

Introduction

Population growth in retrospect and prospect

The papers that follow in this issue of the *Philosophical Transactions of the Royal Society* provide us with an intellectual feast, even though they will leave a bitter taste in the mouth afterwards. World experts, in a wide range of disciplines, explore the ways in which the inexorable increase in human numbers is exhausting conventional energy supplies, accelerating environmental pollution and Global Warming, and providing an increasing number of Failed States where civil unrest prevails. Few can be left in any doubt that calling a halt to future population growth in both developed and developing countries is the greatest challenge now facing our world.

It is therefore surprising that when the United Nations announced its Eight Millennium Development Goals in 2000, halting population growth was not one of them; it has since been added as an afterthought. Perhaps this is a lesson we must learn for the future; International Organizations, Governments and Religious Leaders will be the last to appreciate the gravity of the current situation, and the last to implement effective measures to halt further population growth.

As Global Warming makes its presence increasingly felt all around the world, more and more people are beginning to accept it as a reality. Al Gore (2006) chose his words wisely when he called it ‘An inconvenient truth’. But there remains a major credibility gap; people have yet to draw the obvious conclusion that since Global Warming is the result of human activities, too many people will only exacerbate the problem. Thus, the developed world must curb its profligate use of non-renewable energy and the developing world its exponential population growth, if we are to arrest Global Warming in the years to come.

When the Book of Genesis was written 3000 years ago, there would only have been a few million people on earth. Hence it made sense to enjoin mankind to:

Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and the fowl of the air, and over every living thing that moveth upon the earth.

(Genesis 1, 28)

In the intervening centuries, we have done just that. The world’s population is now 6.8 billion, and we

have achieved dominion over every living thing. Paul Crutzen, the Nobel Laureate, has recently proposed that in the latter half of the eighteenth century, the world could be said to have entered a new geological epoch which we should call the Anthropocene, since that was when human activities, spurred on by the Industrial Revolution, began to dominate all the ecosystems on earth (Crutzen & Stoermer 2000).

This also coincided with another major change—the development of a Global Economy. In 1776, the pioneer Scottish economist, Adam Smith, issued a prophetic warning in his book *The Wealth of Nations*:

The desire for food is limited in every man by the narrow capacity of the human stomach; but the desire for the conveniences and ornaments of building, dress, equipage and household furniture, seem to have no limit or certain boundary.

Adam Smith had foreseen the fatal flaw in the Economy—it is a human artefact that gives unlimited power to our Selfish Genes, with no negative feedback controls. The global economic recession which began in 2008 was driven by that very greed that Smith identified as having ‘no limit or certain boundary’. When empowered by such an Economy, this greed will ultimately run counter to the inherent ecological constraints of the planet. This may prove to be our Achilles Heel. Unless we can ensure that the Economy is kept subservient to our Ecology, we will self-destruct.

Achieving such ecological dominance will be an uphill struggle, since many of the developed world’s leading economists are population neutralists. For example, Nicholas Stern in *The Economics of Climate Change* (2007) makes no mention whatsoever of population in all its 692 pages, and Ross Garnaut in a similar weighty tome, *The Garnaut Climate Change Review* (2008), commits the same sin of omission. It takes an enlightened economist with a real concern for the developing world, like Jeffrey Sachs, to address the issue head-on in his *Common Wealth—Economics for a Crowded Planet* (2008). He wisely concludes that in the future

The challenges of sustainable development – protecting the environment, stabilizing the world’s population, narrowing the gaps between rich and poor, and ending extreme poverty – will take centre stage.

Sachs specifically advocates that we should attempt to stabilize the world’s population at eight billion or

One contribution of 14 to a Theme Issue ‘The impact of population growth on tomorrow’s world’.

below by 2050. Halting population growth makes sound ecological common sense.

We also have much to learn from another great thinker at the dawn of the Anthropocene, the Revd. Thomas Robert Malthus. A brilliant mathematician and Fellow of Jesus College, Cambridge, in 1798 he published, anonymously, his momentous *Essay on the Principle of Population* (Short 1998a). He drew one simple conclusion:

The power of population is indefinitely greater than the power in the earth to produce subsistence for man. Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will shew the immensity of the first power in comparison to the second. By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal. This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall somewhere, and must necessarily be felt by a large portion of mankind.

Malthus was only 32 years old when he published his 'Dismal Theorem', and it was viciously attacked by the social reformers of the day, like Karl Marx, Frederick Engels and Samuel Coleridge. But the economist John Maynard Keynes subsequently described Malthus' essay as 'a work of youthful genius' (Short 1998b). The highest praise came from Charles Darwin and also Alfred Russell Wallace, who independently stated that Malthus' Essay was one of the most influential books that either of them had ever read, since it provided the key to understanding how the survival of the fittest could lead to natural selection, and ultimately the origin of new species.

