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PRIZE LECTURES

20th James Scott Prize Lecture

Sir Michael Berry, FRS

9 December 2002

Making Light of Mathematics

Sir Michael Berry, Professor of Physics at the University of Bristol, was elected to the Royal Society in 1982, knighted in 1996 and holds numerous national and international awards, including seven honorary degrees.

He is known not only for his pioneering work on phase but also as a communicator to specialists and the layperson alike. In addition, he has been awarded for his work in uniting science and art.

The James Scott Prize Lecture is the result of a bequest by James Scott, a farmer at East Pittendreich, near Brechin, and is held every four years on the subject of 'fundamental concepts of natural philosophy'.

It should be noted that Sir Michael's talk was abundantly illustrated with photographs and computer graphics so the following report cannot summarise it fully.

Physics and mathematics have evolved together and remain intimately connected; optics is a prime example of this relationship. This was illustrated by a series of presentations demonstrating the mathematics underlying everyday physical phenomena, many relating to light.

Sir Michael demonstrated that $1+1$ does not always make two. If two torch beams (messy light) are added, the resulting beam is twice as bright. However, if two beams of pure light are added the contributing waves add to give an additional property, "phase". Phase is the property of any cyclic process and explains at what stage the oscillation exists (at any given moment), as in phases of the moon. The effect of phase means that the beams can, at particular stages, cancel each other out, giving $1+1 = 0$.

Sir Michael went on to define a "caustic" as a line of focused light and showed an image of interference fringes on the edge of a caustic. Such interference can be observed in a rainbow when all the water droplets have roughly the same size. This is caused by sunlight hitting a raindrop at a uniform angle, and emerging at a non-uniform angle, concentrated in a given direction, known as the "rainbow angle". Inside the rainbow, for each particular angle there emerge two rays that enter the rainbow at completely different heights. These two rays interfere to give an interference fringe: the supernumerary rainbow. Mathematically this known as a "2:1 map" because there are two possible angles of entry into the rainbow for every ray of light that emerges. This is not to be confused with the completely different phenomena of secondary rainbows, visible some distance from the primary rainbow.

In contrast, the reflection of sun upon water, giving an intense sparkle of light, is a 'many-to-one map'. The sparkle comprises many images of the sun arriving in one place (the eye) and the images occur at points where the water surface has exactly the right slope to reflect sunlight into the eye. The singularities of the map (the places where the images coalesce) occur on focused surfaces, just above the surface of the water and unseen by the eye. It is the rapid succession of these singularities that give the sparkling effect and if the eye is

positioned close to the water surface, the individual images can be seen. The mathematics describing this phenomenon of natural focusing is "catastrophe theory".

Caustics are the envelopes formed by families of rays in the natural world. Sir Michael showed a series of images representing the planes formed by rays of varying family size, for example, folds and cusps. These lines of focused light are decorated with interference patterns. An example of a caustic (in water rather than light) is Kelvin's ship-wave pattern, i.e. the V shape trailing behind everything from tankers to ducks, always having the same angle. Caustics display points of complete destructive interference, i.e. points of absolute blackness.

Sir Michael explained that physicists use series when unable to make absolute calculations and moved on to discuss the mathematics of "infinite series". There is a famous paradox concerning the apparent impossibility of being able to walk two steps. In walking two steps one must first walk the first step and before completing the second step one must walk the first half of the second step. Before one walks the remaining half one must first walk half of that distance, and so on ad infinitum, never actually completing the second step. Mathematically this is a convergent series with a finite sum, and it took a long time to explain the apparent paradox: $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} \dots$

Stokes created an infinite divergent series to explain Airy's rainbow integral, which concerns the transition from the bright side of a rainbow to its dark side. To get from the bright side to the dark side without going through the zero point (the caustic) involves one ray diverging into two. The series takes the form: $1 + \frac{1}{10} + \frac{2}{100} + \frac{6}{1000} + \frac{24}{10000} \dots$ This appears to be the beginning of a convergent series, but after a while the contributions get bigger. Stokes understood that the point at which the contributions get bigger is associated with the transition from the bright side of a rainbow to the dark side.

Sir Michael then examined the mathematics of zero. When a wave has zero intensity, its phase is indefinite and if phase were represented by colour, all colours would be represented at the zero point. If sound is represented by waves then the areas of silence at the points at which they interfere can be represented by

“strings”. These strings can be intertwined in many ways, and ‘knot theory’ explains their connections. Examples of the forms they take include being wound on a torus, and a trefoil threaded by a triple helix. Black (zero intensity) light can be represented similarly, as can waves that exist at a quantum level within an atom. In the latter case the string is a series of points representing the zero probability of finding an electron. As beams of energy (sound, light or electrons) are changed, so do the strings change, knotting and unknotting in spectacular fashion.

Sir Michael then examined the “geometry of colour”. He explained that colour cannot be solely regarded as a spectrum as the quantity of each individual frequency must also be known. Just three types of cone cells within the eye interpret this infinite number of frequencies. He described his interest in the “colours of darkness”. If one looks at a zero intensity point, i.e. absolute darkness, on an interference pattern, and magnify the intensity of the colour at these points, then one sees a characteristic pattern of colour, comprising shades of purple, black and white.

Sir Michael proceeded with an examination of extreme interference. A normal interference pattern from a diffraction grating (described by Young in 1800) can be mathematically explained by Gauss sums. Extreme interference is a further aspect, producing patterns that depend very sensitively on the angle “ x ”. All the resulting patterns have a basic “curlicue” shape but have layers of individual intricacy overlaid. For many years these patterns were of interest only to number theorists but are now recognized by physicists as an “optical microscope”. Incredibly, the pattern for almost every “ x ” contains somewhere within it the pattern for almost every other “ x ”.

Sir Michael continued with an exploration of fractals. They are infinitely wiggly curves, appearing infinitely intricate upon magnification and are represented by a dimension. A curve has a dimension of 1, whereas a very wiggly line has a dimension between 1 and 2, where 1 is smooth and 2 is completely filling area. With diffraction images if you look across a diffraction image you see a dimension of 1.5. However, if you

look along the image you see a dimension of $7/4$, and at certain diagonal lines the dimension is $5/4$.

Sir Michael argued that physics is full of analogies and an analogy of the optical diffraction grating phenomenon is found in quantum mechanics. In quantum optics the key is the distance from the grating. The corresponding variable in quantum mechanics is time. The wave equation describes the phenomenon in optics; in quantum mechanics it is Schrodinger’s equation. In the latter, the repetitions in the image produced by the grating become repetitions (revivals) in time of quantum waves. Quantum carpets are the paths woven by electrons following a fractional revival.

Unlike sound waves, light waves travelling in a crystal oscillate from side to side. Such a matrix acting on a light source changes it, however, if the original light is chosen carefully, the new light is the same as the original. Two waves that get out of step can be made to interfere using a “black light sandwich”, the bread of the sandwich being two sheets of Polaroid, and the filling a crystal between them. The pattern produced has a bullseye pattern.

Sir Michael concluded with two quotations:

James Clerk Maxwell,

“The dimmed outline of phenomenal things all merge into one another unless we put on the focusing glass of theory and screw it up first to one pitch of definition and then to another so as to see down into different depths, the great millstone of the world”.

Lennon and McCartney,

“The fool on the hill sees the sun going down but the eyes in his head see the world spinning round”.

Following the lecture there were questions from the audience. Sir Michael was asked how his lecture related to quantum cryptography. Sir Michael replied that the closest connection would be with number theory, which describes extreme interference. Asked which of his discoveries had given him the most satisfaction, Sir Michael replied that he had enjoyed making a small contribution to Stokes’s divergent series that occurs in Airy’s rainbow integral.

Professor Miles Padgett FRSE moved the Vote of Thanks.

7th BP Prize Lecture

Dr Colin Kidd FRSE

Race and the Scottish Nation 1750 - 1900

13 January 2003

The President, Lord Sutherland of Houndwood, KT FBA PRSE, introduced the lecture by thanking BP for their support of this Prize Lecture, given, in a range of fields, to an academic under the age of forty. He described how Dr Kidd has firmly established himself as a Scottish historian focusing on 18th century Scotland within an international dimension, and has written the acclaimed titles, *Subverting Scotland's Past* and *British Identities before Nationalism; Ethnicity and Nationhood in the Atlantic World 1600 – 1800*. Lord Sutherland then invited Dr Colin Kidd to deliver his BP Prize Lecture entitled *Race and the Scottish Nation 1750 – 1900*.

"Before I start I would also like to thank BP and the RSE for their support, in particular the RSE staff for their Rolls Royce-like efficiency in organizing this event.

It occurred to me this afternoon as I was trying to work out exactly what I was trying to do that there are three things I would try to persuade you about. Since you're still awake I would like to 'get them in early'. You seem to be a very fair-minded audience so I think I may be able to persuade you of one or two of these but I have my doubts about the third.

The three points, as the title suggests, are contained within race and the Scottish Nation. The first point I would like to persuade you of is that race was absolutely central to Scottish identity in the 19th century. In fact, more than that, it was something that was of much greater import than national identity, and led to considerable reshaping, indeed undermining, of national identity in the 19th century.

The second point I want to convey is that this concept of 'The Celtic Fringe' (a term still used to describe those nations on the periphery of the British world - Wales, Scotland and Ireland - sharing a non-English identity and that there is something Celtic about them) would be an anathema to 19th century Scots, as it would be to the 19th century English.

So far I think you can be persuaded. On the third point I have no hope. It is that some, but not all, influential Scots and English commentators in the 19th century thought that the Scots were English, more English than the English, and the English agreed. At least that the Scots of the lowlands were more English than the Englishmen. Not that the English weren't English themselves, just that they were a little bit less English than the Scots. I think you'll have some trouble with that notion!

I would like to start by looking at a couple of Scottish national icons through racial eyes in the late 19th century. I would like to start with Burns. Thomas Carlisle described Burns as a piece of the 'right Saxon stuff'. No mention of Scotland there. John Halliburton, one of the most celebrated of 19th century Scottish Historians described William Wallace as, "the representative or champion of the Saxon or pure Norse inhabitants of Britain who have not yet been subjected to the southern yoke". Saxon or pure Norse; a potential contradiction. Here I would like to refer you to the glossary (see end). Teutonism means someone who

speaks a Germanic tongue, and is used in the 19th century to describe anyone who belongs to the Germanic or Teutonic race. This not only included the Anglo-Saxons (and a few of the Scots were Anglo-Saxons) but was also used of the Norse, as in the last quotation. And this view of Teutonism was a powerfully held, entrenched view in 19th century Scotland. I will show this evening that the view was held right across the sciences, particularly in the medical profession and also in the arts by historians, archaeologists and literary people. One can find a broad based intelligentsia spreading out into the professions in 19th century Scotland, of people who were obsessed with race and thought that the bulk of the Scottish population (i.e. the expanding lowlands) and some pockets elsewhere, were Teutonic people, belonging to a Teutonic race. And that race mattered much more than nationhood in the 19th century. This was the new trendy view and had the purpose of subverting old views. Particularly it's as if race science falsified the old science of nations, that nations were somehow false. Race embodied a new truth, previously hidden. Race was nature, nations were accidents, race was authenticity. If you wanted to understand the world around you, you wanted to understand race, not nation. For that reason nationhood took a back seat in discussion about 19th century Scotland. I should mention how I came upon this topic. I first came across it about a decade ago when I was reading an American historian who was writing about the origins of racial Anglo-Saxonism and the transformation of *English* identity in the 19th century. I was very persuaded by the argument, but who were the figures transforming English identity, racialising Anglo-Saxonism in the 19th century? There was John Pinkerton, Scots literary scholar who wrote about the Picts; there was George Coombs, an Edinburgh phrenologist (glossary), and Thomas Carlisle. I thought it was very interesting how English identity was transformed by a group of people that the authors felt were English; but of course we knew better.

I want to begin by disposing of the notion of the Celtic Fringe. As far as I can trace the term Celtic Fringe actually emerges towards the end of the 19th century. The first mention I can find is in a controversial speech given by Lord Salisbury in 1890 when he was in Lancashire opening a Conservative Club and he used the term 'Celtic edges'. He said the Celtic edges of the British Isles were over-represented in Parliament. What

did Salisbury mean? We get a clue from his nephew Arthur Balfour who in the previous year, 1889, gave a speech in response to JP Clerk's Home-Rule Bill and what Balfour said was that he denied that Scotland was in unity. He said,

"I venture to say that the Highlands of Scotland are more unlike the Lowlands of Scotland in every essential particular than the Lowlands are unlike the North of England. Linguistically, ethnologically (a 19th century term for anthropology) in the character of the people, in the social addictions, in every essential moment I boldly state that the line of division is not the division between England and Scotland but some line to be drawn far north of that."

