physical motion. The two bones must have a compatible curvature at their interface and this curvature must also be precisely compatible with the motion produced by the cruciate ligaments. If the attachment points are not in the right place on the bones, then the motion of the four-bar mechanism will not be compatible with the rolling motion of the bones, and the knee will seize up or fall apart. The ligaments must also be assembled to the correct attachment points so that the ligaments form a cross, as shown in Fig. 1.2. If one of the ligaments is assembled to the wrong attachment point, the four-bar mechanism cannot work and the knee cannot function as a hinge.

Table 1.1 Essential characteristics in the knee joint

PART	ESSENTIAL CHARACTERISTICS	NO. OF CHARACTERISTICS
Femur bone	Protrusion of two condyles	2
	Convex curvature of two condyles	2
	Position of ligament attachment points 1& 2	2
Tibia bone	Concave curvature of two tracks	2
	Position of ligament attachment points 3 & 4	2
Anterior cruciate ligament	Assembly of ligament to points 1 & 4	2
	Length of ligament	1
Posterior cruciate ligament	Assembly of ligament to points 2 & 3	2
	Length of ligament	1
	TOTAL	16

1.5 Irreducible amount of information in the genetic code

THE GENETIC CODE

In order for the parts of a mechanism to be manufactured and assembled, it is necessary for there to be a set of instructions that specify all the characteristics of each part. Table 1.2 below summarizes how information about characteristics is specified in living organisms and engineering. The table shows that there is an analogy between the information in the genetic code of organisms and the information in the engineering drawings of a man-made machine.

Table 1.2 Information in living organisms and engineering

GENETIC CODE	ENGINEERING DRAWINGS
Set of chromosomes (genetic code)	Set of drawings
Individual chromosome	Subset of drawings
String of chemical units (gene)	Paragraph of writing (characteristic)
One chemical unit (base pair)	One letter

In the case of a man-made mechanism such as a watch, the characteristics of the parts are described on a set of drawings. Individual parts are shown on individual drawings and individual characteristics are described by paragraphs on the drawings. For example, a gear would usually be described on one drawing and there would be several paragraphs describing characteristics of the gear, such as diameter, thickness, tooth shape and material. The accuracy of design information in engineering is very important. An error in just one letter of a paragraph could produce a fault in a part which could prevent the watch from working.

In the case of living organisms, the characteristics of the organism, such as eye colour, are specified by information in the genetic code. The genetic code is analogous to a complete set of engineering drawings and a copy of the genetic code is found in the nucleus of every cell in the body. An adult human has many trillions of cells and thus many trillions of copies of the genetic code in the body!

The genetic code is written on a tiny molecule called DNA. The DNA of a human being has 46 separate sections called chromosomes. DNA

contains information in the form of a very long sequence of chemical 'letters'. There are four different chemical letters and the sequence of these letters produces information in a way which is analogous to Morse code. (The four chemical 'letters' are nucleotide molecules: adenylic acid (A), thymidylic acid (T), cytidylic acid (C) and guanylic acid (G)). DNA has a double helix structure and each helix contains its own string of chemical letters. The letters from each helix line up with one another exactly and are joined together to form base pairs. One reason why DNA has a double-helical structure is that it enables the DNA to divide into two parts when a cell divides, allowing a perfect copy of DNA to appear in both cells.

A chromosome contains the information of many physical characteristics and is analogous to a subset of drawings. Even though each chromosome contains a long continuous series of chemical letters, this long list can be divided up into groups of letters called genes. A gene typically consists of several hundred chemical units of information and it is the genes which largely determine the characteristics of an organism. A typical function of the genes is to specify different types of proteins which are needed by the organism to grow and function. A gene is analogous to a paragraph on an engineering drawing and the chemical units in a gene are analogous to the letters in a paragraph. A living organism is continually reading instructions from DNA in order to carry out life's processes, such as growth and repair. Organisms such as mammals typically have many thousands of genes and millions of chemical letters in their genetic code.

IRREDUCIBLE AMOUNT OF INFORMATION

Evolutionists believe that information in the genetic code has evolved one unit at a time. However, the knee joint has at least 16 essential characteristics and this requires the simultaneous presence of a great deal of information. At present, scientists do not know how geometrical characteristics, such as ligament attachment points, are specified by the body. However, there must be information somewhere which specifies such critical characteristics. If it is assumed that each characteristic requires at least the same amount of information as that required to specify one gene (say 1000 chemical units), then many thousand units of information would be required to be present simultaneously for the knee to

work. These chemical units represent an irreducible amount of information in the genetic code.

Not only must all the genetic information be present from the start, but it must also remain unchanged. In the case of a healthy knee joint, if a random change occurs to the information which specifies one of the essential characteristics, such as the position of a ligament, then the knee will cease to function properly.

1.6 Uniqueness of the knee joint

The knee is a unique type of joint because it uses completely different mechanical principles from those used by other joints in the body. While the knee has two ligaments that perform a vital guidance role (the cruciate ligaments), the joints of the hip, shoulder and elbow have no such ligaments at all. While the knee rolls and slides, the joints of the hip, shoulder and elbow only slide. While the knee has a centre of rotation that moves by up to several centimetres, the joints of the hip, shoulder and elbow have a fixed centre of rotation. Indeed, a pivot hinge has none of the characteristics shown in Table 1.1. In particular, a pivot joint has nothing remotely like the two crossed cruciate ligaments at the centre of the joint.

