



The Association for
Education & Ageing

Living and Learning

Exploring our Biological Roots

The Frank Glendenning Memorial Lecture
Given by Professor Emeritus David James

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Frank Glendenning was a founder member and prime mover in the development of the **Association for Education and Ageing** and served on its Executive Committee until ill-health prevented him from continuing. He died in December 2002. The annual lecture series was set up in his memory by the Association in 2003. Distinguished lecturers have included: Chris Phillipson, Alan Walker, Phil Lyon, Brian Groombridge, Eric Midwinter and, most lately, David James. Keith Percy will deliver the lecture in 2009.

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Living and learning – Exploring Our Biological Roots

David James

On Frank Glendenning

*It is, for me, a great honour and pleasure to be asked to give this sixth Frank Glendenning memorial lecture. Our annual conferences, in which these lectures have become a key feature, bring back so many memories of the days when Frank was central to their organisation. Frank's contribution to educational gerontology, however, extended and indeed still extends, far beyond our annual gatherings. Our very existence as an organisation, our publications and what influence we have owes much to his farsightedness, quiet competence and great wisdom. The series of volumes, **Studies in Educational Gerontology**, which he edited, is still amongst the most valuable and inspiring works in the field. Their quality is a fitting tribute to Frank who, for me, remains the doyen of British educational gerontology.*

Introduction

The creation and development of knowledge is often achieved through an individual or a small group of people focussing on a specific issue and examining it thoroughly. Our Journal and Digest are full of such studies. While this approach to knowledge makes it easier for us to comprehend it can result in us losing sight of the 'bigger picture'. Consequently when researchers from different areas of knowledge come together to explore a topic of common

interest, great strides in understanding are often made.

The collaborative efforts of people from many disciplines and walks of life exploring together issues relevant to education and ageing have long been seen as a major strength of this organisation.

I am a psychologist with a biological background. Biology is central to the life sciences and has much to offer other disciplines as seen, for example, in biochemistry, biophysics, biodynamics,

The Biological Bases of Behaviour

Biology's relationship to gerontology has been mainly through the medical profession. This unfortunately has meant that the biomedical model of ageing has become the disease model of old age, with its emphasis on decline of mental faculties, failing health and physical and emotional loss. I often see this in pre-retirement courses when the session on 'health in retirement' is led by a doctor whose contribution evokes a variety of emotions in participants contemplating their futures.

There is, of course, much more to the biological approach to ageing than this. Fortunately with more and more students of the traditionally non-graduate professions allied to medicine, e.g. nursing, health visiting, social work, now studying in higher education institutions they are developing research-mindedness and this hopefully will result in wider and more positive approaches to biogerontology emerging. To illustrate what I mean I want to explore four topics:

- Interaction with our environments
- Biological approaches to the Ageing Process
- Motivation
- Learning

Because of the paucity of biological knowledge in these areas, I shall map them out rather than offer a range of specific findings relevant to ageing. Consequently, parts of the discussion are inevitably rather long on biology but short on ageing.

Interaction with the environment

It is a basic biological principle that living things interact with their environments and largely control that interaction. In other words, most animals take action to deal with what the environment imposes on them. When food becomes scarce they move on, when danger threatens they fight it or run away, when the temperature drops they hibernate or migrate. Success comes from evolving physically or behaviourally to cope with these natural forces, i.e. by natural selection.

This was also true for human beings up to about 10,000 BC, i.e. stone age times. We were hunter-gatherers who followed herds, ate fruit and seeds in season, avoided or confronted danger, migrated south in winter and north in summer. We survived by interacting with and adapting to the forces of nature like other animals. We had survived up to that time by survival of the fittest, i.e. the strongest, the healthiest, the most intelligent. In other words we also were subject to natural selection.

Stone Age people, however, began to develop settlements and become

farmers. Crops were grown, animals kept for food, danger excluded and protection afforded from the elements. We began to manipulate and control our environments to an unprecedented extent. Because we lived in protected environments the effects of natural forces were much reduced. It was no longer survival only of the fittest. Many people survived and of those that achieved adulthood many could reproduce. We chose our mates not only because of their biological prowess but for reasons often clear only to the individuals concerned (much as today!). We then lived and bred in protected environments that we continued to enhance. Biological evolution slowed down and social and technological evolution grew.