It so happened that when Salisbury gave this speech it actually led to a flurry of press interest in the subject and one of the people who responded was a chap called Grant Allan, a journalist, evolutionist and ethnologist in the late 19th century. He didn't like Salisbury's idea but he agreed with him on the premise that the bulk of Scotland wasn't in this 'Celtic Fringe'. He said that the Saxon lowlands were not included in the fringe and even added (and here I might persuade you on my third point) that there were no thoroughgoing Englishmen now left in Britain save among the so-called Scotch of the Lowlands. I have looked at a number of Irish and English anthropologists writing about the Scots at this time; all concur about the Celtic Fringes but they aren't thinking about the three Celtic nations; they are thinking about something much more marginal than that. They are not being sloppy, they are thinking very precisely about the Celtic speaking regions of the British Isles. I have another quotation here from the Rev Isaac Taylor, author of the book, "The Origin of the Aryans". That brings me to the second term in the glossary; "Aryans". It really refers to those people who spoke Indo-European languages, ranging through Sanskrit, the Celtic and Germanic languages and so on. It is a philological term; some people were very careful where they used it (in a strict philological sense) whereas others used it to refer to physical characteristics. It is a term we have come to associate with Nazi Germany, with abuse based upon physical characteristics. But in the 19th century they tended to be strict in the use of the term, certainly under the influence of the philologist Max Mueller. Isaac Taylor argued that the lowland Scotch were more Teutonic than the English. Teutonism is the key characteristic about what it is to be English. English is conflated with race and Taylor located various regions of the British Isles where he thought the Teutonic blood was least diluted; the Orkneys, the Lothians, Yorkshire, East Anglia and Ulster. I think a very similar lecture could be given about Ireland and race in the 19th century, an area I touched on during my research and a wonderful topic waiting to be looked at.

While I was looking at these anthropologists I also discovered that a number of them had carried out fieldwork in Scotland in the 19th century. John Beddoe was an English anthropologist who spent some time in Edinburgh doing medical training as a houseman and he then went out and studied hair and eyes throughout the British Isles but particularly in Scotland. He broke the races of Britain down, county by county, and calculated this using his Index of Nigrescence (glossa-

ry). I knew that I couldn't come to the Royal Society of Edinburgh, with all its mathematicians and scientists, without bringing at least one formula, something that looks like a bit like an equation. Of course it is total nonsense. Nigrescence is not based upon skin colour but is somehow based on the assumption that the Celts are darker than the Teutons, and is based largely upon hair analysis. The interesting thing we're finding here is that English anthropologists and English politicians did not look to Scotland and recognize a Celtic Fringe; by and large they saw Saxons. Beddoe saw plenty of Saxons in places such as the Lothians, East Coast, Far North, and so on, and we get this view that England saw Scotland as a Celtic fringe but as full of sound Teutonic virile people full of the Saxon energies, etc.

Now, how did all this come about? Where did all this start? The starting date I gave for this lecture was 1750. It is not a total red herring. I don't think it's when the Scots began to be interested in race but I think it's when you can detect the first glimmering of the term polygenesis (glossary). In 1748 David Hume wrote an essay on national character. In 1753 he inserted a footnote to that essay, a footnote that is now the most controversial part of Hume's oeuvre, certainly if you read *The Journal of the History of Ideas*. People send in articles concerning nothing else. Hume mentioned Negro inferiority in that footnote and said that there were about four or five different races of men. This is the term polygenesis, meaning that mankind does not have one origin. In other words, different races have different beginnings. Back then it was controversial for very different reasons than today. Now it is controversial because it looks like one of the prime (dead) white European males of the Western canon of philosophy was a racist, and that's why so much scholarly attention is now focused on this one footnote of Hume, which he amends slightly in his 1777 edition. The reason it was so controversial back then (and the reason why he dropped the bit about several races of men) was because of monogenesis. Monogenesis was orthodox doctrine and this where the whole subject of race links up with Christianity. Monogenesis is absolutely essential to the Christian doctrine because if we are not all descended from one Adam and Eve, from one racial origin, the whole theology of Christian redemption falls flat. That's why I think Hume was a bit cagey and that's where I can trace the beginnings of just how race enters into Scottish social thought in 1774 in the work of Lord Kames, *Sketches in the History of Man*. Kames looks around the world and argues that the huge variation in bodily appearance meant that the humans came from more than one origin. He also found it hard to believe that the Americas ad Australasia had been populated by Eurasia and Africa. He came to the conclusion that the evidence of the natural world around us suggested that there were different races, "polygenesis", created in a set of multiple creations. Then came Kames (who had been in trouble before when up for Heresy in the 1750s), watching his back, and invoked his great deus ex machina. He wrote the Tower of Babel, and said that at the Tower of Babel it wasn't just the language of mankind that had been transformed but their bodily constitution. And so that explains everything, home and dry. People read Kames as he had intended it, i.e. he didn't mean the bit about the Tower of Babel.

From 1774 onwards one can find a torrent of comment in Scotland directed against Kames' theory about race. I've been looking at Edinburgh and Glasgow medical theses at the time; they engage with race. I've been looking at medical textbooks, apparently very dry books such as Dr W.P. Allison's *Outlines of Human Physiology*. As a non-medic I find them as dry as dust (!) but in the middle of it all you find Allison having a go about monogenesis and polygenesis, having a go at Kames' ideas. I've been through the very interesting records of the (still student-run) Royal Medical Society, here in Edinburgh and discovered that from the mid-1780s through to the 1812, they had 13 different papers discussing Kames' theories about race. This is absolutely fascinating, in particular their attempt to rebut Kames, discussing issues such as cases of albinos, black people with pale skins, and freckles because paler skins tend to freckle in the skin (and might that not be an environmental explanation about how white people grew dark). In fact one of the papers at the Royal Medical Society discusses colour as a "universal freckle". One of the people who gave a paper was Britain's leading racial scientist of the 19th century, James Coles Pritchard, a Bristolian who studied medicine at Edinburgh and worked out a way of rebutting Kames in a very controversial way. It wasn't heretical but he found a way of explaining how blackness was transformed into whiteness. It sounds good, except he ends up with a black Adam – which poses a bit of a problem. Race science is a big deal in medical and scientific circles throughout the 19th century.

The pseudoscience of phrenology developed by the Edinburgh brothers George and Andrew Coombs contributes to a great interest in craniology (glossary), the science of the skull. This involves reading the skull in terms of the location of various mental characteristics and that was tied to the study of different crania of different racial groups. Phrenology was a very popular pseudoscience in 19th century Britain and its heartland was in Scotland. The Edinburgh brothers were the main British interpreters of a pseudoscience that had developed in the German speaking world. Talking of which the Scottish medical community was very receptive to developments in racial science on the continent and one finds reference to the Dutch scientist Petrus Kamper with his 'facial angle' theory of the races. Also reference to J.F. Blumenbaath, the Göttingen anatomist who coined the term Caucasian and also the Swedish craniologist Anders Retzius. Retzius came up with the cephalic index, a ratio of the maximum length and breadth of the cranium, whence we get these wonderful terms 'dolichocephalic' or long headed peoples, particularly associated in the 19th century with the Teutonic race and the brachycephalic (wide or round headed). This was another subject of tremendous importance in the 19th century, followed not just by medics, but archaeologists also, looking for the 'real truth' about peoples, coming from physical characteristics. This goes on right through the 19th century but it's not just those people on the pseudo-scientific fringes of the medical world. We are talking about very established figures such as Sir Arthur Keith who went on to be the conservator of the Royal College of Surgeons in London. He is now thought to be one of the main perpetrators of the Piltdown fraud in the 1910s. In the middle of the 1890s Keith came to

the conclusion that the key to the races of Britain was the configuration of the ear. Between 1895 and 1897 he studied 15000 ears (you'll be glad to know these ears were still appended to bodies). He looked at the wider community, including prisoners and lunatics. Another one on the south side of Glasgow, Ebenezer Duncan, the first physician of the Victoria Infirmary, and one of the key founders of that hospital. He was also president of the Sanctuary Association of Scotland and a key figure in late 19th century Scottish medicine. He was absolutely obsessed with race and studied the records of hat manufacturers from which he developed "conclusive proof" that the Scots were more dolichocephalic than the English. I have to say that Duncan was an open-minded man, and much as he praised the glories of the Teutonic race of Scotland he also saw a downside to this, "These virile Teutons got drunk more than the Celts and had higher rates of illegitimacy", and I discovered that as well as being a leading medic he was also President of the Langside Union Association. Yet despite this he welcomed Irish immigration into Scotland because these Celts in certain respects might improve the morals of the virile Teutonic race of Scotland. But as I said it's not just in the medical and scientific side that we see race in Scotland. It's also in the Arts side – and the key figure here is John Pinkerton who in the late 18th century was a very keen proponent of the recovery of the mediaeval corpus of Scots literature; he was a great proponent of literature in the Scots tongue. Alongside that he was a notorious Celtiphobe; he despised everything to do with Celts and especially everything to do with Ossian. He came up with the notion that from time immemorial there were two main races in Europe; the Goths or Teutons (a super-race) and an inferior race of Celts. And what is most interesting about Pinkerton (and this is what is total nonsense in his work and is something that has survived throughout the 19th century - I have found traces of it in 1916 in the work of somebody who was a celebrated biographer of Andrew Fletcher of Saltoun) he came up with the notion that the Picts, the aboriginal people of Scotland were not p-Celts (as I think we would believe them to be), but in fact were a Germanic or Teutonic people. His theory about the Picts was controversial but had some followers. It was parodied by Walter Scott in the *Antiquary* but it was a view that was upheld by our own equivalent of Dr Johnson, the Rev John Jimmison. He produced an ethnological dictionary of the Scots language in 1808 and also held this view that the Picts were Teutonic and that Scots language had been spoken from time immemorial by the Picts in Scotland.

History was also shaped by racialist ideas. Archaeologists such as Daniel Wilson included chapters on the cranial characteristics of the races of Scotland. In folklore, in the study of popular culture, there's David McRitchie who believed that the fairy folk, the little folk of Scotland, were in fact a non-Aryan race. He thought they were Picts (Pects) or Finns or Laps speaking a non Indo-European language. In other words the influence is everywhere, throughout the arts and sciences. Empire too helped to reinforce these ideas but I should just point out you could be a racialist and an anti Imperialist. The famous Robert Knox, author of *The Races of Men* argued (as did George Coombs the phrenologist) that races belonged to particular continents, and it was against the laws of nature to go

and conquer and colonise another continent. In other words you could be a racist anti-imperialist. In fact it was quite easy to be progressive and racist. We tend to associate racialism with the politics of the right but in the 19th century, racialism was as much on the left because remember that polygenesis is very daring and atheistic. Racialism is as much progressive and trendy. British anthropology as a whole was predominantly monogenist but the French, having had a revolution of its own, were much more polygenist and plenty of French polygenist ideas came into Scotland.

So we've looked at the causes of all this, what about the consequences? I think there are three. Two are quite well known. Firstly, we've got the Scots response to the Irish, and a number of scholars have written about this. It's obviously something that begins in the early/mid 19th century and was certainly still present in Scotland's respectable circles as late as the 1920s and '30s. This is a hostility towards Irish Catholic immigration in Scotland that is not simply based on sectarianism but also that these people do not belong to a Teutonic race; they are weakening the Teutonic race. Even in official documents, such as the preface to the census in 1871 you find the Scottish registrar bandying about a lot of racial epithets about deterioration of the race in Scotland due to Irish immigration – but I'm not going to harp on too much about this.

Secondly, there's the attitude to the Highlanders. This is something Tom Devine has looked at in his work on the Irish famine in the late 1840s and one of our former Glasgow PhD students, Christine Nephue, in her recent book, looks at the Press response to the 1840s famine. They have shown that many newspapers were less than sympathetic to the plight of the Celts because they took the racist view that the Celts were an inferior race on the verge of extinction - so why bother helping out? Perhaps the most stark was the Sutherland and Fife Journal which said that ethnologically the Celt is weaker than the Saxon and destined to disappear.

And now for third consequence. It relates to my mission to persuade you this evening that the Scots saw themselves as English in the 19th century. What we get is the view that the Scots nation was created as a Teutonic state. The historian Duncan Keith writing in 1886 claimed the Celts of early Scotland were too decentralised to put together a state. It's only as Scotland becomes Teutonised that Scotland becomes a state. One can find similar sentiment in the work of historians such as Halliburton, who writes how Scotland and England were formed out of the "general Saxon aggregate", as if it were an accident that the Northern and Southern Saxons were split up. I came across a wonderful 19th century school textbook that went through many editions, by a lady called Margaret McArthur. I wondered if any of this racial stuff actually trickled down through the classrooms. I couldn't believe my eyes when I saw the material. Page one states how Scotland is composed of two branches of a great Aryan race. My goodness, there would be trouble if that were being taught today. She goes on to say the Saxons of the lowland outnumber the Celts of northern Scotland by more than three to one, despite the fact that the Teutons were called by the name of the Celtic people. She goes on to the War of Independence. This is a difficult point because if race

is everything and nations don't matter, then the War of Independence is made to look like a civil war within the Saxon race family. What does she find? Edward I does his stuff for Scotland and what do the Celts of the North do? Nothing! She uses the word apathy to describe them. But the lowlanders, the descendants of the early Teutonic settlers, had remained more purely English in blood and speech than their Kinsfolk on the Southern side of the border. And she said that at the Battle of Bannockburn the Saxons of the lowland had decided their own fate and that of the Celtic people by whose name they were called and whose kingdom they chose to belong. In other words the war of Independence is all about the Teutonic race and their mistake, and that's where William Burns is important.