Advanced textbooks on anatomy sometimes acknowledge that the mammalian knee joint is a unique type of joint.[7] However, these books never attempt to explain how the knee could have evolved. It is very difficult to explain how an evolutionary process could cause two ligaments to suddenly become crossed at the centre of a pivot joint precisely at the same time that a space was formed to accommodate them and precisely at the same time that a complex and compatible rolling motion was produced!

If the knee joint had evolved, one would fully expect to find many intermediate forms of joint between the pivot joint (elbow) and the knee joint in either living creatures or extinct creatures. However, there is absolutely no evidence that any intermediate form of joint has ever existed. Considering the large number of fossils that has been studied and that no intermediate forms of joint between a pivot joint and a knee joint have been found, it must be concluded that there is overwhelming evidence that the knee has not evolved.

If the knee joint had evolved, it should at the very least be possible to 'imagine' what intermediate forms of joint should look like. Considering

the ingenuity of man, this should not be a difficult task if intermediate forms are possible. However, all attempts to imagine intermediate forms of knee joint have failed. The failure to imagine intermediate forms of mechanisms throughout the animal kingdom has been fully acknowledged by leading evolutionists such as Stephen Jay Gould, who has said:

> Our inability, even in our imagination, to construct functional intermediates in many cases has been a persistent and nagging problem for gradualistic accounts of evolution.[8]

1.7 Growth of the knee joint

The fact that the knee joint must be grown in the developing embryo adds further complexity to the design. As well as specifying all the characteristics of the knee joint, the cell must also specify how the knee will grow and become assembled. The knee joint is formed in the early part of pregnancy, within about 12 weeks of conception. In the early weeks of life, the human embryo has limb buds where the legs and arms will develop, as shown in Fig. 1.4. Each of the cells in each limb bud contains all the information necessary to construct the limb. The cell not only specifies the materials of the ligaments, muscles and bones but it also has the amazing ability to specify the positioning and timing information which is necessary to assemble these parts.

When each leg limb bud reaches a certain size, instructions are somehow given for the bone in the limb bud to separate and form the separate bones of the lower and upper leg. Instructions are also somehow given for the cruciate ligaments to form a cross and connect with the bones to make an assembled knee joint. The positioning and timing of the ligament connections and the splitting of the leg bones must take place with great precision in order for the knee joint to be produced. The self-assembly of

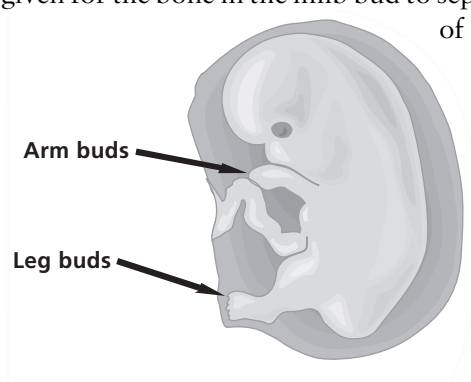


Fig. 1.4 Limb buds on the human embryo

the knee joint is so sophisticated that scientists do not know how it happens. A recent textbook on the development of organisms says:

> The mechanism whereby the correct connections between tendons, muscles, and cartilage are established has still to be determined.[9]

This admission is very significant. If evolutionists do not know how a joint assembles itself, how can they be so sure that it evolved by a series of random genetic mistakes? The self-assembly of bones, ligaments and tendons represents a complicated and awesome task. Humans have never yet been able to design any machine that can build itself, let alone a machine containing many thousands of complex parts like the human body.

1.8 Critical nature of geometrical characteristics

The geometrical characteristics of a mechanism must generally be specified with much more precision than the material properties of the parts in the mechanism. This fact is well known in the field of mechanical engineering. For example, the geometrical characteristics in a mechanical watch, such as the shape of the gear teeth, must be specified within very close tolerances. If a geometrical characteristic such as the shape of a gear tooth is slightly in error, the clock will cease to function. In contrast, if the material properties of the gear are changed slightly, then the watch will usually still be able to function. Often, the only impact of a new material is to change long-term aspects of performance such as how long the watch will last.

Despite the critical nature of geometrical characteristics, books on evolution virtually never mention them. The evolution of new characteristics is generally described as a process whereby genes are gradually evolved and each new gene simply specifies more proteins. However, this description grossly underestimates what would actually be required for an organism to evolve because the cell must contain geometrical information about the organism. While it is true that scientists do not yet understand how geometry is specified in an organism, this is not an excuse for ignoring the need for such information. There is no doubt that evolutionists avoid discussing geometrical information because such information presents a major problem for evolution.