This process has continued and accelerated ever since. I shall concentrate on social and technological advances but the continuing influence of natural selection is still to be seen, for example, in resistance to disease. In earlier times, human groups living in temperate climates developed by natural selection some immunity to temperate diseases, while those living in the tropics did so to tropical diseases. Today in Southern Africa a similar phenomenon may be occurring with resistance to HIV-Aids evolving through natural selection.

We now live in a rapidly changing world where human beings are responsible for many of the changes. We are, however, much better at creating change than managing it. For example, in the mid-twentieth century we split the atom, thereby discovering many of the secrets of matter. Although

great benefits have accrued from this knowledge, we also created an apocalyptic bomb with potentially disastrous effects for the whole natural order. We are currently exploring the structure and functioning of DNA thus exposing many of the secrets of life. Let us hope that we concentrate on exploiting the benefits of these developments and avoid unnecessary man-made catastrophes.

There are, however, many more mundane everyday examples that essentially are mis-matches between our biological needs and our modern lifestyles.

- In nature palatability and the nutritive value of food are linked and so most animals eat a balanced diet. Science has separated these two characteristics making substances of little nutritive value taste very palatable. This results in inappropriate eating habits causing malnutrition, obesity and a variety of other disorders.
- We need to move around our environments, which should provide much needed exercise. Now we have transport that moves us quickly and effectively but with little bodily exertion resulting in heart, muscle, joint, weight and many other problems.
- Not all modern developments have such negative side-effects. Copulation naturally leads to reproduction. The separation of these two activities through the development of contraceptives has facilitated the liberation of women from a lifetime of alternate pregnancy

and lactation that has had enormous benefits for all concerned.

- A much more complex picture emerges in this time of information technology when we are able to separate communication from face-to-face contact. Direct social interaction performs so many functions from identification of need to giving a sense of being valued and supported. This clearly needs to be born in mind particularly when considering the needs of more isolated members of society.

So human beings have control over their lives to a much greater extent than other species. If this control is removed is the individual dehumanised? We express concern about prisoners and slaves and indeed people in extreme poverty or subject to brutal dictatorial regimes living in inhuman conditions. What about older people in this context? Paulo Freire talks about 'liberating older people from structures that are dehumanising.'¹ 'Learners' he says 'are domesticated, so being inhibited from realizing their full potential of being human'. Domestication may be defined as 'bringing under human control'.

For one human being to control the life of another raises some very interesting issues. In family life, when children are small they are under the control of their parents. Bonding in human beings as in many other animals causes the adult to subordinate its needs to those of its offspring. But when the young become sexually mature this bonding relationship changes. In many species when the young

begin to assert themselves they are often driven away by the adults, which clearly has many biological benefits (not least avoiding in-breeding).

In humans we tend to stay together in family groups but the intergenerational tensions resulting can be no less disrupting. Interestingly, these tensions are greater between the young and their parents than between the young and other unrelated adults. Does this relate to an innate mechanism to avoid incestuous relationships?

If an adult child is unable to fend for itself, parental bonded behaviour often continues and indeed in some people it appears to be sublimated into careers in nursing or teaching. What about care for the frail elderly? It is unnatural to survive once we are unable to fend for ourselves and is only possible because we live in a human-controlled social environment. Human beings, however, appear to have evolved no mechanism for redeveloping bonding in later life and older people themselves do not seem to elicit it in others. A consideration of some of these basic biological issues may well be relevant to ameliorating some of the underlying factors in elder abuse and other forms of maltreatment and neglect of those of declining competence unable to cope for themselves.

Biological approaches to the ageing process

Ageing may be defined as 'changes which occur as time passes'. Consequently it is a life-long process from conception to death and teenage and middle age

are just as much stages in ageing as old age. The changes which occur fall into two broad groups:

- growth and development
- decline and deterioration

When an organism is young growth tends to dominate but the processes of decline are present. For a child to achieve its full potential as an athlete, musician or linguist it needs to practise actively as soon as it is ready so to do. If a child only speaks English until it is 11 years old and then learns French it will always speak French with an English accent having lost the linguistic flexibility to pronounce the full range of French sounds.

As we grow older, the balance between development and decline changes but at different rates and in different ways in different people under different circumstances. Consequently dividing up the lifespan on the basis of chronological age, while being administratively convenient, is biologically flawed.