As far as I can see William Burns is the true Scottish Nationalist historian of the 19th century. He produces a history of the War of Independence in 1874 in which he argues that if all this racist nonsense takes hold, then Scottish history will come to mean nothing. Instead of being held as a noble tale of patriotism, the war of Independence should in strict logic be lamented as an unfortunate blunder or a specimen of wrong-headedness. He argued that if the racial theorists were correct then the history of our country ceases to have any meaning. As Robert Knox said, "forget for a time the word nation". In other words nations are accidents, what really matters is race. So what I'm driving at is that these theorists were so driven by race that they concluded that in effect nations were nonsense. Black was white, Scotland was England. Pinkerton, for example, claimed that two words had hitherto totally ruined our history; Scots and Scotland. Duncan Keith suggested in his history of Scotland that the name Scotland suggests an untruth. Ebenezer Duncan claims that the names England and Scotland have no value ethnologically. Their view was that the two countries were indistinguishable. Furthermore, because England had had a Norman Conquest (and therefore had experienced significant immigration) Scotland, along with other places such as Northumberland, remained more purely racially Teutonic.

I want to finish by looking at the period we think of as the crucible of modern Scottish history, the period when Nationalism took hold. You can see how race here provides a justification for Union, because it is not a union of opposites; Union is simply a corrective ending the accidental division of Scotland and England. As a result of Irish Home Rule, the Scots begin to agitate for the same, and in 1886 the Scottish Home-Rule Association was formed. This is a tremendous period of creativity for Scottish constitutional thinking. I had always assumed (and here I must correct something I previously published) that there was logical connection between racialism and unionism. But believe it or not I have begun to find racist home-rulers saying that "Scotland is England". For example, W.Scott Dalgliesh writing in the 1880s, a home-ruler writing in periodicals, argues that for a restored Scottish Parliament so that she can express her Teutonic virtues. He goes on to say that the Scots are more English than the English. There are others too, like Robert Cassie, who continues writing about home rule right into the 1930's. A Teutonic racist who in the 1930s was still writing was Hugh McDermott and Erskine (it's not the pan-Celtic notion of Scottish of

Nationalism - that in his view that's nonsense). G.B. Clarke, in that home rule debate of 1889 that I mentioned, concluded by saying that home-rule should in no way undermine the great Anglo-Saxon union.

What I have also discovered is that in the 1880's there were a lot more ideas than simply home-rule, e.g. constructive imperialism (imperial confederation). There were plans to do things with the empire. The empire has been acquired in a fit of absence of mind and we ought to rationalise its procedures, bring people in to play, think about we should run the economics of the empire. Here too a lot of Scots took the theme of home rule all around and linked it in with the idea of imperial reform. We see an Imperial Federation league formed in 1884, and the famous Scot, Lord Roseberry, who of course thought of the Scots as an Imperial race, served as its President. What I've discovered is that these themes of race, home rule and imperial confederation all link up in myriad ways. The 1880s are not simply about home rule and nationalism; what I've discovered for example is the idea (alongside imperial confederation) of racial imperialism espoused by people such as Major Stuart Lythen Murray of the Gordon Highlanders. This seems pretty obscure. Slightly less obscure is the view of Andrew Carnegie who believed that there were two great racial Teutonic superpowers in the world; the British Empire and the Americans. An accident (somewhere about 1776!) had separated them. When he bought Skibo Castle he ran up the flag of his racialist empire – a compound flag of the Union Jack and Stars and Stripes sewn together. What he promoted was the idea of an Anglo-Saxon racial union and in that racial union (he was no friend of Kings and Queens) he envisaged Britain being drawn into something of a Republican grouping in which Scotland would enjoy a bit of home rule. But Scotland would be a bit like a state within the "United States of the Saxon world".

And closer to home, and to finish off, I discovered another little charming racial fantasy in the Orkneys and Shetlands, known as the Udal league. This is a grouping (established in the same year as the Scottish home rule association, 1886,) set up to promote home rule for Orkney and Shetland. Here, another variety of racialism existed; the Norse version of Teutonism, because the Norse too were part of the Teutonic race. In the 19th century a number of figures in Scotland, led by Samuel Lane, the Orcadian who produced a famous edition of Snorrie Stuleson's Heimsckreimler – an Icelandic saga of the kings of Norway written in the 1840's, promoted the notion that the Saxons, so much for being virile, they were actually the "softies" of the Teutonic race. The real hard men were the Norse and the reason why they were even more energetic and libertarian and democratic than the other branches of the Teutonic race was because of their Udal law - the antithesis of feudalism - and by which land was split up, i.e. there was repartable inheritance. It was in effect a peasant democracy. The Udal league was led by an Alfred Windall Johnson (who curiously led the Udal league from Welwyn Garden City). Most of these people were actually exiles and they also established a Viking Club for Northern Research in London. The intention was to revive Norse institutions such as

Herad, Lawting and Althing (courts and parliaments) where Udal democratic representation would at last free Orkney and Shetland from corrupt feudalism.

I'm not sure if I have persuaded you of any of the things I initially set out to persuade you of but I hope at the very least I have shown you that the 19th century view of the English was not quite the familiar 20th century view. That is, the notion that the English were some kind of ethnic other to which the Scots did not belong."

Discussion

What is the importance of language in differentiating nations of the same racial origin?

Dr Kidd

"In the 19th century they were very aware that there were two main branches of ethnology; one looking at physical characteristics and another very different one looking at language. With the emergence of the Indo-European model, certainly from the work of William Jones in the 1780s, the Sanskrit speaking peoples and the Persic speaking peoples of the Indian sub-continent and the middle East – and also the Aryans – many scholars try to bring the two together. However a number of them have this view that language is not the ultimate test because a language can be acquired. They have the problem of dealing with, for example, English-speaking black slaves in North America or French-speaking Haitians. They find anomalies in demarcating race simply by language. They do try, when talking about Aryanism, but the tendency I detect during the course of the century is to move increasingly towards a more hard-line "physicalist" interpretation of race."

Is it possible that the Scots' determination to be more English than the English may have been an attempt to be at the forefront of the British Empire.

Dr Kidd

"I think this feeling of the Scots stems more from an understanding of the history of the peopling of the British Isles and the view that the Jutes, Saxons and Fresians were populating the south-eastern part of Britain whereas places like Northumbria and the Lothians were more purely Anglian."

Why did Scots dress up in tartan and pretend to be Celts during the 19th century.

Dr Kidd

"Although I think the trend I have discussed was the dominant one during the 19th century, I don't think it's exclusive. The cult of Tartan is certainly another. I think what's significant is that there were Scots, who were otherwise Lowlanders, espousing racialist nonsense at the weekend, dressing up in tartan kilts or whatever. I don't see tartanry as anything other than cultural. It doesn't have the same political significance as this racialist ideology has. The racialist ideology provides an alternative meta-narrative for the story of Scotland or Britain. It provides another way (to borrow Benedict Anderson's phrase, of "imagining community").

I should also add that race works in different ways. One thing I haven't mentioned in this talk is the way that Aryanism, in the pure philological sense (remember the Nazis are wrong in thinking that Aryanism was

simply about the Germanic Nordic people of Europe). Aryanism was as much about the Celts, those people who speak Indo-European languages. The likes of John Stuart Blackie and other figures who supported Highland causes, who promoted the Celtic chair, they used Aryanism to promote Celtic, so that race wasn't working on a straightforward way – there are other by-ways of this phenomenon that haven't received as much attention."

Would Dr Kidd like to turn his attention to the 20th century, particularly to two characters. Firstly, Sir James Ramsay, Laird of Banff and Regius Keeper at Christchurch, Oxford, who wrote the history of the Middle Ages and was convinced that his family and tenantry were purely Teutonic. Secondly, Charles O'Donnell, whose notion was that the major British stock in Britain was Celtic, not Teutonic.?

Dr Kidd

"It's very interesting that you raise this problem of inversion. Although the dominant school in English anthropology in the 19th century was the Saxonist–Teutonicist one, there was another school developed in the 1860's by Luke Owen Pike which argued that the people of England were Celtic because they so outnumbered any subsequent invasion of Saxon, Norman and Danish migration. I didn't mention this because it doesn't quite invalidate my argument about a Celtic Fringe. There's no Celtic Fringe – because everybody is Celtic in that view of the world!"

Professor Anne Crowther FRSE moved the Vote of Thanks.

62nd Neill Medal Prize Lecture
Professor Philip Corbet FRSE
Dragonflies: Behaviour and Ecology of Odonata
3 February 2003

The Neill Medal was introduced in 1851. It is awarded by the Royal Society of Edinburgh approximately triennially, for a work or publication by a Scottish naturalist on some branch of natural history, completed or published during the last five years. Professor Philip Corbet has an honorary chair from Edinburgh University and is Emeritus Professor of Zoology at Dundee University. He has made truly significant contributions to zoology and human ecology. His book, *Dragonflies: Behaviour and Ecology of Odonata* is a classic.

"Sir David, Fellows, Ladies and Gentlemen, I am delighted, and honoured, to be able to deliver the Neill Medal Prize Lecture, and also to be able to devote it to my favourite subject: the natural history of dragonflies. From an early age I have been fascinated by dragonflies, and for most of my life I have derived intense pleasure from collecting and collating facts about their biology. Before launching into my favourite subject, I am glad to acknowledge help I have received, related to this lecture, from various sources: from friends and colleagues who have allowed me to use their illustrations, and from my friends Professor Aubrey Manning and Professor David Saunders, whose advocacy and support enabled me to spend eight years as an Honorary member of the Department of Zoology, later the Institute of Cell, Animal and Population Biology, in the University of Edinburgh, where I wrote the book on which this lecture is based.

This lecture will focus on the natural history of dragonflies, but its existence is due to the Neill Medal, two aspects of which deserve brief mention by way of introduction: first, the Medal and its founder, Patrick Neill; and second, the discipline of natural history.

The Neill Medal is awarded by the Royal Society of Edinburgh approximately triennially, for a work or publication by a Scottish naturalist on some branch of natural history, completed or published during the last five years. It was awarded to me for a book, from which the title of this lecture derives. The medal was established from a bequest of £500 from Patrick Neill, and was first awarded in 1859, since when there have been 62 recipients.

Patrick Neill was a distinguished citizen of Edinburgh. Born in 1776, seven years before this Society's establishment, he was one of its early Fellows. He headed a large printing firm in Edinburgh, Neill & Company, but from an early age devoted much of his time to natural history, especially botany and horticulture. For many years he was Secretary of the Caledonian Horticultural Society and of the Wernerian Natural History Society, where he would have met Charles Darwin as a visiting speaker. Patrick Neill's interests included social reform, mineralogy, pteridology (the study of ferns), and especially horticulture, for which he endowed a second medal. His most evident legacy to the city of Edinburgh is to be seen in the West Princes Street Gardens, where about 77,000 shrubs were planted under his direction after the Nor' Loch had been drained. He authored the article on Gardening in the 7th edition of

the *Encyclopaedia Britannica*, a publication that was still in its infancy during his lifetime. He died at Canonmills in 1851, only 8 years before the publication of Darwin's *Origin of Species*. His tombstone in the cemetery in Warriston records that he was "distinguished for literature, patriotism, benevolence and piety." I hope that this lecture will do justice to his memory, and to his munificence. I hope also that, after this lecture, you will realise that there is more to dragonflies than meets the eye. Now for some reflections on natural history.

Much could be said about the development of natural history, as a science, since the time of the immortal Aristotle, but this evening I shall confine my remarks to emphasising two points: first, that natural history is an *inclusive* subject, intimately linked to observation of the natural world, and second, that it is a *foundation* subject, from which many other disciplines have sprung, and the practitioners of which include such luminaries as John Ray, Carolus Linnaeus, James Hutton and Charles Darwin. A useful, contemporary definition of natural history could be, "The experience of the natural world through cataloguing the diversity of life and the day-to-day activities of living things." Or perhaps that ventured by the late Frank Fraser Darling, "A delight in knowing how nature works and a love of beauty which may or may not be conscious."

The standing of natural history as a foundation discipline was well expressed by the distinguished North American entomologist, William Morton Wheeler, when he wrote in 1923, "History shows that, throughout the centuries, from Aristotle to Pliny to the present day, natural history constitutes the perennial rootstock or stolon of biological science and that it retains this characteristic because it satisfies some of our most fundamental and vital interests in organisms, as living individuals more or less like ourselves."

In the abstract prepared for this lecture, I likened the process of describing the behaviour and ecology of a single order of insects to assembling the tesserae of a mosaic, or the pieces of a jig-saw puzzle, in order to construct a comprehensive picture of the natural history of one insect order, the Odonata, or dragonflies.

This evening I shall be describing a few pieces of the mosaic that portray the behaviour and ecology of dragonflies. Some of these pieces have been obtained from planned observation and experiment, in the field

or the laboratory, whereas others have come as *windfalls*, the significance of which has been evident only to the prepared mind. I shall mention examples of both. Likewise, some of the pieces derive from my own work, and some from the work of others.