The avoidance of critical characteristics can be seen in virtually every secular school and university biology textbook which discusses evolution. Biology textbooks often give examples of how a new colour of moth could plausibly evolve by gene mutation. The authors then argue that, since colour could plausibly change in one step, it can be assumed that every single characteristic of the moth could change in single steps. But this argument makes the crucial mistake of assuming that all characteristics are as simple as colour. Even though the colour of a moth may be important to its survival, the characteristic of colour is nevertheless a trivial one in terms of how it affects the functioning of organs and parts within the moth. The supposed evolution of colour by gene mutation can never produce new mechanisms and therefore it does not demonstrate evolution. To prove the theory of evolution, the evolutionist would have to show how a geometrical characteristic, such as the attachment position of a cruciate ligament, could evolve. However, this has never been done, and never can be done, because such a critical characteristic could not evolve in isolation.

The importance of geometrical characteristics can be illustrated with the analogy of car design. Just imagine going to a lecture on car design and hearing the speaker claim that the only thing needed to design a car is to specify the materials! Such a statement would be absolutely wrong because the car contains many mechanisms which need to be specified by many geometrical characteristics. In a similar way, it is very misleading for evolutionists to give the impression that an organism needs only to specify proteins in order to grow and function. The superficial nature of colour can also be illustrated with the analogy of car design. Just imagine someone arguing that, since the colour of a car could change in one step, every characteristic of the car could evolve in single steps! This would be absolutely ridiculous because the geometrical characteristics of the car, such as the internal dimensions of the engine, are vastly more critical than the colour of the car. In a similar way, it is ridiculous to use colour change in organisms as an example of evolution.

1.9 Supreme design in the knee joint

The diagrams of the anatomy of the knee in Figs. 1.1 and 1.2 are deliberately simplified in order to identify the parts that are absolutely

essential to the basic functioning of the knee. However, it is important to note that the complete knee has many other sophisticated parts that help to produce an efficient and strong joint. These parts include a bone at the front of the knee called the patella (kneecap) and a fibrous capsule containing several ligaments which surrounds and supports the joint. There is also soft cartilage to reduce shock loads between the bones and an elaborate arrangement of muscle fibres connected to the front and back of the leg to enable the movement of the joint to be finely controlled. In addition, there is a lubricating fluid, called synovial fluid, inside the knee that makes the joint rotate smoothly and last a long time.

The biomechanics of the knee are also simplified in Fig. 1.2 for clarity. In reality, the ligaments do stretch by a small amount when the knee is in certain positions. There is also a small amount of torsional freedom between the femur and tibia bones. These features make the knee joint an extremely sophisticated joint. Indeed, the knee joint is so sophisticated that human designers have been unable to produce an artificial knee that has anything approaching the performance of a real knee.

1.10 The human knee joint

The basic principle of the mammalian knee joint is unique whether it is the knee joint of an animal or of a human being. However, there is yet a further problem for evolution in that the human knee is distinctly different from the knees of monkeys and apes. In the case of humans, the knee is designed to lock conveniently in the standing position so that maintaining a vertical posture is easy. Also, the layout of the human knee enables humans to walk and run upright in a completely natural way. In the case of monkeys and apes, the knee cannot be straightened and must be continually loaded in flexion (bent leg). Evolutionists admit the fact that there is a big difference between the knees of animals and humans. For example, Dye and Scott say:

> Despite the overall similarity of the design of the knee in tetrapods, no ideal animal model of the human knee is available.[10]

Evolutionists also admit that the only way apes can attempt to stand

upright is by having awkward bends at the ankle, knee and hip joints.[11] Such a distorted posture means that apes can stay vertical for only short periods and distances. In contrast, an able-bodied and fit human being can walk and run many miles without great difficulty.

1.11 The limited effect of gene variation

When Charles Darwin first proposed his theory of evolution, he thought that the apparent changes in characteristics that normally appear in offspring could accumulate to produce new mechanisms. It is now known that these apparent changes in characteristics are produced by gene variation. It is also now known that gene variation has strict limits of change and cannot cause new mechanisms to appear as Darwin thought. This fact is now acknowledged by many evolutionists.

The reason why gene variation cannot produce new mechanisms is that gene variation involves only the shuffling of existing genes from the parents of the offspring. When two parents produce offspring, the offspring contain a unique mixture of genes from the parents. The only effect that gene variation can have is to change the expression of superficial characteristics such as size and colour. The limited change that can be produced by gene variation is demonstrated in selective breeding. For example, while it is possible to breed horses with extreme expressions of characteristics such as fast speed or great height, it is not possible to change a horse into another type of creature.

Gene variation has two very useful purposes. One purpose is to introduce beautiful variety into the world. This is particularly important in the case of the human being. Life would be very strange indeed if we all had an identical appearance! A second purpose of gene variation is that it enables a certain degree of adaptation to take place. For example, since moths sometimes have the genetic potential to produce a range of colours, they are able to adapt to changes in the colour of trees. If dark-coloured trees become more common than light-coloured trees in a particular area, it is an advantage for moths to have a darker colour since a darker colour is less conspicuous to predators such as birds. When it is an advantage to have a darker colour, it can be observed that the proportion of dark-coloured moths becomes greater than the proportion of light-coloured moths.

It should be noted that changes in colour and size represent very superficial changes and these cannot lead to the development of new mechanisms. It should also be noted that the ability of animals to adapt can be seen as an evidence of design because it is just what would be expected from a Creator who wanted creatures to fill the earth and survive changes in the environment.

