



University of **HUDDERSFIELD**

University of Huddersfield Repository

Roach, Jason and Pease, Ken

Evolutionary Perspectives on Crime Prevention

Original Citation

Roach, Jason and Pease, Ken (2013) Evolutionary Perspectives on Crime Prevention. In: Encyclopedia of Criminology and Criminal Justice. Springer-Verlag, London, UK, pp. 1447-1454. ISBN 9781461456919

This version is available at <http://eprints.hud.ac.uk/id/eprint/19224/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

<http://eprints.hud.ac.uk/>

TITLE

Evolutionary Perspectives on Crime Prevention

BYLINE

Jason Roach and Ken Pease

University of Huddersfield
J.Roach@hud.ac.uk

SYNONYMS

None come to mind

OVERVIEW The Darwinian worldview, whereby organisms evolve by a process of natural and sexual selection, has come to permeate biological science, and to varying degrees the social sciences, with anthropology, psychology and economics the disciplines most influenced. Criminology has remained little touched by Darwinian thinking. This essay describes and refutes common criticisms of the application of evolutionary theory in the social sciences, and sets out some possible points of contact between evolutionary theory and crime prevention. The policy recommendations which may be tentatively made by drawing on the meagre volume of relevant research conducted to date are diverse and unlikely to offend liberal sensibilities.

MAIN TEXT

Key Issues and controversies

Evolution is the process whereby attributes of plants or animals, including people, change over generations as a result of selection pressures operating on random genetic mutations. Organisms best adapted to their environment (i.e. most equipped to survive and bring their offspring to reproductive maturity), thereby come to feature in increasing numbers within the population. While the evidence base for evolution is seen as overwhelming by the great majority of scholars in the life sciences (see Coyne 2009), the theory remains controversial for three reasons. First, it may be rejected because its account of the origins of life is at odds with that of major religious texts. Second, the notion of 'survival of the fittest' (not a quotation from Darwin) is seen as the theoretical undergirding for eugenics, the Holocaust and subsequent horrors in the name of 'ethnic cleansing'. The third reason is the erroneous ascription of biological determinism to Darwinian thought.

The first reason for rejection is not liable to challenge by evidence and will not be discussed save to affirm the right of people to their own theology. The second reason stems from Herbert

Spencer's perversion of Darwinian thought and should not preclude an open-minded consideration of the implications of evolutionary thinking for crime and criminality. Darwin's own view (Darwin, 1871) was that the intentional neglect of the weak and helpless was a "certain and great present evil" (p169). The third reason is simply wrong, with large human brains offering diversity and flexibility of behaviour consistent with Darwinian purposes (see Pagel 2012).

If evolution were to be accepted as a true account of the shaping of organisms' attributes, the implications for criminology are no less profound than they are for the other social sciences. Readers wishing to consider evolutionary implications for social policy generally are referred to the website of The Evolution Institute, brainchild of the biologist David Sloan Wilson <http://evolution-institute.org/>. The Institute's foci include risky adolescent behaviour and other crime-relevant topics.

The key presumption of the theory of human evolution is that modern Homo sapiens represents the product of selection pressures operating on our forebears in the late Pleistocene era, known as the Era of Evolutionary Adaptedness (EEA). Since (excepting for a few remaining hunter gatherer communities) our environment is now very different from that of the EEA, there is a mismatch between the setting for which evolution shaped us and the setting in which we are required to function. The plausibility of this view is best illustrated by current obesity and diabetes epidemics, the consequences of dietary preferences established at a time when food availability favoured those ingesting protein and sugar-laden diets coming to prove disastrous in times of plenty (Gluckman and Hanson 2006).

Criminologists are used to confronting the most predatory and socially disruptive of human actions, (plus those perhaps foolishly deemed by authorities of a particular culture and epoch as socially disruptive, hence for example legislation on sexual mores). But if one thinks of human behaviour as lying on a continuum from cruel predation to heroic altruism, things (at least to the writers) look somewhat different. The bulk of the relevant evolutionary literature characterises people as ultra-social, 'super-cooperators' (Nowak 2011). The term eusociality (deriving from the Greek prefix eu meaning good or real) represents a state of affairs in which some individuals reduce their own lifetime reproductive potential to raise the offspring of others. Eusociality underlies the most advanced forms of social organization and the ecologically dominant role of social insects and humans (see E.O.Wilson 2012). Wilson's view (in common with other scholars) is

that communities require a majority of cooperators, with deviant 'freeriders' threatening community cohesion when constituting more than a small minority. Areas vary massively in rates of crime. Crime levels remain an important determinant of the decision to move home, especially for those with children and the affluent (see for example Katzman 1980). The Wilson view would imply a highly skewed small area distribution of crime rates and a 'tipping point' as those able to move away from an area do so.