Dragonflies are the largest living insects, that is those with the greatest linear dimensions. Some living species have a wingspan of about 19 cm, and a body length only slightly less. In the past they have been much larger: some of the earliest fossil dragonflies had a wingspan of 68cm. The late Jacquetta Hawkes wrote hauntingly of these early giants in her book, *A Land*, "Over the streams and pools, through the oppressive greenish light, with a clittering of glassy wings, twisted gigantic dragonflies, the largest insects the earth will ever know."

Here is the sort of evidence on which dragonfly history is based: the imprint of an anisopteran that lived about 140 million years ago, in what is now Bavaria.

Ever since they first appeared on earth, indeed for more than 300 million years, dragonflies have retained their characteristic appearance, which probably means that they have always followed much the same lifestyle as they do today.

The order Odonata, or dragonflies, contains two suborders, representatives of which are closely similar in structure but easily recognisable as distinct. These are the Anisoptera (meaning "unequal wings") and Zygoptera (meaning "similar wings"). The larvae of the two suborders, like the adults, are robust in the Anisoptera and slender in the Zygoptera. The Zygoptera, which are usually smaller and more delicate, are sometimes called "damselflies", but such terminology leaves one unsure of the meaning of the other word "dragonfly" which under such usage could mean either the order Odonata or the suborder Anisoptera. To allow the same word to have two different meanings would have made Linnaeus turn in his grave, being contrary to all the principles of biological nomenclature. So this evening I shall use the term "dragonflies" to mean members of the order Odonata and the terms "Anisoptera" and "Zygoptera" to denote members of the two suborders respectively.

Before describing some of the ways that dragonflies have developed systems for survival, I should describe the life cycle that is common to all members of the order. The winged adult spends most of its life near ponds and rivers in which the eggs are laid, and in which the growth stages, or larvae, develop. The larvae, which are aquatic, vary widely in shape and size. The greatest evolution in body shape and behaviour has taken place in the larval stage, reflecting adaptations to concealment and respiration in the aquatic environment. Being insects, dragonfly larvae have an external skeleton and so must grow by shedding the skin, or moulting, a process that can occur many times during the life of an individual. The larva, like the adult, is exclusively carnivorous. When it has completed its growth, a process that may take up to 4 years, it must leave the water to disclose the winged adult. This event is termed "emergence". By day or by night it can produce a spectacle of arresting beauty, especially if it is synchronised. After emergence, the adult flies away from the water, leaving behind it in marginal vegetation the cast larval skin. The young adult spends the

first week or so of its life away from water, feeding, and becoming sexually mature. Then, when it *is* mature, it seeks a body of water that thereafter typically provides the *rendezvous* where the sexes meet and mate. As in many birds, the male dragonfly is often territorial, defending part of the margin of a pond or stream. This behaviour can improve his chances of mating, and therefore of becoming a parent.

I shall now describe three biological functions which dragonflies perform conspicuously well and which enable them to survive and compete, both within a generation and between generations.

1. Foraging behaviour in the larva and adult

2. Migration, and

3. Reproductive behaviour

The first of these biological functions is foraging, or prey acquisition. This behaviour reveals extraordinary plasticity in what many regard as primitive, generalised insects.

Foraging is the means by which an animal maintains a positive energy balance, that is a balance whereby energy income equals or exceeds energy expenditure. Foraging is conducted in two very different environments: by the larva under water, and by the adult in the air. For the larva, energy income derives from the prey that is captured and consumed; whereas energy expenditure comprises maintenance and growth, and activities such as changing position, avoiding predators, aggressive display and securing prey. For the adult, energy income derives from the prey that is captured and consumed; whereas energy expenditure comprises that needed for maintenance, maturation of the gonads, reproductive activity (including territorial defence, copulation and egg-laying) and of course prey acquisition. Both larva and adult have to budget their time with finesse to ensure that energy expenditure does not exceed energy income. In describing how larvae and adults meet this challenge, I shall focus particularly on how they detect and secure prey efficiently.

The dragonfly larva possesses a unique structure, the labium, specialized for catching prey from an ambush position. Positioned folded beneath the head, it comprises fused mouthparts and can be extended, almost instantaneously, using hydraulic pressure, to catch prey. The hydraulic pressure is generated by a transverse muscular diaphragm in the abdomen. In Anisoptera this diaphragm also serves to generate a respiratory current through the rectum and to power an emergency form of locomotion by jet propulsion. Obviously the diaphragm can only generate pressure in one direction at a time. So when the labium is being extended at the front end, the diaphragm's functions at the rear end have to be suspended.

For all dragonfly larvae *ambush* is the default foraging mode, and larvae devote time and effort to finding a profitable perch or a camouflaged position from which to hunt in this way. Only when a larva runs short of food at its ambush site will it walk or swim away in search of prey. There are of course costs attached to moving away: the energy cost of moving, and the cost to survival of increased exposure to other predators, such as fish. However, for most of the time, the ambush mode suffices. The ambush mode is a very

energy-efficient mode of foraging and has been exploited successfully by other animals such as leopards, spiders and ant-lions. In the ambush mode, the dragonfly larva lurks, cryptic and immobile, until prey comes within range of the labium, which is then abruptly extended. This mechanism is unique to dragonfly larvae. While at rest the labium lies folded beneath the head, held there by a locking device. When prey approaches within range, a moment detected by stereoscopic fixation by the compound eyes, the locking device is released and blood pressure extends the labium to its full length. Extension of the labium involves a very rapid movement taking less than 25 milliseconds because it makes use of the latent energy accumulated while the labium was locked in position before the strike. After extension, the terminal hooks on the labium grasp the prey. Then the labium is drawn back beneath the head, bringing the prey close to the other mouthparts whereupon it is masticated and consumed. Prey capture usually occurs during daylight, but sometimes also at night, when tactile or olfactory cues are used for prey detection instead of the more usual visual cues.

For such primitive, generalised animals, dragonfly larvae show great flexibility in their predatory behaviour, exhibiting a refined blend of innate and learnt behaviour. For example a larva will sometimes *stalk* immobile prey, such as a snail, using *form* perception (rather than movement) to recognise it, and then adopt a sequence for capturing and handling the prey which is tailored to each kind of prey. So a snail and a caddisfly larva will be stalked and handled differently. Such behaviour is not learned, but is innate. Also, dragonfly larvae can modify the predatory sequence, to reflect their experience. For instance, they soon learn to avoid organisms with impervious or distasteful bodies. Likewise, when employing the ambush mode of hunting, larvae choose their perches in relation to prey abundance and to immunity from their own predators, such as fish, and sometimes they may be obliged to defend these perches against occupation by other usurping dragonfly larvae. This they do by employing ritual confrontational behaviour which includes a repertoire of aggressive actions, ranging from staring at the opponent, sometimes for as long as 45 minutes, at one extreme (staring is also employed by gorillas and humans), to attacking it with the labium at the other.

Besides the ambush mode and stalking, there is yet another, extraordinary, option available to some anisopteran larvae. By using the jet-propulsion facility, a larva can maintain itself, head uppermost, just beneath the water surface where some kinds of aquatic invertebrates, such as planktonic Crustacea and mosquito larvae, habitually congregate. Such behaviour gives the dragonfly larva access to prey that would otherwise be unavailable, unless a suitable foraging perch happened to be present just beneath the water surface. A larva foraging in this way presents a bizarre appearance, seeming to bounce up and down in the open water without any visible means of support. And since they cannot use the diaphragm for swimming and prey capture simultaneously, such larvae must have to time their actions with precision.

The adult dragonfly generally forages by catching other insects in midair, using its superior powers of visual

acuity (primarily movement detection) residing in the upper facets of the compound eye (as a proportion of body volume the eyes in dragonflies occupy more space than in any other animal). They also use aerial manoeuvrability to do so. This is known as the midair foraging mode. Midair foraging can be practised in either of two ways: an adult may remain in flight, feeding the while, or it may make repeated sallies from a perch, to intercept prey that comes within range. Then, after each sally, it returns to the perch to consume the prey. Less often, an adult uses an ability to perceive form (rather than movement) to capture sessile prey, such as aphids or caterpillars, from a stationary surface. It swoops down to the surface and snatches the prey with its legs, much as a kestrel might capture a field vole. This is called the *gleaning mode*.

Almost all adult dragonflies are "generalized predators", exploiting almost any kind of prey that is sufficiently numerous and not too large to handle. Because they are so opportunistic, they are seldom likely to suppress one kind of prey enough to be attractive as biological-control agents (for example to suppress adult mosquitoes) or harmful as predators of beneficial insects, with one memorable exception. In southern Florida, apiarists (or bee-keepers) fear the largest Anisoptera which have the troublesome habit of assembling outside the hives of honey bees and picking off the worker bees, one by one, as they enter or leave the hive. The local beekeepers call these dragonflies "bee-butchers" and no doubt other names as well, and they do not underestimate the damage that the dragonflies can cause. It has been calculated that a hive of 50,000 worker bees could be exterminated in 20 days by 500 dragonflies or in 10 days by 1,000 dragonflies. Such densities of dragonflies are not at all unrealistic, especially as the adults of several species assemble from a wide area to forage at bee yards. Evidently the word soon gets around.

As prey, hive bees present a special case because they are concentrated in space and time. Normally the challenge that the foraging dragonfly faces is to avoid any semblance of random search, a strategy that would almost certainly yield insufficient return for the energy expended in midair foraging. And so it happens that dragonflies have adopted an impressive range of alternative strategies for locating and exploiting concentrations of prey. These strategies, which conform to what has become known as optimal foraging theory, are surprisingly diverse; and once again one can marvel at the plasticity of behaviour they reveal.

The first major strategy entails foraging where prey is concentrated in space and time, as in the example of the beehives I have just mentioned. Using this strategy under more natural conditions, dragonflies often exploit swarms of small flies or flying ants or termites, soon learning to be at the right place at the right time of day. Or they may assemble where prey has already been attracted to a point stimulus, such as a street light or a pile of fermenting fruit, sometimes taking up their positions before the prey arrives, thus exhibiting an appreciation for time of day. Localized thermals, or pockets of rising hot air, can also serve to concentrate small insects, and dragonflies exploit this situation also, flying into a thermal for a brief snack while foraging nearby. Other microclimatic features that

dragonflies use for foraging are lee sites, and sunflecks on the forest floor, both of which provide assembly points for small insects. On a larger, physical scale, a gap or clearing in forest can be used in a similar manner.

A second kind of strategy involves increasing capture success. Some dragonflies achieve this by facing west when foraging during evening twilight, so that prey appears in silhouette against the setting sun, or by facing into the wind so that prey is continuously brought towards them.

A third kind of strategy is to take prey by surprise, a tactic used by a dragonfly hunting from a perch, when it makes a sudden, darting sally towards an insect passing nearby (essentially adopting an ambush mode). Perhaps the most remarkable strategy is that adopted by a few species that forage over open grassland in the Tropics. In such an environment, characterized by extreme dryness, small insects spend the heat of the day sheltering at the base of the herb layer where they are unavailable to flying predators like dragonflies. A few species of dragonflies there have taken a leaf out of the book of birds such as cattle egrets and swallows and assemble close to herds of ungulates walking slowly through the grass. The ungulates disturb the insects close to the ground, forcing them to fly up, whereupon they become accessible to the dragonflies. Interestingly, experiments have shown that such dragonflies are not assembling in response to the prey itself but in response to an indirect (token) stimulus, namely the presence of large, slowly moving objects that they can readily detect from a distance. So a steamroller will elicit the same response, even if travelling over a tarmac surface from which no small insects can be flushed. If one looks closely at films of big game animals in grassland, which are frequently shown on television nowadays, one can often detect swarms of dragonflies assembling around them over the grass. Other species of dragonflies will themselves flush sessile prey in order to make it accessible. For example, an adult will sometimes hover close to vegetation in which small midges are sheltering, or even brush the vegetation with its wings, so forcing the midges to fly; or, on the African plains, an adult may "buzz" a settled locust hopper and then catch it when it leaps up. I have still not described all the possible strategies for improving foraging efficiency. There is one more. Some dragonflies concentrate on exceptionally large prey, such as butterflies, cicadas or other dragonflies. This gives the dragonfly a good return for the energy expended on prey capture. I hope I have said enough to show that foraging dragonflies, as generalized predators, have a rich array of options to choose from when trying to achieve a positive energy balance. I find it a stirring thought that, each day of its life, an adult dragonfly must repeatedly choose how it will spend its precious time and energy, striking a balance between the acquisition of energy, by foraging, and the expenditure of energy, of course through foraging, but more importantly through reproductive activity, which is the *raison d'être* of its existence. Each day will present a different set of possibilities, each demanding a decision, depending on the weather, the availability of prey and its hunger level.