1.12 The modern theory of evolution

According to the modern theory of evolution, the process by which organisms gain new characteristics is through genetic mistakes called 'gene mutations'. A gene mutation is typically the result of a copying error during reproduction and it produces a random change to the chemical information in the genetic code. Gene mutations in offspring are rare and only appear once in several thousand reproductions. Even though a gene mutation does change information in the genetic code, it cannot be assumed that the change could ever lead to the evolution of a new mechanism.

Current evidence shows that, in the vast majority of cases, gene mutations are very harmful. For example, gene mutations are known to be responsible for serious genetic disorders such as haemophilia and cystic fibrosis.[12] Even in cases where gene mutations do not cause serious harm, they certainly do not create any new mechanisms. No gene mutation has ever been identified that has produced a new mechanism or increased information in the genetic code.[13] Yet, despite the absence of any evidence of mutations that have produced a new mechanism, evolutionists believe that, over millions of years, millions of genetic mistakes have produced all the complex mechanisms that exist in nature.

Some evolutionists have recently claimed that evolution occurs in a punctuated equilibrium where there are periods of stability followed by relatively rapid change. It is important to realize, however, that punctuated equilibrium does not change the fact that evolution relies on an accumulation of small changes to characteristics. Punctuated equilibrium simply postulates that there are relatively long periods when there are few selective pressures and then relatively short periods of intense selective pressures.

It is important to recognize that the modern-day theory of evolution proposes that evolution does not occur in the vast majority of a population

of organisms. The modern-day theory of evolution proposes that evolution happens only when reproduction goes wrong through gene mutation. Also, when a person has a deformity or disease due to a gene mutation, according to evolution this must be seen as a very necessary part of life because it is nature's way of experimenting with the design of a human being. According to evolution, without such experimentation and suffering, humans would never have evolved from primitive creatures.

Evolutionists fully acknowledge the cruel nature of the theory of evolution. One evolutionist has said the following:

> The essential feature of Darwinian evolution is its accidental nature. Mutations occur by blind chance, and as a result of these purely random alterations in the characteristics of the organisms nature is provided with a wide range of options with which to select on the basis of suitability and advantage. In this way, complex organized structures can arise from the accumulation of vast numbers of small accidents. The corresponding increase in order (fall in entropy) occasioned by this trend is more than paid for by the much greater number of damaging mutations which are weeded out by natural selection. There is thus no conflict with the second law of thermodynamics. Today's beautifully fashioned creatures sit atop a family tree festooned with genetic disasters.[14]

Notice in this quote that the author admits that evolution works by an 'accumulation of vast numbers of small accidents'. Also notice how the author admits that a great number of genetic disasters are an essential part of the process of evolution.

The damaging nature of gene mutations shows the foolishness of believing that God could use evolution to create the world (theistic evolution). Gene mutations cause enormous suffering and it is inconceivable that an infinitely wise and loving Creator could ever choose to use such a process. It is also important to point out that an irreducible mechanism cannot evolve by gene mutation even if an intelligent being is able to select which gene should mutate in each step.

1.13 The deception of evolutionary theory

Evolutionists cannot give a single example of how one type of creature has evolved into another type of creature. The complete absence of examples

of evolution means that evolutionists must employ strategies for explaining how evolution could supposedly work. As we have already seen, one tactic is to focus on superficial characteristics. Two other deceptive strategies that are commonly used are to focus on peripheral parts or to focus on a gradual increase in size.

FOCUS ON PERIPHERAL PARTS

A peripheral part is a part which is not essential to the functioning of a mechanism. For example, the glass front on a mechanical watch provides a useful cover but it is not essential for the watch to function. It is always possible to argue that a peripheral part could evolve by chance. However, even if peripheral parts could evolve, this does not mean that essential parts could evolve. When discussing the theory of evolution, evolutionists will deliberately discuss only peripheral parts of a mechanism without explaining this to the reader or audience. They will then argue that, since some parts could have evolved by chance, all the parts of the mechanism could have evolved by chance. Any reader or hearer who does not realize that only peripheral parts have been mentioned may then be convinced that evolution can really work.

A common example of how evolutionists focus on peripheral parts is the eye. Evolutionists argue that the lens is not essential for the functioning of the eye and so one can imagine an eye without a lens evolving into an eye with a lens. They then try to convince the reader that every single part of the eye could have evolved step by step. However, this reasoning is false because there is an irreducible mechanism in the eye. Each individual light-sensitive cell consists of several parts, such as photosensitive regions and a region for making connections with the optic nerve fibre. The optic nerve fibre, which transmits signals from the retina to the brain, also consists of several parts, such as the connecting region and signal path. There is also an essential need for processing parts in the brain to make vision possible. Therefore, it is impossible for a light-sensitive eye cell to evolve since such cells have no functional use except as part of a fully functioning eye.

A similar situation exists for the knee joint. When evolutionists attempt to discuss the evolution of the knee, they describe how the kneecap is not actually essential and how it just appeared and was retained because it gave

advantages. They also say that the lubricating fluid was not essential but that it suddenly appeared and remained because it gave advantages. After giving several such examples, they try to convince the reader or hearer that every single part of the knee could have just evolved by chance. But this argument is false because there is an irreducible mechanism at the core of the knee joint.