One milestone that is particularly relevant to this discussion is 'mid-life'. This is the age at which we (and presumably stone age people) cease to reproduce. It is usually taken to be between 45 and 55 years of age. Biological evolution occurs through natural selection, the fittest being the ones that survive and reproduce. Once reproduction ceases, there can be no further biological evolution. Consequently while the stages in embryological development, infancy, childhood, adolescence and young adulthood have all evolved to meet the requirements of those stages in life, there can be no evolved stages of later life.

The best that we can hope for is that we maintain the potential levels of mental and physical competence achieved by mid life. Few of us ever achieve our maximum potential so that there will still be plenty of opportunity for us to do new things later in life but it is assumed that the maximum level of potential will not increase and, indeed, is likely to decline progressively. To maintain our physical and mental wellbeing we need

- a good supply of energy (food and oxygen) to the brain and body
- appropriate levels of physical and mental activity

One of the characteristics that we share with other primates is our upright posture. This has clear benefits, e.g. it elevates our major sense organs and frees our hands for a multiplicity of uses. But pulling a body designed for a quadruped up into a vertical position clearly also raises problems. For example, skeletally we are prone to backache and our hips and knees wear out. Our hearts have to pump blood vertically, which may well be the cause of many of our cardiovascular problems.

Our comparatively long lives also mean that parts of our bodies need replacing, such as joints, heart valves, hormones; or boosting, for instance, our immune systems or insulin in diabetic patients; or need artificial aids, e.g. spectacles, false teeth or pace makers.

The examples above are mainly physical although they may well have psychological effects as well. The brain itself also begins to

deteriorate. From mid life onwards the average person loses about 40,000 brain cells every year. Reduction in mental competence is one of the greatest challenges facing medicine today and the longer we live the bigger the problem becomes.

Let us briefly explore our thinking about longevity. Two concepts are central here:

- *life span* is the genetically determined maximum length of life the members of a species can achieve
- *life expectancy* is the environmentally determined length of life an individual actually achieves.

Our bodies are composed of cells which grow and divide. Each time they do this the complex complement of chromosomes, which every cell contains, has to duplicate itself and mistakes inevitably occur. Eventually this causes cells to stop dividing, although some do continue even with substantial genetic mistakes making the daughter cells weak or cancerous, or causing them to show other disease effects.

Life span is largely determined by the number of times a cell can divide in a viable manner. That is why larger species of animals tend to live longer than smaller ones. More cell division means more bulk but also apparently longer viability of vital organs. The number of cell divisions in the life span of a species is determined by telomeres – small chains of tiny blobs of protoplasm attached to the ends of chromosomes. One blob on each chromosome is used up at each cell division. Very few organisms

live in such a supportive environment as to achieve their full life span. Rats live in foul places and horses are ridden, driven or in the wild fall prey to predators.

	<u>Life span</u>	<u>Life expectancy</u>
Rat	7	4-5
Horse	44	40
Human Being	118-9	79-83 (max 109)

These figures raise an interesting point. Human beings have a long life span but their bodily size is not enormous. Perhaps as an adaptation to some aspect of our evolution, e.g. our upright postures, we have developed the ability to control our overall size. People in the world today who suffer from gigantism (due to the overactivity of their pituitary glands) are three times more likely to die of heart failure than those of more average height.

If, however, there is such control in people of normal size, it might mean that if, in the future, by genetic modification we could increase the number of times our vital cells divide more or less correctly, then we could extend our life span without becoming physically much larger. This clearly is in the realm of science fiction at the moment. It is worth noting, however, that genetically modified yeast fungi can be now given a life span of several hundred years.

Motivation – energising the individual to respond

Earlier in this paper we talked about organisms interacting with their environments. Here let us explore that interaction more closely.

For example:

- We take in food and give out waste products (eating and voiding)
- We take in oxygen and give out carbon dioxide and water (breathing)
- We take in experiences and give back responses (learning)

Firstly, take the example of eating. You are the same person before a meal as after it but the meal changes you a little – it makes you a bit bigger or stronger or gives you more energy. The change is so small that you don't notice it. But, in fact, your whole body is composed of the food that you have eaten over your lifetime fashioned into its exact form by your chromosomes. Physically *you are what you eat* while the oxygen you breathe is essential for providing the energy you require to develop.

The same principles apply to psychological development. Our chromosomes give us the blue print of how we shall develop mentally but the actual content of our minds depends upon the experiences that we have. Our knowledge, skills, attitudes, values, culture, language all are learned. Psychologically *we are what we learn*. And just as we die physically when we stop eating and breathing, so we die psychologically when we stop learning. Brain death is the condition in which we no longer respond to stimuli.