I mentioned that most dragonflies are generalized foragers. A few, however, are specialized foragers. They present a fascinating exception to the general rule and, in my view, support the maxim that truth is stranger than fiction. The only unequivocal specialists all belong to one family of Zygoptera, the Pseudostigmatidae, which is found only in the rainforests of Central America where they breed in the water that accumulates in tree holes, commonly found at the edge of forest clearings. The adults are among the largest and most handsome of dragonflies, having a body length of about 12cm. They prey only on web-building spiders in sunlit gaps in forest. By adopting this life style, they can combine foraging with reproductive activity in warm, productive pockets in otherwise cool, energetically inhospitable surroundings. Their foraging mode, which is of course a kind of gleaning (plucking spiders from their webs), probably makes specialization possible for several reasons: first, the rich biomass found in forest clearings has already been harvested by a spider and sequestered within its fairly large body, giving the predator of the spider a large reward per unit of prey, despite the loss that results from energy conversion from one stage in the food chain to another; second, the dragonflies are probably "farming" their spider prey because in that habitat spiders tend to occupy vacant webs promptly. Thus, by learning the location of webs, and removing the spider in each, a dragonfly can be virtually assured of a continuing source of food. It follows that these pseudostigmatids are "creaming" an ecosystem in which net production is low, at the cost of their complete dependence on one kind of prey in a localized habitat in the forest. To encounter such an elaborate case of specialization in an insect order consisting largely of generalized foragers leaves one in awe of the surprises that natural history can come up with.

The aspects of dragonfly biology that I have described so far represent areas that can be investigated by planned observation and experiment. There are others, no less important or exciting, that can only be revealed by chance, when an observer with suitable background knowledge finds himself, or herself, by good fortune alone, in the right place at the right time. Some might call such an event pure luck. But, as the celebrated polar explorer, Raoult Amundsen once remarked, "Luck comes to the prepared mind."

The incident I am about to describe represents an example of this kind of good fortune. It relates to the elusive phenomenon of dragonfly migration. Dragonflies that breed in temporary pools in seasonal-rainfall areas of the Tropics arrive promptly, often in large aggregations, in places where rain is falling. Their larvae then develop very rapidly in the rainwater pools that appear, usually completing development before the pools become dry. Then the newly-emerged adults disappear, to reappear somewhere else as the rain arrives there. For many years nothing was known about how these dragonflies accomplished their migrations because information about them came only from snapshots at the times of their appearance and disappearance. However, in the 1960s it was noticed that their pattern of behaviour and ecology closely resembled that of the migratory locust, the migration of which had recently been elucidated by some brilliant

observations by Professor Reginald Rainey, working in a seasonal-rainfall area in Kenya. Rainey was employed as an entomologist by the Anti-locust Research Organisation but his spare-time hobby was gliding and, during the latter pursuit, he acquired a direct and intimate knowledge of small-scale weather systems. He noticed that the appearance of locust swarms coincided with the arrival of the Inter-Tropical Convergence Zone (ITCZ). This is a belt of converging trade winds and rising air that encircles the world in the Tropics. The rising air produces heavy rain on either side of the belt, which moves north and south according to the seasonal position of the earth in relation to the sun. The convergence associated with this kind of weather front concentrates insects (up to 60x fold) from a large catchment area, as a cold front passes. A climate subject to the ITCZ typically features two rainy seasons each year close to the equator, and one rainy season each year, at the Tropics of Cancer and Capricorn. Rainey observed, sometimes from his vantage point in a glider, that when ready to migrate, locusts are aggregated by convergent winds whereupon they allow themselves to be lifted by thermals and then to be transported by rain-bearing winds (of the ITCZ) at considerable heights, and often over long distances. During their journey, each evening the thermals that kept them aloft during the day subside, as the ground becomes cooler, and the locusts descend to the ground where they remain overnight. Then they either remain to breed, if rain is falling, or they catch the next morning's thermal and continue on their way. This pattern of behaviour was discovered and confirmed by Rainey in the early 1950s. I hypothesised that certain dragonflies in seasonal-rainfall areas were using the same transport system but for many years I lacked confirmation of this. It had been noticed that large numbers of adults appeared at the onset of the rainy season and disappeared when the rains were over but they were never observed in transit. However, by analogy with locusts, dragonfly-watchers knew approximately what to expect. And then, one evening in 1962, almost exactly on the equator in Uganda, near the north shore of Lake Victoria, I witnessed the whole sequence of an evening descent, overnight roosting and a morning ascent of a large migration of dragonflies belonging to species that typically occupy temporary pools. I witnessed the descent only because at the time, about 45 minutes before sunset, I happened to be looking directly upward through binoculars, straining to keep a high-flying hawk in view. While so occupied, I became aware of small flying objects entering my field of view, mere specks, also high up in the sky. The specks became progressively larger until I could make out that they were dragonflies which were descending steadily from a height of at least several hundred metres, seeming to darken the sky as they did so. Because I had been watching the hawk, I could be sure that the dragonflies were indeed descending from a great height. The descending dragonflies levelled out at about 2-7 m above the ground, keeping to one direction and then, as the sun set, they chose their overnight roosting sites, the bare tips of tree branches a few metres above the ground on western faces warmed by the setting sun. There was an audible jostling as late arrivals tried to alight on perches that were already occupied. Then, as darkness fell, I left my observation post for the

night, returning to it before sunrise the next morning. As the sky illumination gradually increased during morning twilight, the dragonflies on their perches briefly fluttered their wings, presumably to warm the flight muscles (because, facing west, they were now in shadow) and then one or two, then several, and then a tremendous wave of them took to flight. They departed en masse, flying steadily higher until lost to sight, maintaining the same direction in which they had been flying the previous evening. Knowing the pattern of locust migratory behaviour, I found it plausible to interpret this event as a migration of dragonflies making an overnight stop while travelling with the ITCZ. The observation was additionally informative because I was able to determine the species involved, and also to ascertain their state of sexual maturity and confirm that they had been feeding during the last 24 hours (one may suppose on small flying insects that were using the same means of transport). Many anecdotal records exist of large numbers of dragonflies suddenly appearing in a locality and then disappearing abruptly, but apart from the incident I have described none has noted their descent or ascent. My good fortune, in being able to witness the arrival and departure, depended entirely on the fact that I was watching a high-flying bird through binoculars at the time; and, because I already knew the pattern of locust migration, I was able to put my observation in context and complete part of the mosaic relating to the migration of tropical dragonflies.

One of the several remarkable things about dragonflies, indeed a feature that is unique among insects, is their manner of copulation. Almost all other insects have the external genitalia of the male only at the tip of the abdomen, but not so dragonflies. The external genitalia of the male dragonfly, including the intromittent organ or penis, lie underneath the abdomen and at the front. After grasping a female behind her head with the claspers at the end of his abdomen, but before copulating, the male transfers a packet of sperm to these external genitalia by bending the tip of his abdomen forward and upward, until the tip (which contains his genital orifice) engages with his external genitalia, where the sperm can be temporarily accommodated. Next, if the female is willing to mate, she bends her abdomen forwards and upwards so that the tip (which contains her genital orifice) engages with the male's external genitalia. This action forms what is termed the copulation wheel, in which insemination takes place. As I shall shortly explain, remarkable things happen at this time.

One of the strongest evolutionary imperatives that any species faces is the need to ensure that its genes are transmitted to the next generation, and preferably also to subsequent generations. This process entails strategies which pit male against male, and often male against female and which constitute the raw material of sexual selection. About 25 years ago a discovery was made about the mechanism of copulation in dragonflies that had a lasting impact on the science of biology as a whole. Not only did it provide the Rosetta Stone for understanding the unusual mating posture of dragonflies, but it also enlarged current perspectives of sexual selection throughout the animal kingdom. I refer to the phenomenon known as sperm competition which in dragonflies, as was later found in the Dun-

nock or Hedge Sparrow, takes the form of sperm displacement. By means of an elegant experiment, an investigator in North America demonstrated that, during copulation, the male dragonfly employs his penis for two quite different purposes. It was already well known that the female dragonfly mates several times during her life. So, when a male copulates with a female, she may already have the sperm of rival males in her sperm-storage organs, or spermathecae. It is obviously in the male's interests to try to ensure that, when his copulation partner lays eggs, which she usually does soon after mating, he alone is the parent of those eggs. So, somehow, he must ensure that the female gives his own sperm precedence over that of rivals already in her body when she fertilises her next batch of eggs. In all dragonflies so far investigated, copulation begins with the male using his penis to remove or displace rivals' sperm in the female's spermathecae. In species that remove sperm, the tip of the penis is often furnished with minute, recurved spines or scales, discernible using the scanning electron microscope, and positioned so that they can draw sperm out of the spermathecae. In other species, in which the sperm of rivals is displaced, by being pushed into recesses where it will only be used later, the head of the penis resembles a club or pestle. It had long been observed that, immediately after completing copulation, some males remained close to females, sometimes nudging them towards the egg-laying site. The significance of this behaviour now becomes evident. Within 24 hours after a copulation the sperm in a female's body becomes thoroughly mixed, so that the sperm received last ceases to enjoy priority when she fertilizes her eggs. So it is clearly in a male's interest to make sure that his copulation partner lays eggs as soon as possible after mating is completed. The female also can exercise choice in this running contest between the sexes. She has several strategies available. She can choose which male to mate with, by selecting a territory that is being defended; she can choose whether or not to copulate; and she can choose whether or not to lay eggs promptly after copulating.

The discovery of sperm displacement in dragonflies was made by a brilliantly designed experiment in 1979. So it happened that the biological function of the unique copulatory posture of dragonflies, first described by the great Dutch naturalist, Jan Swammerdam, in 1669, remained an enigma for more than three centuries until the accumulated observations of naturalists provided the raw material needed to generate the hypothesis of sperm displacement.

This evening I have described several parts of the mosaic that represents current knowledge of the natural history of dragonflies. Many more pieces of

the mosaic remain to be put in place, but the picture we already have is colourful and rich because of the careful and sometimes inspired contributions of our predecessors. In the words of Samuel Taylor Coleridge: "The dwarf sees farther than the giant, when he has the giant's shoulder to mount on." "

Discussion

Given the narrow margin between sourcing food and survival, how profligate was reproductive behaviour? Professor Corbet explained that there is a huge wastage and the percentage survival from one generation to the next is less than 1%. Female dragonflies can lay up to 5000 eggs, the minimum being 300.

How have dragonflies managed to survive 300 million years when many contemporary species did not? Professor Corbet replied that, notwithstanding his bias, dragonflies must have immense ability to adapt to changes in the ecosystem and prey availability. Nowadays the main food source of dragonflies (especially those using the mid air foraging mode) is small diptera which didn't exist until half way through the history of dragonflies. It isn't clear what they fed on previously. It is possible that the balance between mid air foraging and gleanings was different at other times.

Have there been any successful attempts to reintroduce dragonflies in areas where they have become extinct? Professor Corbet did not know of any such attempts. One species has become extinct in Britain in the last 50 years but no attempt has been made to reintroduce it. However there have been successful attempts to increase the range of dragonflies but only where detailed studies of habitat requirements have been performed in advance.

What impact might climate change have upon dragonfly distribution and behaviour? Professor Corbet replied that studies in Europe and Japan have shown significant changes in dragonfly distribution the last ten years. It is tempting to explain this as local/global warming.

How do adults catch prey in flight? Professor Corbet explained that dragonflies catch prey using their mandibles directly and also using their legs. In one remarkable species the legs interlock and act as a sweep net to catch prey.

Are there many new species of dragonfly remaining to be described and also what species is Professor Corbet's favourite dragonfly? Professor Corbet explained that there are about 5500 described species of dragonfly (including Anisoptera and Zygoptera). Species diversity is greatest near the equator and new species are being described at the rate of several dozen per year. His favourite dragonfly is the Emperor, the species that he studied for his PhD.

Professor David Saunders FRSE moved the Vote of Thanks.

**WAR OF WORDS:
THE BRITISH ARMY AND THE WESTERN FRONT**

Richard Holmes

CRF Prize Lecture

26 & 28 May 2003

Aberdeen and Edinburgh

"You will all have a sense of what you *think* I am going to say before I have actually uttered a word. For a British audience there is no other event of world history that double-clicks on our collective memory icon in the way that First World War does. Mud, blood, barbed wire; shell-holes filled with dead bodies; subalterns with wispy moustaches staring out of sepia photographs, great aunts who never married.

Contemporaries instinctively called it Great: La Grande Guerre, Weltkrieg, and we can easily see why. Of course it was not the largest single event of world history: that ghastly honour must go to the Second World War, which in terms of human suffering and material destruction was infinitely worse for the world as a whole. But for Britain alone the First World War actually caused more casualties, which partly accounts for the fact that it is remembered in a particular way here. Many who lived through both conflicts agreed with Harold Macmillan and J. B. Priestley that the First World War as a more significant watershed than the second. Barbara Tuchman may have been the first to use the analogy of 1914-18 as an iron gate separating the present from the past, and it has proved very appealing since.

So there it lies, overgrown, like the trenches that still lace the landscape of Northern France, but somehow dug deep into our consciousness. And it usually enters that consciousness not as history, but as literature. One of the problems with trying to teach the First World War is that your audience has always read Wilfred Owen and Siegfried Sassoon, Pat Barker and Sebastian Faulks before you get to them. My lectures are not generally total failures (I realise grimly that this may be an exception) but when talking to school-children about the First World War I often sense that I am on a loser: if it is Holmes versus Owen, then Owen wins every time.