FOCUS ON SIZE

Evolutionists often focus on how an organ could theoretically evolve from a small organ into a larger organ. For example, Richard Dawkins argues that one can imagine a 'simple' eye with only a few light cells gradually evolving into a 'complex' eye which has thousands of cells.[15] However, this argument is flawed because an eye which has a few light-sensitive cells has components which are just as complex as an eye with thousands of cells. The main complexity in the eye lies within the design of each individual light-sensitive cell and not in the number of cells.

1.14 The deception of evolving words

Another strategy used by evolutionists to attempt to give evidence for evolution is to argue that the evolution of living creatures is analogous to the evolution of sentences of words. Words are used to represent information in the genetic code and their change is used to show how information in the genetic code could supposedly evolve over time. For example, Richard Dawkins uses the following sequence of words to model the supposed process of evolution:[16]

LFHGUXSBX	(jumble of letters)
MFHGUXSBX	(first beneficial mutation—characteristic labelled 'M')
MFHGUISBX	(second beneficial mutation—characteristic labelled 'I')
MF GUISBX	(third beneficial mutation—characteristic labelled ' ')
MF TUISBX	(fourth beneficial mutation—characteristic labelled 'T')
MF THISBX	(fifth beneficial mutation—characteristic labelled 'H')
MF THISBS	(sixth beneficial mutation—characteristic labelled 'S')
MF THISKS	(seventh beneficial mutation—characteristic labelled 'K')
ME THISKS	(eighth beneficial mutation—characteristic labelled 'E')
ME THINKS	(ninth beneficial mutation—characteristic labelled 'N')

Each new set of letters is supposed to represent a slightly changed organism with one single new improved characteristic. After accumulating many changes, the final sentence is supposed to represent the genetic code of a new type of organism with a new mechanism. It is important to notice here that evolutionists admit that evolution only works by changing one characteristic at a time.

At first sight, the evolution of words might seem convincing. However, the use of letters enables the evolutionist to obscure the fact that real organisms have interdependencies and critical characteristics. To illustrate why words cannot demonstrate evolution, let us assume that each of the letters in the words 'ME THINKS' represents one of the critical characteristics of the knee joint as follows (refer to Fig. 1.3):

M	= Position of ligament attachment point 1 (Femur)
E	= Position of ligament attachment point 2 (Femur)
T	= Position of ligament attachment point 3 (Tibia)
H	= Position of ligament attachment point 4 (Tibia)
I	= Assembly of anterior cruciate ligament to point 1
N	= Assembly of anterior cruciate ligament to point 4
K	= Assembly of posterior cruciate ligament to point 2
S	= Assembly of posterior cruciate ligament to point 3

It is now clear that all of these characteristics are actually *interdependent* and *critical* and must exist simultaneously! In his evolutionary sequence, Dawkins assumes that, when the first correct letter (in this case 'M') is selected, it will improve the system. However, in the case of the four-bar hinge, getting one single characteristic such as the position of one attachment point correct while all of the other characteristics are incorrect would result in a useless, non-functioning system! Therefore, only when the letters read 'ME THINKS' is it possible for the four-bar hinge to function.

1.15 The deception of evolving pictures

Another abstract model of evolution which is used by Richard Dawkins involves the evolution of pictures from simple lines to complex images.[17] Starting with just one line, Dawkins applies a variety of rules for branching

off lines and evolving patterns in an incremental way. Some of the rules inevitably produce interesting patterns that give a pictorial resemblance of such things as bats and insects, and so there is a claim that this demonstrates evolution. However, the fact that it is possible to evolve a picture does not mean that it is possible to evolve a living organism. A picture does not have any interacting parts and therefore there is no requirement for the lines of the picture to exist simultaneously. If each line of the picture represented the different characteristics of a four-bar mechanism, then the picture could not evolve and its lines would have to appear simultaneously. As with letters and words, the use of a set of pictures to model an organism is completely invalid unless account is taken of the interdependent characteristics of the real physical system.

It is important not to confuse the complexity of a physical system with the apparent complexity of an inanimate object like a detailed picture. No matter how complicated a picture is, it does not perform physical functions with complex interactions. To claim that the evolution of a picture can demonstrate the evolution of a complex organism is absurd. Pictures are used to describe evolution because this enables the evolutionist to escape the real world of physically interacting systems.

The fact that evolutionists have to use jumbles of letters and pictures to explain evolution adds weight to the argument for design. If organisms could evolve, the evolutionist would not have to make up abstract models in the first place. Nothing would be clearer or more convincing than to show how a real functioning mechanism such as the knee joint could have evolved.

1.16 The deception of Genetic Algorithms

Genetic algorithms (GAs) are modelling techniques which attempt to apply the theory of evolution to real-life problems such as the design of a new mechanism. The GA method of optimization is now widely taught to undergraduate students in many disciplines including engineering and mathematics. Not surprisingly, there are claims that the use of GAs proves that evolution does work. However, when case studies are analysed, it is clear that GAs do not demonstrate evolution at all. In fact, GAs provide a useful means of showing how evolution cannot work.