Malthus, an unmarried clergyman, was understandably ignorant about how human population growth could be held in check. He was unaware of the fact that breastfeeding is Nature's contraceptive, which in traditional societies can keep births spaced 4 years apart by inhibiting ovulation. Perhaps he had not heard that a vaginal sponge soaked in diluted lemon juice was widely being used by women throughout the Mediterranean region as a reliable contraceptive (Himes 1963). He condemned abortions as 'improper arts to conceal the consequences of irregular connections', and contraception as 'promiscuous concubinage'. The Anglican Church only approved of contraception within marriage in 1930, while we still wait in vain for the Catholic Church to follow suit. Malthus was forced to conclude that it would be the 'preventive check' of late marriage (he eventually married at 38 and had three children), plus the 'positive check' of high levels of infant and childhood mortality, coupled with 'wars, infanticide, plague and famine' that would prevent further population growth. Never in his wildest dreams would he have imagined that the world's population would increase from the one billion of his day to 6.8 billion today. It certainly never dawned on him that it would be the increasing concentration of carbon dioxide in the atmosphere that might be the ultimate check

to population growth. That time-honoured phrase 'The sky's the limit' has taken on a sinister new meaning.

So we must turn the page, and peer into the future. It is slowly beginning to dawn on us that Global Warming could ultimately threaten every ecosystem on earth and hence our very existence. James Lovelock, the distinguished physical chemist, in *The Revenge of Gaia* (2006), concludes that the world's population will eventually stabilize at around half to one billion people, which would allow us to live in equilibrium with the environment. That would take us back to the beginning of the Anthropocene! A more optimistic proposal was put forward in 1993 at the Population Summit of 60 of the world's Scientific Academies, including the US National Academy of Sciences and the Royal Society, meeting in New Delhi. The meeting concluded that 'if current projections of human population growth prove accurate and patterns of human activity on the planet remain unchanged, science and technology may not be able to prevent irreversible degradation of the natural environment and continued poverty for much of the world'. The Academies therefore called for 'zero population growth in the lifetime of our children' (Graham-Smith 1994). Given common sense, that is achievable.

The shortcoming of the Scientific Academies meeting was that it did not explore the constraints that were operating in both the developed and developing world that effectively denied women access to the new generation of steroidal contraceptives, and safe abortion.

The contraceptive revolution began in 1953 when the American biologist Gregory Pincus and his Chinese colleague, Min Chueh Chang, working at the Worcester Foundation for Experimental Biology in Shrewsbury, MA, USA, published a landmark paper on 'The effects of progesterone and related compounds on ovulation and early development in the rabbit'. Pincus personally informed me just before he died that they decided to publish it in an obscure and now defunct South American journal, *Acta Physiologica Latinoamericana*, hoping that it would not attract the attention of competitors such as Carl Djerassi and his colleagues in Syntex who were developing a range of synthetic orally active gestagens. But it was that Pincus and Chang paper that heralded the development of hormonal contraception for women, a momentous achievement. They had shown that progesterone, or related synthetic gestagens, if given intramuscularly, orally or intravaginally to rabbits, could prevent ovulation.

With the intellectual support of Margaret Sanger, and unlimited financial backing from Katharine McCormick, Pincus then enlisted the cooperation of a Boston clinician, John Rock, who started the first clinical trials of an oestrogen/gestagen oral contraceptive pill in women in Puerto Rico in 1956 (Speroff 2009). The trials were a success, and resulted in the first approval of a female oral contraceptive pill for use in the United States in 1960. Today, we have a whole array of hormonal pills, injections, implants, patches and intrauterine devices that women can use to regulate their fertility, and control the frequency

and intensity of their menstrual periods. And they are all off patent, so anybody can make them.

John Rock was a devout Catholic, who went to Mass every day; he argued strongly for the moral acceptability of steroidal contraception (Rock 1963). Unfortunately, Pope Paul VI took the opposite view, and in his encyclical letter *Humanae Vitae* of July 29, 1968 he condemned 'any action... specifically intended to prevent procreation'. Pope Benedict XVI put the lid on it when he announced in 2008 that contraception and abortion were now to be added to the list of Seven Deadly Sins. Only celibate male theologians could be so ignorant and so callous about the plight of women at the hands of men. This was eloquently summarized by Sir Dugald Baird, a Scottish obstetrician, who called for the women of the world to be granted a Fifth Freedom, Freedom from the Tyranny of Excessive Fertility (Baird 1965). Amen to that.

There is an interesting new twist to this tale. The Catholic Church may yet be forced to re-think its position on celibacy in the priesthood. Studies of concordance rates between identical, monozygotic twins who have been reared apart show that there is only one characteristic in which both twins are highly likely to behave identically, regardless of the environments in which they were reared, and that is Religiosity (Bouchard *et al.* 1999). If one twin is religiously inclined, the other will probably be also, even though they might adopt different religions. If the heritability of Religiosity is so high, there may indeed be a God Gene. To forbid all Catholic clergy from marrying and passing on their God Genes to succeeding generations is to commit intellectual suicide. But while Rome fiddles with its own sexuality, the rest of the world is burning.