I want to look at the war in two ways. Firstly, by summarising how we have got where we are today in terms of its historiography. This is relative simple and very unoriginal: a frontal attack with plenty of supporting fire. Then I'd like to go a little deeper, and to examine what the war actually meant to the men who fought it: what do they tell us that we often forget? This is a more complex task, which takes me squarely up against a lot of uncut wire. So here we go: first the easy part.

I am certainly not the first historian to complain that it was far too literary a war. Cyril Falls began the process even before the Second World War; Correlli Barnett continued the movement thirty years ago and only last year Brian Bond's *The Unquiet Western Front* fired yet another well-aimed burst into an enemy who shows little sign of falling, but lurches on, stick-grenades in hand, intent on doing yet more mischief to our

understanding. Professor Bond suggests that 'the "real" historical war abruptly ceased to exist in November 1918.'¹ What followed was the resurrection and reworking of the war largely in terms of novels, memoirs and war literature in general. Indeed, Paul Fussell, in his influential book *The Great War and Modern Memory*, suggested that the war was uniquely awful and as such lay 'outside history', explicable primarily through its literature.

This process has not simply affected the way we think of history: it strikes a resonance through the present and on into the future. Omer Bartov described what he termed 'the invention of memory' when he considered the effect of war literature in both France and Germany. 'Experience of loss and trauma extends beyond personal recollection,' he argued, 'and comes to encompass both individual and collective expectations of the future.'² When Bartov presented this paper to an audience composed largely of military historians in Edinburgh seven years ago there was a good deal of muttering in the ranks (some of it, sadly, from me) about psychobabble. But the more I think about it, the more it seems to me that Bartov has identified a key element of the process. By studying the war as literature we do not simply colour our view of the past and make it all but impossible to teach the war as history. We go on to tint our picture of the present and our image of the future too. When Second World War soldiers wanted to describe something going particularly badly they spoke of 'The biggest balls-up since the Somme.' For years it was impossible to attend a military presentation without a clip of *Blackadder Goes Forth* discussing the strategic imperative of inching Field-Marshal Haig's drinks cabinet closer to Berlin, and in the first Gulf War British camps in the desert were named after Captain Blackadder and his cronies. When I commanded a battalion my driver was nicknamed Baldrick; my adjutant Percy, and I could guess the rest.

No sooner had its last shot echoed away than some participants recognised that the war they knew was being hijacked. Charles Carrington, who won his Military Cross at Passchendaele, complained:

It appeared that dirt about the war was in demand... Every battle a defeat, every officer a nincompoop, every soldier a coward.³

Cyril Falls, another veteran turned academic, saw how:

Every sector become a bad one, every working party is shot to pieces; if a man is killed or wounded his entrails always protrude from his body; no one ever seems to have a rest... Attacks succeed one another with lightning rapidity. The soldier is represented as a depressed and mournful spectre helplessly wandering about until death brought his miseries to an end.⁴

In practice it was not that simple, for many of the men writing in the 20s and 30s – Robert Graves and R. C. Sherriff amongst them – were actually ambiguous about the war, and actively resented being termed ‘anti-war authors.’

Ambiguity became less marked as the war receded. Oddly enough, this happened at precisely that moment when, had the war been considered primarily as history, the appearance of a wide range of new sources – not least the first of the Official Histories – might have been expected to have broadened understanding. Erich Maria Remarque’s *All Quiet on the Western Front*, first published in 1929 and made into a film the following year, was an important milestone. Remarque’s own experience of the war was very limited. The very undisillusioned Charles Carrington served at the front perhaps a hundred times longer than the horrified Remarque. But in a sense this is part of the problem. Ghastly though a couple of weeks at the front must have been, they were all Remarque had to go on: what we have is memoir as pastiche, which more accurately reflects the state of its author and his friends in 1929 than the condition of the German army twelve years before.

Alongside the evolution of a literary cult which, by and large, came to see the war as waste built on futility and compounded by human error, there grew up a historical genre which was scarcely less influential. During the war there had been two major schools of strategic policy in Britain. One, the easterners, took their tone from a letter written by Lord Kitchener to Sir John French, British commander-in-chief on the Western Front, at the very beginning of 1915. Kitchener suggested that the German lines in France might well be ‘a fortress which cannot be taken by assault,’ and suggested that there might be merit in looking elsewhere. Gallipoli and Salonika were both offspring of this logic. The other, the Westerners, would have agreed with Sir Douglas Haig, who took over as C-in-C in late 1915, that the war would only be won by beating the German army in the field. And as Haig announced in his final dispatch, this could only be accomplished by ‘one great continuous engagement.’

Historians still squabble about Haig’s honesty. Some detect a rock-line dedication to this continuous engagement throughout, and see a strategy justifiably based on attrition. Others detect genuine hope of a tactical breakthrough in the summer of 1916 on the Somme and a year later at Third Ypres, scent the most seductive of modern military buzzwords, manoeuvre, and say that the continuous engagement was a post facto justification for a breakthrough that failed. I believe that, in a sense, both are right. Attrition and manoeuvre across history are often contrapuntal in time or place. First we attrit, and then we manoeuvre against a weakened enemy. Or we attrit in the north, to pin the enemy to his positions, in order to weaken him for our manoeuvre in the south. I am convinced that Haig expected a period of attrition to be followed by manoeuvre: that, surely, is the real reason for his retention of a cavalry corps, the basis of a pursuit arm which would turn manoeuvre into rout. That in itself was not wholly foolish, and a good deal of sensible opinion now tends to the view that the Germans might indeed have won in March 1918 had they retained a sizeable body of cavalry.

But I digress. What happened in the 1920s and 1930s is that the Easterners, who had shown little sign of winning the war, certainly won the historical argument. Churchill’s *The World Crisis* lambasted offensives on the Western Front which were, he declared, ‘as hopeless as they were disastrous.’ Churchill had served as a cavalry officer, charging at Omdurman in 1898, and had been a battalion commander on the Western Front in early 1916. I can forgive him much on those counts alone: whatever he lacked it was not physical courage. But what of Lloyd George, whose mid-1930s *Memoirs* announced the bankruptcy of ‘narrow, selfish and unimaginative strategy and... [the] ghastly butchery of a succession of vain and insane offensive.’ He accused generals not simply of professional incompetence and ignorance of the real conditions, but of personal cowardice. These accusations gloss over the fact that, as Prime Minister, Lloyd George had a personal responsibility for the very strategy he criticised. It would be rather like Tony Blair lamenting that the Chief of the General Staff was dead set on going to Baghdad and there was not really a lot that he as Prime Minister could do about it. And Lloyd George was not right to carp about the cowardice of First World War generals. About 58 were killed, or died of wounds received. Three divisional commanders were killed at Loos in September 1915, more British divisional commanders than were killed by enemy fire in the whole of the Second World War. Generals were many things: but they were not cowards.⁵

There was a more weighty combatant in the wings. Basil Liddell Hart, whose evergreen captaincy veiled about six weeks’ service at the front followed by a longer stint in the Educational Corps, argued that Britain’s commitment to the Western Front clearly violated his own, oft re-invented, strategy of indirect approach and clear-sighted description of the British way in warfare. Britain should have avoided that lethal concentration of troops and gone somewhere else. Gallipoli had been promising, and T E Lawrence had done really well in the desert. He could produce no evidence that the destruction of railways in the Hejaz made the teacups rattle in Berlin, but no matter. What had really brought Germany down, he argued, was naval blockade and internal collapse. I must not trivialise Liddell Hart, for he remains a commentator of rare insight, was helpful to students and, even late in life, was capable of surprising generosity to Haig. But he is the archpriest of the argument that there must have been a better way: his liturgy, after all these years, still has the power to inspire.

The historical debate – not really the right word, for there was never much debate about it – was rejuvenated in the 1960s. Things like the growth of an independent youth culture, the Cuban missile crisis, the Aldermaston marches and the Vietnam War encouraged iconoclasm, and the generals of the First World War received unprecedented critical attention. But although the reduction in the release period of Public Records from fifty to thirty years meant that most documents on the war became available in 1968, there was no immediate rush to re-interpretation based on this evidence. Indeed, perhaps the most influential book ever written on the war, A J P Taylor’s *The First World War: An Illustrated History* was little

more than a triumphant flambeeing (with the blow-torch lit by Liddell Hart) of the left-overs of the 1930s.

On re-reading it I am stunned by its brilliant, incisive, overweening juxtaposition of bons mots, real insights and excruciating, unmitigated garbage. 'Failure [at Third Ypres in 1917] was obvious by the end of the first day to everyone except Haig and his immediate circle,' it declares. Obvious, that is, to everyone except the German high command, which grew gloomier as the battle wore on, and thousands of British participants, whose letters and diaries testify to a confidence not shared by those writing in the foreknowledge of failure. Even the Australian official history, its volumes not generally accused of excess affection for the Poms, speaks approvingly of 2nd Army's attacks up the Menin Road in September, almost two months after everyone was meant to have lost confidence in the battle.

Leon Wolf's *In Flanders Fields*, whose publication actually predated that of Taylor's book, was in many respects a more respectable work. A study of the 1917 campaign around Ypres, it is well-written, and makes good use of memoirs and inter-war histories. But it confirmed the primacy of a school of historiography which is not interested in the facts because it has already made up its mind. There is no real sense of the campaign's strategic purpose. However much or little we admire Haig, it is worth asking quite what he was meant to do in 1917 with his main ally in a state of mutiny and the navy begging him to get German submarines off the Flanders coast. And there is no feel at all for the British army's vast improvement in tactical method.

Alan Clark's *The Donkeys* applied the same method to the war's earlier years, although – and I say this with respect for a man who brought some much-needed colour into British politics – it contained a streak of casual dishonesty. Its title is based on the 'Lions led by Donkeys' conversation between Hindenburg and Ludendorff. There is no evidence whatever for this: none. Not a jot or scintilla. Liddell Hart, who had vetted Clark's manuscript, ought to have known it. It is history delivered with all the flair of a late-night speech in the Commons after supper at Wheeler's with a bottle or two of Bolly: amusing, malicious and gassy. The real problem is that it sold well then and still does so now. It is the sort of book that the ordinary man on the Clapham omnibus reads because it tells him what he wants to know.

But help is at hand. The scrabble of feet on duck-boards announces the arrival of supports. First there was John Terraine's *Douglas Haig: The Educated Soldier*, published in 1963, and really a brave and remarkably impartial piece for its day. Terraine held his ground alone for some time, assailed by pastiches like *Oh What a Lovely War*, but by the mid 1970s revisionism with some real scholarly weight behind it crashed into the argument. Historians like Tim Travers, Robin Prior and Trevor Wilson worked with the documents to look at the British high command, Peter Simpkins examined at the New Armies, Paddy Griffith charted the improvement of British tactics, and John Bourne, of the admirable centre for First World War Studies at Birmingham University, initiated a mass of work on the background of British generals. It is a cruel reflection on book-buying that some of the most important work

was not the most widely read: J. G. Fuller's *Troop Morale and Popular Culture* and Gary Sheffield's *Leadership in the Trenches* have never enjoyed quite the sales of Alan Clark's *Donkeys*.

I do not applaud the appearance of these works just because some of them are revisionist – as it happens I find myself in the uncomfortable No Man's Land of historiography, collecting salvos from both extremes – but because they are serious and scholarly in a way that an awful lot of earlier work simply was not. Last year's publication of the first volume of Hew Strachan's magisterial *First World War* does, in a way, mark a turning-point in the whole process: he we have scholarship blended with emotion, and a successful attempt to look at the conflict as a world war, not just as the Western Front with attached sideshows.

So why am I still unhappy? Partly because of a question of focus. Many of the war's historians are preoccupied with the big political, strategic and operational issues: Was the war avoidable? Had Britain any other course of action in 1914? Were British generals actually geniuses rather than donkeys? Was the Treaty of Versailles too hard or too soft? How well understood was the post-Somme doctrine for divisions in the attack? In the process they often lose sight of the men who actually fought the war. True, they get anthologised, and we have lots of examples – some of them actually very good – of the historian as copy-typist. And there is an ever-widening use of oral history, so that the words of this fast-disappearing generation can reach out to tell us what it was really like.

Or can they? I make this point as gently as I can, for it is no conventional politeness to say how much I admire the men who fought on the Western Front. But the interviewing of veterans in the 1980s and beyond concentrated, as it must, on those who had survived. Sometimes this survival was, in and of itself, the most remarkable thing about them. And sometimes they played their roles too well: they became Veterans, General Issue, neatly packed with what we wanted to hear, exploding at the touch of a tape-recorder button. Up to my neck in muck and bullets; rats as big as footballs; the sergeant major was a right bastard; all my mates were killed. And, in part at least, they tell us this because they have heard it themselves.