In order to apply a GA to the design of a new mechanism, an existing

mechanism is described in terms of a set of characteristics. The existing mechanism is made to produce offspring with a new set of characteristics. The new characteristics are determined by gene variation or gene mutation. Offspring which are considered to be the fittest are selected for breeding the next generation of solutions. Offspring are continually evolved until no further improvements are needed or until no further improvements are possible. In practice, it is found that GAs can produce optimal characteristics, such as size, in a mechanism. However, this is not surprising because gene variation is well able to produce beneficial changes to superficial characteristics, such as size, in real organisms. When a GA breeds an optimized solution, there is no difference between this and the breeding of a thoroughbred horse.

The real test for GAs is whether or not they are able to produce new types of mechanisms. Despite years of research, this is something that GAs have not been able to do. For example, in one paper in the *Journal of Engineering Design*, a gene mutation was applied to the design code of a helicopter which resulted in the helicopter changing from a single rotor blade to a double rotor blade design.[18] Such a design change involved the changing of thousands of precise geometrical characteristics. Therefore, the researchers had to abandon temporarily the process of evolution and make the 'single' mutation represent thousands of simultaneous changes. Such intervention meant that the researchers were actually modelling an 'intelligent' design process and not an evolutionary process at all! The use of GAs in this instance actually showed that evolution of physical systems cannot take place.

Research into engineering design practice in industry has actually shown that the best method of design is to be as concurrent as possible,[19] which essentially means to bring information together simultaneously. This conclusion shows that the best way of designing is to be as different as possible from the process of evolution!

1.17 Lessons from engineering design

The supposed process of evolution is the complete opposite to the process of design used by human designers. Evolution is a 'bottom-up' process that supposedly starts with details and finishes with a concept. In contrast,

human designers design in a 'top-down' process, starting with concepts and finishing with details. Engineers throughout the world are taught that the engineering design process must be a top-down process which starts with fully functioning concepts.[20] The reason why designers are taught to design in a top-down way is because engineering contains many irreducible mechanisms and these mechanisms cannot be designed from the bottom up. Since engineering and nature contain similar mechanisms, and since human designers have found that they must design from the top down, this provides yet further evidence against evolution.

The top-down process of engineering design is demonstrated in the design of bridges. When designing a bridge, a designer first of all chooses between different concepts such as a suspension bridge, truss bridge and cable-stayed bridge. After selecting the concept, the designer then designs all the details such as the connections and beams. It would be ridiculous for a designer to begin the design of a bridge by evolving a simple plate of material and hoping that it would eventually turn into a bridge. Such an approach would get nowhere because a single crude piece of material cannot turn into complex layouts in single steps.

It is interesting to note that four-bar mechanisms are commonly used in mechanical engineering. For example, four-bar mechanisms are often used in the steering systems of four-wheeled motor vehicles. The theory of evolution is analogous to proposing that one can take the engineering drawings of a simple pivot joint used in a motorbike steering wheel and evolve them into the drawings of the steering system of a four-wheeled vehicle. The information on the drawings is equivalent to the genetic code, and random photocopying errors in the information are analogous to gene mutations. The evolutionist believes that the random photocopying errors will sometimes produce a slightly better system and that eventually the steering system will turn into a four-bar mechanism and form the steering system of a four-wheeled vehicle!

Such reasoning is absurd for several reasons. Firstly, if a random change is made to the information on a drawing of a motorbike steering system, this will at best cause no change in the basic functions and at worst have fatal consequences. Secondly, there are no intermediate mechanisms between a motorbike steering system and a car steering system, whereas

evolution would require hundreds of fully functioning intermediate forms. In a similar way, it is impossible for the knee joint to have evolved from a simple pivot joint by copying errors in the genetic code.

1.18 The effect of the Fall

While the knee joint contains supreme design, it is also subject to diseases such as arthritis. Genesis 3 teaches that God put a curse on the whole of creation as a judgement for the sin and rebellion of Adam and Eve. In the case of human beings, the judgement involved undesirable effects such as aging, illness and mortality. Even though there are signs of the curse on creation, it is still possible to see clear evidence of design. It is important to point out that gene mutations are part of the curse on mankind and only existed after the rebellion of Adam and Eve. It is ironic that evolutionists consider gene mutations to be the creator of life, when in fact gene mutations are a part of the curse which has brought death into the world. It is also sad that many theologians believe that God used evolution to create the world.

1.19 The power and wisdom of God in creation

The irreducibility of the mammalian knee joint provides powerful evidence that the natural world has a Designer. However, the extreme elegance, efficiency and durability of the knee joint also give evidence of the infinite power and wisdom of that Designer. The knee joint is just one example of design in nature that shows the truth of the biblical statement that 'His [God's] invisible attributes are clearly seen, being understood by the things that are made' (Romans 1:20). In the Old Testament, Solomon spoke of the wonder of the growth of bones in the womb: 'As you do not know what is the way of the wind, or how the bones grow in the womb of her who is with child, so you do not know the works of God who makes everything' (Ecclesiastes 11:5). Recent studies on the growth of joints have shown the remarkable truth of these verses.