Another major barrier to making contraceptives available to the women who need them has been the pharmaceutical companies of the Western world, Big Pharma. They have no interest in marketing steroidal contraceptives in the developing world, where there are no profits to be made; but this is where they are most needed. Big Pharma has found it far more profitable to keep all steroidal contraceptives only available on medical prescription. There is absolutely no medical justification for this cautionary action (Trussell *et al.* 1994), but covertly it enables the pharmaceutical companies to exploit doctors as their unpaid sales force, while at the same time maintaining a relatively high price for a product that is off patent, and could be made for next to nothing.

This medicalization of contraception denies access to those who need it most—impecunious and embarrassed teenagers all over the world who are reluctant to advertise their nascent sexuality to a doctor, since he might feel obliged to inform their parents, especially if they are under age. If the Western world was not so obsessed with the Sin of Sex, parents might be more prepared to rejoice that their children are experiencing the Joy of Safe Sex.

The highest priority must be given to providing knowledge about and access to safe contraceptives, particularly to young women throughout the developing world. Donor agencies would therefore be well advised to avoid Big Pharma, with its obscene profits (Angell 2004), and patronize the excellent

pharmaceutical companies of the developing world, such as those in China, India, Indonesia and Thailand.

And so we come to Abortion, a topic that no man will ever fully understand. The World Health Organization (2007) estimates that every year, 42 million women facing an unplanned pregnancy will decide to have an abortion. About 20 million of these will be so-called 'back street' abortions, carried out using unsafe procedures; 98 per cent of these will take place in developing countries, and one-quarter of these women will suffer severe complications, or even death. Abortion, whether induced surgically or medically, can be one of the safest obstetrical procedures. It is sad that in many developing countries, abortion is still illegal, thereby denying women access to the latest and safest procedures. Vacuum aspiration abortion was first developed by two Shanghai doctors, Yuantai Wu and Xianzhen Wu, and published, in Chinese, in the *Chinese Journal of Obstetrics and Gynaecology* in 1958. The procedure spread rapidly by word of mouth throughout China, thence into Russia, and throughout the Communist world, before being taken up by the Western world. I will never forget going to Skopje, in what was then Yugoslavia, in the mid 1970s to look at family-planning methods. When I asked Prof. Antonovski what contraceptives Macedonian women used, he told me that the hospital preferred abortion to contraception—it was more profitable. When I asked him the largest number of vacuum abortions he had ever performed on one woman in her lifetime, he paused for a moment and then replied 'Sixty'. Incredulous, I asked him how that was possible. He said it was easy—you only needed to do four a year starting at about the age of 16, and it did not take very long to get to 60.

Vacuum aspiration abortion must have saved the lives of millions of women around the world in the last 50 years. The doctors Yuantai Wu and Xianzhen Wu from Shanghai are surely among the unsung heroes of women's reproductive health.

Another momentous Chinese development was the establishment of a nationwide One Child Family Policy (Xiao 1996). Chairman Mao had initially been pronatalist, but then it became increasingly apparent that China could not support continuous population growth. The first step was when Chairman Mao launched China's 'Later, Longer, Fewer' campaign in the 1970s, which encouraged couples to postpone childbearing, increase the spacing between births, and accept smaller families. But that was not sufficiently effective, so in the early 1980s it morphed into the One Child Family Policy, that is still in place. Although it has been condemned by most of the Western world for denying couples their reproductive freedom, it has had spectacular benefits for China as a whole. Not only did it halve the birth rate, but there were amazing reductions in maternal and infant mortality. With excellent availability of Chinese-made oral contraceptives, intrauterine devices, no-scalpel vasectomies and condoms, and safe back-up aspiration abortion, China has led by example. If only India, or Pakistan, or Nigeria, or even the United States could follow suit, the world would breathe more easily in future. The fact that China has been able to prevent a

population explosion, with excessive numbers of uneducated, unemployable, testosterone-driven young men who see terrorism as their only way to fight the system (Potts & Hayden 2008), means that China will be relatively stable in the years to come, as it takes over the reins of global leadership.

In conclusion, there is no doubt that the current rate of human population growth is unsustainable. If we enabled all the women of the world to have control of their own fertility, there would be a dramatic decline in population growth. So it should be possible to achieve that goal set by the world's Scientific Academies in 1993: zero population growth in the lifetime of our children. That is not much to ask, when the future of all life on earth is at stake.

Roger V. Short*

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*Faculty of Medicine, Dentistry and Health Sciences,
University of Melbourne, Australia*

*r.short@unimelb.edu.au

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