Let me give you an example, which has actually influenced the way that historians have written about the war. Here I must give credit to David Kenyon, one of my research students, who has dug out the facts and figures. On 15 July 1916 the British attacked and overran much of Longueval Ridge, the German second position on the Somme battlefield, in a well-executed night attack. They had planned to bring cavalry forward to exploit and, in the event, failed to do so. Why? I think you already know. The silly old cavalry, not a chin between them, charged into High Wood and were cut to pieces by machine guns. And an artillery officer actually watched it happen:

It was an incredible sight, an unbelievable sight. They galloped up with their lances and pennants flying, up the slope to High Wood and straight into it. Of course they were falling all the way... I've never seen anything like it! They simply galloped on through all that and horses and men dropping on the ground, with no

hope against machine guns, because the Germans up on the ridge were firing down into the valley where the soldiers were. It was an absolute rout. A magnificent sight. Tragic.⁶

Casualties were certainly heavy. *German casualties*, that is. The war diary of the attacking cavalry brigade, compiled at the time, reports that large number of Germans – perhaps more than fifty – were ridden down and speared in the initial charge, and 32 prisoners were taken. When German machine-guns opened fire, the brigade's machine-gun squadron came into action and silenced them, and yet more prisoners were taken. The entire cavalry brigade lost eight men killed the whole day, most of them, incidentally, not in the charge at all. It was a lucky infantry company which did not suffer more heavily. Nobody tried to gallop into High Wood: the contemporary accounts of British infantry on its edge make that absolutely clear. What would have been the point? The cavalry plan was to exploit across the open ground between the woods, and even the densest dragoon would have realised that a partly-shelled wood in full summer foliage, filled with wire and trenches, is not the place to gallop into.

In short, this poignant vignette of an old-fashioned charge into the mouth of death is the purest moonshine. But A J P Taylor rises magnificently to his task: 'This glorious vision crumbled into slaughter as German machine-guns opened fire.' And the more far more serious Robin Prior and Trevor Wilson talk of the machine guns taking care of the cavalry, when the reverse is true. The eyewitness was a brave man. He was not consciously lying. He was telling an interviewer what he believed the truth to have been. And that truth reflected, *inter alia*, half a century of reading precisely those books which I've already talked about.

So we should be somewhat cautious about oral history: sometimes forgotten voices tell us about imaginary incidents. Far better, I think, to go back to what people thought at the time. And in the case of the First World War there is really no excuse for not doing so. Both the Department of Documents at the Imperial War Museum and the Liddle Collection in the Brotherton Library at the University of Leeds are bursting with letters, diaries and an assortment of ephemera. And when I say bursting, I mean just that: new material is arriving faster than a single diligent historian can keep up with. However gloomy I get about being an historian, I am always excited by opening one of those big brown archive boxes, and tipping out letters on YMCA notepaper from the Infantry Base Depots at Etaples, a leather-bound Jermyn Street diary, or a Field Message Book with its flimsy, carboned paper and waterpoofed cover. There is something unutterably poignant about a diary entry written by somebody who didn't know whether he would be alive to eat his supper that day. I am not suggesting that we ought not to read Sassoon and Graves, Campbell and Carrington, all published after the war: but the closer we get to events the better our chance of finding out how people really felt.

What do these documents tell us that the wider literature does not? Time limits me to just one essential point: this was an army of extraordinary diversity, and this, the result of its wholly unprecedented expansion and accompanying social transformation,

coloured absolutely everything it did. Personal accounts stress this diversity, and emphasise not only the danger of generalisation and the utter futility of deconstructing the war's history to focus on experience out of context. This is Rule One: I am not altogether sure that there is a Rule Two.

It is as rash to speak of the British army in the First World War as about the British University in 2003. Even Oxford and Cambridge Colleges are not the same, and there is rather more of a difference between, say, Balliol College Oxford and a former Polytechnic in the West Midlands. Thus a Regular footguards battalion had almost nothing in common with a New Army battalion of the Lancashire Fusiliers. A battery of Territorial artillery, hailing from the same bit of Yorkshire and retaining a deep sense of regionality and civilian identity, was nothing like J Battery Royal Horse Artillery, tangibly old army throughout the war.

It is not just that some units were better than others. It was that they were different, often markedly so: to understand the army's microsociology we need to look at the way that soldiers saw the closed world inside the regiment. Units dressed differently (in the British army uniform really means multiform), fought differently, behaved differently in the line and out of it, and had different ways maintaining discipline. Private Bill Shotter of the 5th Lancers always called his troop sergeant Charley, and got a job for him after the war. The regiment was informal off parade, and pre-war relationships were not swept away by heavy casualties. No 5th Lancer was executed during the war. In contrast, Driver James Mullaney of 72nd Battery Royal Field Artillery shouted 'what about some bloody tea' when his battery was harnessing up, and then struck his Battery Sergeant Major when the tea-break did not materialise. He was shot for it, shortly after Gunner Thomas Hamilton of the same battery was shot for hitting Second Lieutenant Oates. There was no easy informality in that unit: Oates was struck after he brushed aside Gunner Hamilton, who began the conversation with a perfectly reasonable: 'Beg pardon, Sir...'⁷

There were at least four armies: Old, New, Borrowed and Blue. They may not look distinct to us, but at the time a man was perfectly well aware of which tribe he was in. The Old army, the Regulars, sent 100,000 men to France in August 1914, and by Christmas its battalions, 30 officers and 1000 men strong that summer, had only 2 officers and 20 men of the original compliment left. The Regular army looked pretty much as we would expect: officers who needed private income, and soldiers who, in a majority of cases, were able to cite no civilian trade on their enlistment forms. Wellington would have understood it well. But it did not last. Regular ranks were winnowed yet again by the spring offensives of 1915, and by the rough and tumble of another three years of war. The keen-eyed Dr James Dunn, regimental medical officer of the regular 2nd Royal Welch Fusiliers, charted the steady decline of Regulars in his own battalion, until by the end there were perhaps a couple of dozen left.⁸ There were some exceptions. The Guards Division, formed in 1915, retained a distinctive character because it always kept control of its recruit-training depot at Caterham, which turned out guardsmen in a pre-war image, and always ensured that Grenadiers went to Grenadier

battalions, and so on. At least one of the reasons for the division's fine fighting record is exactly this: insistence on high standards, and sufficient clout within the army to ensure firm links between the training organisation and units in the field.

A similar process of transformation went on in the New Armies, battalions of wartime volunteers who were often recruited, as Pals' Battalions, from specific areas. For instance, Accrington and the surrounding cotton towns of East Lancashire produced the Accrington Pals, and Glasgow formed three battalions of Highland Light Infantry: the Tramways battalion, the Boys Brigade battalion and the Glasgow Commercials. There were middle class men, who would never have joined the regular army in a month of Sundays, proud to serve as private soldiers, and some wholly bizarre phenomena like Company Sergeant Major Stewart Roberston of B Company 5th Cameron Highlanders: 'a Roberston of Struhan, the son of a colonel, the grandson of a major-general, and an undergraduate of Magdalen College Oxford.'⁹ It is hard to exaggerate just how good was the human material in many of these units. Lieutenant Talbot Kelly, a gunner officer supporting the New Army 9th Scottish Division, describes a parade shortly before the battle of Loos in September 1915:

Our Scottish infantry created an enormous impression on our minds, Never again was I to see so many thousands of splendid men, the very heart and soul of the nation. These were they who, on the outbreak of war, had rushed to enlist, the best and first of Kitchen-er's New Armies. And here we saw them, bronzed and dignified, regiments of young gods.¹⁰

Loos was a worse day for Scotland than Flodden: 'When shivered was fair Scotland's spear, and broken was her shield.' Lance-Corporal Andrew, serving in a company of Glasgow university students, wrote that: 'it was clear that 6th Camerons as a fighting force had ceased to exist.' He saw RSM Peter Scotland looking at his prostrate colonel and asked if he should get a stretcher bearer. 'No use,' replied the RSM, 'the old man's dying.'

The division lost six thousand officers and men at Loos: 5th Camerons went into action 820 strong and emerged with two officers and 70 men. I know that Britain's war dead of 700,000 are not, in that ghastly term, 'statistically significant,' and that there was no 'lost generation' in a literal sense. But I am constantly struck by the qualitative loss, especially at battles like Loos and the Somme, when the nation really did lay upon war's altar its dearest and its best.

Most New Army battalions faced their first – and sometimes last – real test on the Somme in the summer of 1916, and many never really recovered their regional character after that. Indeed, such was the impact of heavy casualties on small communities - attacking Serre on 1 July ripped the heart out of Sheffield and Accrington – that the War Office abandoned regional recruiting, and New Army battalions were, increasingly, simply topped up by replacements who came through the Infantry Base Depots at Etaples.

The Territorial Force – 'borrowed', in my jargon, because its members were civilians who carried out part-time military training – retained regional identity longer, in part because its members had different terms

of service and enjoyed some political support for their argument that they should only serve in the regiments they had enlisted in. It sheer diversity mirrors that of the army more widely. The all-Territorial London Regiment included battalions like the 5th London (The London Rifle Brigade), in which all ranks were on first-name terms off duty, and private soldiers paid an annual subscription equivalent to a month's pay for a regular soldier. The latter practice was continuing as late as 1915: regulars were genuinely mystified that men had to pay for the pleasure of serving in France. The London Regiment also had the decidedly down-marked 11th London, allegedly the Finsbury Rifles, but known, from the location of its Drill Hall and the alleged propensity of its members, as the Pentonville Pissers.¹¹

One of the best divisions in the war, 51st Highland, was a Territorial Division, and although it is clear that fewer and fewer of its soldiers actually came from the Highlands, it retained a distinctive Scottish flavour to the very end. A gunner officer saw the division, already very hard hit, coming up bravely through the wreckage of his battery to counter-attack in March 1918.

It was magnificent and too moving for words. No music, not even the trumpets of the French cavalry which I heard screaming their wild song of triumph after the armistice, has stirred me as deeply as the sobbing, skirling pipes of the 51st Division playing their survivors back into battle, and I stirred with pride as I watched those glorious Highlanders swinging by – every man in step, every man bronzed and resolute. Could these be the weary, dirty men who came limping past us yesterday in ragged twos and threes, asking pitifully how much further to Achiet le Grand?

Who could behold such a spectacle and say that the pomp and circumstance of war is no more?¹²

Territorial units often retained a strong sense of regional identity, and their discipline, at its best, reflected the tradition of the civilian workplace rather than the manual of Military Law. Men retained a strong sense of what they had been once, and would be again. A sergeant in the Northumberland Hussars was outraged to be reprimanded by his RSM, and said as much: the RSM was only a regular warrant officer – but *he* was Forester to the Duke of Northumberland. His troop commander, masquerading as an officer but really a local landowner, took the point perfectly.

My Blue army refers to the conscripts. Over five million men served in the army during the war, and almost exactly half of them were conscripts, called up in consequence of a series of Military Service Acts who took effect in early 1916 and became more stringent as the war went on. Some waited to be conscripted on point of principle: they would come willingly when called, but they would not volunteer. Others struggled hard against going, and the government became increasingly draconian in doing away with exemptions and re-examined men who had failed medicals earlier. There were those who, like Alfred Hale, whose journal in the Imperial War Museum was published as *The Ordeal of Alfred M. Hale*, found the whole business an agony. An Oxford-educated middle-aged man of independent means, in 1916 he found himself thrown into a training organisation which ground the individual into nothing. Bullied, sworn at, despised because

of his ungainliness, he became an officer's servant, and spent his war polishing Sam Browne belts and scrubbing out dixies.

But we must not judge all conscripts by Alfred Hale. In 1918 the British Army in France was composed of just over 50% 18 year olds. They had grown up during the war, had seen older brothers and senior schoolmates go, and expected to go themselves. Frederick Hodges and his school-friends went to enlist in March 1917, before being formally called up.

My friends and I had been quite determined not to be classified as anything but A1 when we joined up so half a dozen of us had gone into strict training during the winter. We went for long runs through country lanes outside the town, and we formed a boxing club and spent two evenings a week boxing in a room in one of the local shoe factories.

He went to France in April 1918, and found himself, as so many reinforcements were, preremptorily transferred from the Northampton to the Lancashire Fusiliers, but he quickly bonded with his new battalion. When issued with ammunition he reflected:

We accepted that our young lives were no longer our own in this crisis, and that our country expected us to sacrifice them. I felt no fear. The grave situation overwhelmed personal fear.

He was a full corporal by the time he was nineteen. He saw only two cases of shell-shock and one of cowardice, and has nothing but praise for his officers. He saw some British graves in October 1918:

I walked slowly past them, and noted that Captain Hamilton now had a posthumous MC, and that Lieutenant Gibbs was a captain... I noticed that both these fine young officers were aged twenty-four and at the time I thought this was quite a mature age; in the circumstances of their young lives, it was.¹³

By this stage Etaples, with its hated Bull Ring training area, simply posted officers and men to battalions that were short. The old army's regimental system had ceased to exist: there were Brummies in the Black Watch, Scousers in the Royal Fusiliers, Jocks in the Kensingtons and Irishmen everywhere – although by way of compensation the Connaught Rangers had a French-speaking company of Jersey men. What comes across so clearly from personal accounts is the way men took on the tribal markings of their new regiments. Percy Smith, who has left his own little mark on history in a few scribbled notes in the Imperial War Museum, was not enthusiastic about the war in 1917.