Notes on Chapter 1

1 A paper on the knee joint, based on the contents of this chapter, has been published in the

AIG Technical Journal entitled: 'Critical Characteristics and the Irreducible Knee Joint' (CET Journal, 13/2 (1999)). This paper has also been translated into German and published in the German journal *Factum*: 'Das Design des Kniegelenks', *Factum*, 6 (2000), pp. 14–18.

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17 Ibid. p. 52.

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The irreducible flight mechanisms of birds

Then God said, 'Let the waters abound with an abundance of living creatures, and let birds fly above the earth across the face of the firmament of the heavens.' So God created great sea creatures and every living thing that moves, with which the waters abounded, according to their kind, and every winged bird according to its kind. And God saw that it was good (Genesis 1:20–21).

The Bible teaches that birds were created as fully formed flying creatures and that they have not evolved from land creatures as claimed in the theory of evolution. In fact, the Bible teaches that birds were created before land creatures. Modern discoveries about the very demanding requirements of flight have provided overwhelming evidence that birds must have been created as fully formed flying creatures. This chapter describes some of the intricate and irreducible mechanisms which are required for bird flight. It also shows how the irreducibility of flight is demonstrated by the history of aviation.

2.1 Irreducible mechanisms for gliding

Fig. 2.1 shows some of the essential mechanisms required for gliding. Even though gliding may appear to be a simple form of flight, it is not simple at all. Gliding requires the simultaneous existence of several precise mechanisms including aerofoil wings, light structures and control mechanisms.

I AEROFOIL WINGS

The aerofoil cross-section of a bird wing is shown in Fig. 2.2. The leading

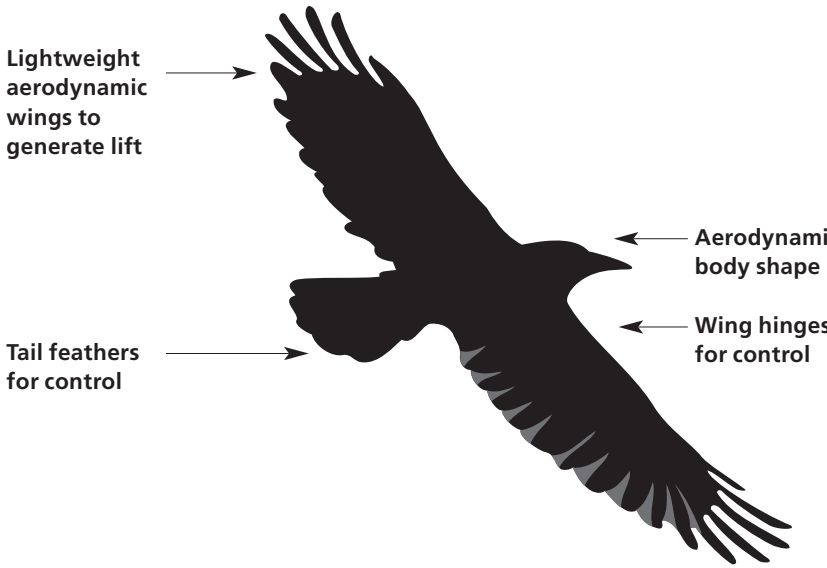

Fig. 2.1 Essential parts for gliding

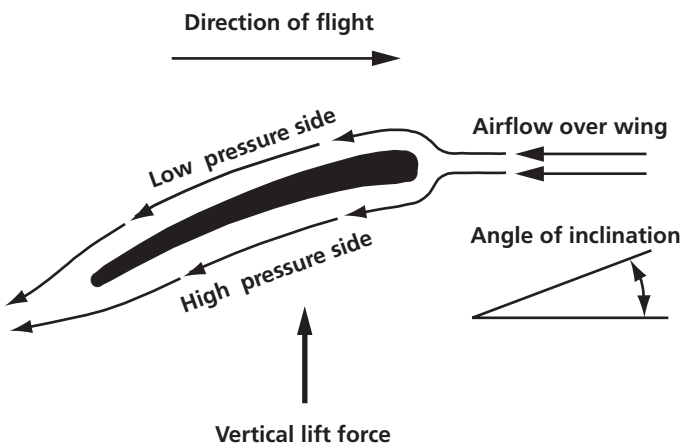

Fig. 2.2 The aerofoil cross-section of a bird's wing showing the principle of flight

edge of the wing is rounded and the thickness gradually tapers towards the trailing edge. When air flows past the leading edge of the aerofoil, the air has further to travel on the upper surface than on the lower surface. The difference in air speed causes a decrease in air pressure above the wing while the air pressure is nearly constant or increased below the wing. The relatively high pressure on the bottom surface of the wing produces an upward force on the wing. As long as the bird has enough forward speed, the aerofoil wing produces an upward force which keeps the bird in a steady glide.

II LIGHT STRUCTURES

Air has such a low density that there is a limit to the lifting force that a wing can generate. Therefore, a bird must be extremely light to enable gliding to take place. As well as having light wings, birds must also have light bodies. Modern studies have shown that the feathers and bones of birds are supremely well designed for producing lightweight structures.