What I have said so far applies to all animals. Human beings have developed a much more complex range of social needs in addition to the survival needs exemplified above. A convenient hierarchy has been produced by A H Maslow.²

Hierarchy of Human Needs after A H Maslow

- Survival
- Security
- Belonging
- Esteem
- Cognitive
- Aesthetic
- Self Actualization

Clearly depending on which of our needs are frustrated, we will feel insecure, threatened, bored, rejected, devalued, unfulfilled. In a perfect world it would be possible for each of us to satisfy our own needs without thwarting the needs of others. This, however, is often not the case. We are all aware of examples in which the teacher reinforces his status and security by denigrating and threatening his pupils, or the healthcare professional who pulls rank on his or her patients.

In such instances the underdog needs help to move from being a passive recipient to becoming an active participant in the relationship. This is also true for elderly people whose needs may be perceived inappropriately or ignored by others be they professionals, politicians or simply people from other age groups. Putting some of these wrongs to rights will be a huge job but an essential part of what Julian Huxley described as moving from a 'welfare state' to a 'fulfilment state'.

Learning

Learning may be defined as 'any more or less permanent change in behaviour resulting from experience'. This definition excludes such short-term effects as

those of fatigue or alcohol or drugs. As I have indicated in the previous section, in its most basic form it is essential for survival of all animals. In human beings, par excellence, learning processes have been developed to an extraordinary extent.

There are many different ways of describing and classifying these learning processes. For our purposes it is convenient to distinguish two main categories:

- a. *extension or exploratory* learning through which individuals acquire new skills, develop new interests, increase understanding and broaden horizons;
- b. *reinforcement or consolidatory* learning through which individuals revisit and confirm experiences and ideas with which they feel comfortable, re-affirm their identity and re-establish their position in the world particularly after some major change or challenge in their lives.

While reinforcement learning provides the individual with predictability, consistency, confidence and security, extension learning provides interest, excitement, expansion and stimulation. The balance between the needs for security and stimulation changes with circumstances. The child starting school, the patient entering hospital, the older person recently retired or bereaved may well need to take stock of the new situation, to come to terms with it, to establish and assert themselves in

it. Only when they feel reasonably secure will they enjoy taking risks by involving themselves in new and challenging situations.

The U3A provides a host of examples of individuals who initially are looking for some mutually supportive group of like-minded people with whom to interact informally, but who over time through a range of graded opportunities can be enabled to take on more and more demanding and exhilarating activities eventually even assuming leadership roles where they create learning opportunities for others as well as themselves.

It is interesting in this context to look at life as a series of strands, e.g. work strand, domestic strand, leisure strand. As we go through life the relative importance of each of these is likely to change. A young married couple may find that work and domestic strands dominate their lives, while when the young have left home a more balanced arrangement may be achieved. For the successful business or professional person, however, as they progress up their vocational ladder they may well find that work dominates and they have few interests in domestic and leisure activities. Consequently when they retire and the work strand is severed they become very vulnerable. For such people, the value of pre-retirement preparation cannot be over emphasized.

A word further on this point: There are several known forms of 'sudden death syndrome'. Perhaps infant sudden death Syndrome is the best known but there are others. Bereavement sudden death

syndrome is well documented where one person dies and the remaining partner, now with such a great loss, is unable to cope and so dies quite soon afterwards having nothing left to live for. In many ways, retirement can be seen as 'job bereavement' and its loss can have similar far-reaching effects that it can cause death through retirement sudden death syndrome.

Conclusion

I have selected a few topics that are currently of interest and importance to gerontologists who, in the main, view them from social, political, financial, educational and health perspectives. They also have biological dimensions to them. We are a very successful species of animal. Our behaviour is complex and impressive but it can also be analysed in a way that illustrates its origins. We do ourselves no favours if we concentrate only on our higher motives and ignore more fundamental ones that are vitally (literally) important to us.

We need to remember that while we are rapidly changing the world both socially and technologically, as a species we have evolved little in biological terms in the last 12,000 years. We have basically stone-age bodies and brains although we live in an increasingly unnatural world. It behoves us to, at least, be aware of this mismatch and some of its potential consequences.

References

- 1 Friere, P (1972) The Pedagogy of the Oppressed, Harmondsworth: Penguin
- 2 Maslow, A H (1970) Motivation and Personality, 2nd edition, New York: Harper and Row