If the relatives and wives of us boys knew the real state of affairs out here they would worry more and more and most likely there would be an unrest in the country.

But soon he was very proud of his regiment – whatever it was, for he doesn't tell us. He told his mum.

The regiment I am in is a fighting regiment. We are always on the move we never stop at one place long, it was the first regiment out here when war is declared and we have some fine fellows. Fritz sure knows when we are about.¹⁴

We can get a good feel from letters like this about the conundrum of 1918. How did this army of 18 year olds push the Germans back across France, capturing

twice as many prisoners as the French, Americans and Belgians put together? It cannot be that the Germans stopped fighting: about 80,000 British casualties a month proved that. In part it is true that the German practice of putting the bravest and the best into stormtroop battalions, which inevitably suffered most heavily, had done serious structural damage to the German army. But the real reason, I think, is that in 1918 the British army had become the sort of force that military historians traditionally have a high regard for: inexperienced but generally enthusiastic soldiers led by young and very experienced commanders.

So contemporary documents and subsequent memoirs illustrate the extraordinary diversity of this army, and show us just what a difference even individuals of comparatively low rank – a battery commander here, a company sergeant major there, could make to men's lives. It is very striking to see just how well-regarded officers and NCOs are in the majority of private soldier accounts. I say majority, and remember my earlier warning about generalisation. Of course I have references to the brutal and the incompetent, the cowardly and the snobbish. But I have read nothing written at the time which portrayed officer-man relations in as black a light as W H A Groom's *Poor Bloody Infantry*, published in 1975 with the explicit aim of preventing the war from becoming romanticised. Romanticised? In 1975? There is plenty of admiration for officers like: 'Captain Haybittle, who stood in full view of the enemy on No 1 gunpit. Our brave Captain Haybittle, whose conduct that day was beyond all praise.'

Private George Fortune of 18th Lancashire Fusiliers wrote:

Our officers and NCOs were wonderful the way they used to do their duty. They were always watching over us and seeing we got a hot drink. We used to have a drop of water out of our water bottles to help make the tea. One day I had drunk all of mine and could not give any. I told our officer I did not want any tea. He said 'you must' and 'come and see me when we are out of the line.' I went to see him and he gave me another water bottle.

But remember the danger of generalising. Sergeant Watts, in contrast, was not popular: 'He made me clean the metal washbasins with sand. The water was ice cold, and the sand got into my broken chilblains. Since 1919 I have been looking for that Bastard,' mused George Fortune. 'It's not too late yet to kill him.'¹⁵

Corporal Robert Iley saw his commanding officer, Charles, Earl of Feversham, fall leading his battalion in the assault on 15 September 1916. 'When people scoff the aristocracy,' he wrote, they should look at Duncombe Park Helmsley and see what that man left to die in action.'¹⁶. And even those who did complain, noisy and often, about the aristocracy, and who welcomed the Russian revolution (surprisingly the case with as many officers as soldiers) often saw no inconsistency in becoming NCOs or officers themselves: their political views had little impact on their own conduct of the war. On 23 January 1917 Will Fisher, a lifelong socialist, recorded in his diary:

DEATH OF MY BOY GEORGE. The lad is better off: he is free from wage slavery and the insults of class rule.

Yet he volunteered at the very start of the war and then soldiered on, despite the TB which eventually killed him, rising through the ranks of the Royal Engineers, happily noting in his diary on 2 May 1919: 'Promoted Company Sergeant Major. The top of the tree.'¹⁷

And regard for officers by soldiers cut the other way too. I have come across only one account in which an officer consistently reviles his men as worthless and idle. The war brought many middle-class officers into close contact with men they would not normally have met in their ordinary daily lives, and many of them were transformed by the experience. There are constant references to men's courage; to their endurance; to their resolution when wounded. Many officers found it hard to understand (as have many historians) how men who owed their country so little could do so much for it. A staff officer gives a fly on the wall account of a conversation at Headquarters 4th Army in 1916: none of the officers present could understand why their men fought on: it was, just as Baldic would have said, a mystery.

Many historians have overplayed the role of harsh discipline in maintaining morale, and we have become almost indecently obsessed by the death penalty. The surprising thing about the death penalty is not how many diarists comment on it, but how few. Lieutenant Colonel Rowland Feilding and the Reverend Julian Bickersteth were amongst those who deplored it, the latter all the more because he shared the last minutes of two condemned men. But a private in the Royal Fusiliers noted in his diary, having just read the official notification of three capital sentences, that the army needed an extreme sanction, or more might fail. Private Frederic Manning and his comrades thought that Miller the deserter deserved to be shot: it would, as Corporal Hamley cheerily put it, 'encourage any other bugger who's thinking of deserting.'¹⁸

What soldiers resented far more was No 1 Field Punishment. This, introduced in the 1880s, was specifically a substitute for flogging: it punished a man but did not let him off duty. He was tied to a fixed object, often a wagon wheel, for two hours a day. It was nicknamed crucifixion, though apologists maintain that the victim's arms were left by his side. But in the summer of 1916 tank gunner Victor Archard wrote:

I saw No 1 Field Punishment inflicted for the first time. The prisoner has been strung for several hours against the railings at the main entrance to camp, with his arms tied to the rails about a foot above his shoulders.¹⁹

The punishment was widely reviled by officers and men alike: diarists are outspoken on the subject. It was 'an insult to citizens who have volunteered to fight for their country;' 'a reflection of the brutal ways of the old army;' and 'inhuman and degrading.' Its prevalence meant that many soldiers felt that it might easily happen to them, whereas it was actually quite hard to get shot by firing squad. Between August 1914 and November 1918 there were some 238,000 courts-martial in all theatres of operations, resulting in 3,080 death sentences, of which 346 were actually carried out, three of them for murder, itself a capital offence in civil law.²⁰

What is striking is just how close most men's horizons were. The next meal; the rum ration; getting out of the

line; going on leave. Money or its lack was a constant worry. The infantry private got a shilling a day, and by the war's end his teenage daughter would be doing much better as a munitions worker, and, as an Essex vicar recorded with horror, spending fourteen shillings and sixpence on a hat. Money was subtracted for all sorts of things, usually items that the soldier needed but did not want; rates of exchange seemed designed to disadvantage the British, and there was not much cordiality to the Entente in towns like Hazebrouck or Amiens where omelette and chips cost a day's pay and a moment of stolen pleasure cost three times as much. Much as historians might wish to believe otherwise, men spent little of their time talking about the high command. An army padre, Harold Davies, wrote on 17 October 1916 that:

There is a curious difference in the interest which is taken in generals at Divisional Headquarters and lower down in the brigades and battalions. At divisional headquarters they were full of [the new general] and could talk of nothing else. In a battalion nobody talks of the general or cares a hang about him. At present I am one of the very few officers in 4th Bedfords who knows his name.²¹

Douglas Haig, commander in chief of the BEF from December 1915 until the end of the war, features as arch-donkey in much of the literature. In contemporary accounts he scarcely features at all. In dozens of diaries I have come across a handful of mentions, most of them favourable. He looked very tired indeed by 1918, but till then his soldierly manner made a favourable impression. Even the army commanders are rarely mentioned. Sir Edmund Allenby features because of his obsessive regard for discipline. His nickname was 'the Bull', and the Morse code BBL for 'Bloody Bull Loose' announced that he had left his headquarters. Sir Herbert Plumer (Daddy to his soldiers but Drip, because of a long-running sinus problem, to irreverent young officers) features for just the opposite reason. He was regarded as competent and thoughtful: men liked serving under him, and said so.

Start to finish this was a tribal army: introspective, suspicious of outsiders, the Jocks or Micks or Geordies next door, the gunners behind, the new company commander or the dug-out brigadier. Its war aims embodied a general belief in British superiority – one officer wrote that if the Germans won and invaded England they would still be laughed at in the villages as ridiculous foreigners. There were a deeper sense of personal obligation, ties between man and man that were part-feudal and part-industrial.

It was generally bad at hating. Men killed prisoners when the general mood favoured it: the German gas attack of April 1915 generated a wave of brutality. In the British case this was informal and unstructured. Major Lord Stanhope was shocked to see a French general interview a prisoner, ascertain that he had been involved in the gas attack, and then order a sergeant major to 'take a file of men and take that man to the wall at the bottom of the garden.'²² A quarry-full of prisoners was grenaded at Arras in 1917 for unwisely applauding the success of a German counter-attack which had included the bayoneting of British wounded. Or they killed for personal reasons: A Scots Guards sergeant always asked permission to shoot prisoners

after a battle to avenge his brother. Or perhaps they killed for sheer convenience: it was sometimes quicker and safer to kill a man that to take him back through the barrage. The Germans, for their part, behaved in just the same way. Ghastly game, hard rules. But do not deconstruct hostility: there were rules for it as for everything else, and they varied from place to place and tribe to tribe.

The army varied, too, in its approach to the increasing volume of very good publications that chart the British army's tactical progress. There remained a wide difference between theory and practice. Even the much-praised emphasis on platoon training, initiated by Lieutenant General Sir Ivor Maxse, the first director-general of training in France, often fell on stony ground. Why? Because as personal accounts tell us, platoons were often too small and their membership too turbulent to enable the system to work. What happened during the war, though, was that the four armies became well-integrated. Leaders – from generals to lance-corporals – learnt, and the system grew better at codifying that experience. Promotion became open to talent in a way that it never had been before. I despair when I read that most officers came

from Eton or Winchester. Most of the nearly 100,000 officers commissioned in the last two years of the war came from Ikley Grammar or Mean Street Board School by way of a sergeant's stripes, and very good they were.

And that, I suppose, is where we came in. The army of 1918, warts and all, represented the greatest collective endeavour of the whole of British history: over four million men went to France and nearly three quarters of a million stayed there forever. As the war went on they drifted apart from the land that had raised them, and lived in a world with its own rules, values, beliefs and language. They celebrated the armistice in silence, not with wild rejoicing. And then they went back to pick up their lives. For most of them the war was not, *pace* Paul Fussell, a break, a sundering. It was, as Private David Jones termed it, in parenthesis, bracketed into a busy life.²³ It soon became evident that they had won the war but lost the peace, and the corrosive effect of this sense of collective betrayal can hardly be over-emphasised. The positive diaries become the bitter memoirs as Military Crosses and Military Medals went to the pawnshop. And so we remember the war not as we might, through the eyes of 1918, as a remarkable victory dearly won, but through the eyes of 1928 as a sham which had wasted men's life and squandered their courage."

- 1 Brian Bond *The Unquiet Western Front* (Cambridge 2002) p.26.
- 2 Omer Bartov 'Trauma and Absence: France and Germany 1914-1945' in Paul Addison and Angus Calder (eds) *Time to Kill: The Soldier's Experience of War in the West 1939-45* (London 1997) pp 348-358..
- 3 Charles Carrington *Soldier From the Wars Returning* (London 1965) p.264.
- 4 Cyril Falls *War Books* (London 1995) pp.i. ix.
- 5 See Frank Davies and Graham Maddocks *Bloody Red Tabs: General Officer Casualties of the Great War 1914-1918* (London 1995).
- 6 Quoted in Lyn Macdonald *Somme* (London 1983) pp.137-8.
- 7 Cathryn Corns and John Hughes-Wilson *Blindfold and Alone: British Military Executions in the Great War* (London 2001) p.357.
- 8 Captain J. C. Dunn *The War the Infantry Knew 1914-1919* (London 1987) pp.503-4.
- 9 I. G. Andrew Papers, Liddle Collection, Brotherton Library, University of Leeds.
- 10 R. B. Talbot Kelly *A Subaltern's Odyssey* (London 1980) p.50.
- 11 Personal information from the late Field-Marshal Lord Harding, who chose to join this battalion before the war because, as a post-office clerk, he would not have obtained a commission in a smarter one. He rose to the rank of temporary lieutenant colonel during the war and transferred to the regular army at its end.
- 12 Arthur Behrend *As From Kemmel Hill* (London 1963) p. 82.
- 13 Frederick James Hodges *Men of Eighteen in 1918* (Ilfracombe 1988) pp.21, 41.
- 14 Percy Smith Papers, Department of Documents, Imperial War Museum
- 15 George Fortune Papers, Family Collection.
- 16 Robert Iley Papers, Liddle Collection, Brotherton Library, University of Leeds.
- 17 William Fisher *Requiem for Will* (privately printed by his nieces, Monmouth 2002) pp.63. 99..
- 18 Frederic Manning *Her Privates We* (London 1930) p.81.
- 19 Victor Archard diary, Tank Museum Archives, Bovington, Dorset.
- 20 Corns and Hughes-Wilson *Blindfold and Alone* pp. 102-3.
- 21 The Reverend Harold Davies Papers, Department of Documents, Imperial War Museum.
- 22 Lord Stanhope Papers, Department of Documents, Imperial War Museum.
- 23 David Jones *In Parenthesis* (London 1961) p.xv.