III CONTROL MECHANISMS

Other essential mechanisms for gliding are control mechanisms. A bird must be able to have fine control of wing and tail movement in order to achieve stable and safe gliding. In particular, a bird must have mechanisms to change altitude, direction and speed. To change altitude, the lift force on the wings must be controlled by applying fine adjustments to the angle of inclination of the wings. If the angle of inclination of the wings is not controlled finely enough, the bird could experience unstable flight and drop from the sky. To change the direction of flight requires banking to the left or right. This can be achieved by inclining the wings at different angles in order to produce a different lift force on the two wings and thus tilt the bird into a turn. Banking is a particularly difficult manoeuvre because it also causes a different drag force on the two wings. This inequality of drag forces would put the bird into an unstable spin if there were no other compensating forces being generated. A bird generates such compensating forces by moving other flight feathers such as the tail feathers.

One of the most difficult challenges of flight is that of slowing down

sharply before landing. To slow down, a bird spreads out its wings and tail feathers in order to greatly increase the amount of drag on the bird. This manoeuvre requires split-second timing and precise control in order to be carried out safely. Some birds even have a special group of feathers, called the 'alula', on the leading edges of their wings to help give them stability at low speeds. The alula contains three to six small stiff feathers and these form a small slot at the leading edge of the wing at low flight speeds. This slot has the effect of squeezing and speeding up airflow across the top of the wing, thus reducing the effects of slow-speed turbulence and thus helping to prevent an unstable stall. It is interesting to note that modern aircraft have a feature similar to the alula for the same aerodynamic reasons. The slot in aircraft is sometimes called the 'Handley Page slot'.

There are thousands of species of flying bird and they all have the essential mechanisms of aerofoil wings, lightweight structures and control mechanisms. These mechanisms are not found in land animals; indeed, they would be a hindrance to them. There are such vast differences between the requirements of gliding and land locomotion that birds could not have evolved from land animals and must have been designed to be fully functioning as birds from the beginning of their existence.

2.2 Irreducible mechanisms for powered flight

The fact that a bird requires several sophisticated sub-systems for gliding alone shows that it cannot be the product of evolution. However, virtually all birds can also perform powered flight for long distances. Powered flight requires all the sub-systems of gliding plus additional parts such as a special breastbone and large wing muscles. The breastbone in a bird is unique because it has a long extension for attaching the wing muscles. This long extension is called a keel.

Evolutionists fully admit that birds need many specialized sub-systems simultaneously in place for flying. However, they cannot explain how these sub-systems could have evolved in small steps by genetic mistakes. One advanced book on the structure of birds says this about the requirements of flight:

The anatomical requirements of flight include not only these limitations on total body

weight, but also a general streamlining of the body, virtually total commitment of the forelimb to flight, a specialized pectoral girdle and wing bones, modification of the thoracic musculature for flight, and accentuation of the special sense organs, especially vision and balance, with corresponding enlargement and modification of the brain. Finally the energetics of flight impose special demands on the respiratory and circulatory systems.[1]

2.3 Irreducible feathers

A flight feather is a masterpiece of design and is one of the most efficient structures known to man. A flight feather is shown in Fig. 2.3. It consists of a hierarchy of structures. The main feather stem comes first, then the barbs and finally the barbules. The main stem consists of a hollow structure that contains air or foam to give it an extremely high stiffness-to-weight ratio. The stem starts off as a circle near the root of the feather. The cross-section of the stem then changes into a rectangular shape which is structurally more efficient.

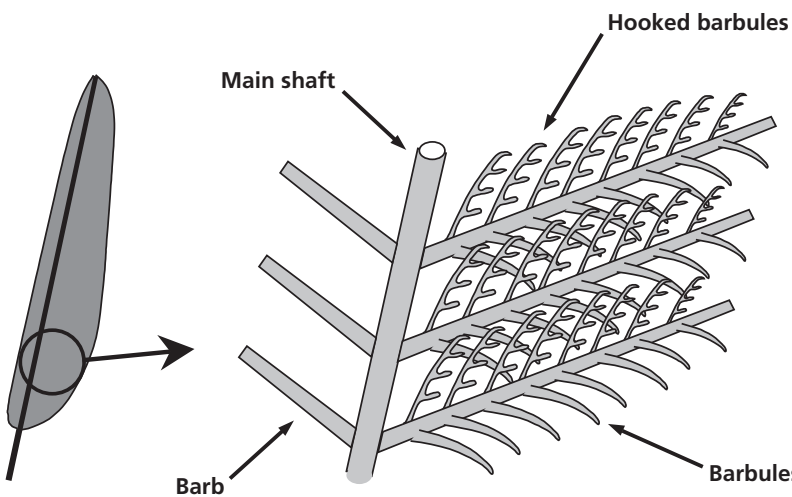

Fig. 2.3 Flight feather

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From the Preface by Professor Andy McIntosh, University of Leeds

Professor Stuart Burgess has taught engineering design at Cambridge University and Bristol University. He has also carried out spacecraft design for the European Space Agency. In 1989 he received a Design Council Prize for engineering design presented by the Minister of State for Trade and Industry. In 1993 he received the Turners Gold Medal for the design of the solar array deployment mechanism on the £1.4 billion ENVISAT satellite (presented by the Vice Chancellor of City University). He is author of several other books also published by Day One.

Day One Publications
Ryelands Road Leominster HR6 8NZ
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