To return to the central notion of Homo sapiens as a super-cooperator, it will come as a surprise to many criminologists, together with believers in Original Sin, that the default setting for human nature in maturity seems to be cooperation with, and weak altruism towards, other people. With that changed perception comes the suspicion that criminology ought not to form a distinct discipline. If the overarching aim of applied social science is to foster cooperative social relationships, then there is a case for ceasing to see the task as one of reducing the number of outlier behaviours labelled as crime, and instead to see it as directing people towards the cooperative end of the continuum, *wherever on that continuum they started*, ie to nudge altruists as well as the selfish further towards the heroic altruism pole. This would possibly be achieved by a rapprochement with the emergent discipline known as positive psychology. This perspective (bear in mind its origins in clinical practice) seeks to make normal life more fulfilling rather than exclusively to treat mental illness. It emphasizes the importance of using the scientific method to determine how things go right (Seligman and Csikszentmihaly 2000). In the same way, reconfiguring research so that the prosocial-antisocial continuum is treated as such, rather than antisocial outliers being hived off for study by a separate discipline called criminology makes sense against the background of the raft of research on human eusociality. It should be stressed that evolutionary thinking is not the only route towards the incorporation of criminology within positive psychology. Indeed, religious and other obstacles mean that it may always be 'the road less travelled'. While the implications of what amounts to a paradigm shift in criminology are immense, that theme will not be pursued here. Rather, the bulk of what follows is restricted to the implications of evolutionary thought for criminology as currently conceived.

The Dunbar Number

Put crudely, if one accepts the Darwinian account, we evolved to act locally. How local is local? The Dunbar number refers to the maximum number of other people with whom a person can maintain stable social relationships (Dunbar, 1992). Robin Dunbar found a relatively narrow band of group sizes with an average of 150. This number (plus or minus some) characterised group size among numerous contemporary hunter-gatherer groups, and also the average estimated size of Neolithic farming villages. Modern comparisons were made with the size of military units. Whatever its evolutionary origins, the Dunbar number has major *unexplored* implications for designing conflict-minimal contemporary human settlements. We know that real differences in rates of crime are immense and that crime is a major reason for moving home amongst those who can afford to do so. We know that certain street types are associated with low levels of crime (Johnson & Bowers, 2009) and the recent work of David Weisburd and colleagues at George Mason University have emphasised the need for small-scale, *street segment* analyses of crime levels (see Weisburd et al. 2012). What we have yet to do is to consider attributes of late Pleistocene settlements *alongside* contemporary variations in residential crime risk. For example, do sinuous cul-de-sacs of the kind identified by Johnson and Bowers as low in crime share line-of-sight or other attributes with hunter-gatherer settlements? The reader will think it unsatisfactory in an encyclopaedia entry to say what should be done rather than what has been done, and indeed it is. However it is inevitable given the lack of penetration of evolutionary thinking into contemporary criminology.

Child abuse and parenthood

Margo Wilson and Martin Daly have looked at violence (among other things) from a Darwinian standpoint for some thirty years. Their work provides an illustration of what was implicit in the foregoing text, namely that an evolutionary mindset leads one to ask different kinds of question from those typically encountered in criminology.

For most, the killing of a child is the most heinous and distressing of all crimes (Adler and Polk, 2001). It is mercifully rarer for children to be victims of homicide than adults. In England and Wales there will be approximately 110 child homicides per year from an average total number of

approximately 700 recorded homicides, roughly equating to 14% of all homicide victims (Brookman, 2005).

The notion that your own family represents the greatest danger to your wellbeing was conventional wisdom in the 1960s, and that undifferentiated view is still held in some quarters to this day. It was obvious to Daly and Wilson that biological and step-parents should be separated in any analysis of abuse (including lethal abuse) of children. When this was done, it was found that rates of child homicide by step-parents were *one hundred times or more* greater than rates of child homicide by biological parents. In a nod to the eponymous fairy story, they called this the Cinderella Effect (Daly & Wilson, 1998).

Daly and Wilson do not argue that killing the offspring of others is adaptive for humans, though it is for some other species, such as lions (see Packer and Pusey 1983) as a means whereby incoming males prevent females from investing in the care of the offspring of other males, and eliminating the partial contraceptive effect of lactation, thus maximising the period in which females may conceive their cubs. Rather they argue that nurturance tends to be given preferentially to one's own offspring. Abuse and homicide are outliers. Most people don't keep their step-daughters from going to balls or feed them poisoned apples. The Cinderella research has been much criticised, with Daly and Wilson defending their position persuasively (Daly & Wilson, 2007). They assert

"Abundant confirmatory research has followed, such that the disproportionate victimisation of stepchildren is now the most extensively documented generalisation in the family violence literature. This... raises further questions, such as what explains variability in the magnitude of Cinderella effects between maltreatment types and locales, and whether the individual level predictors of abuse are the same for fathers, mothers, step-fathers and step-mothers. Unfortunately, progress on these important issues has been hindered by a relentless distraction: the manufacture of 'controversy' about whether Cinderella effects exist at all. We suspect that the reason for this nay-saying resides largely, though not entirely, in antipathy to the Darwinian world-view and its application to *Homo sapiens*" (p383-384).

Daly and Wilson write thus of their critics:

“From the perspective of two researchers on the receiving end of these attacks, a disturbing and sometimes perplexing element has been their incivility.... [our critics] are not just sceptical, they are angry, and we are still not entirely sure what they are angry about” (p396).

Future Discounting and Crime

Comparisons with ants and termites (the only other eusocial organisms) will be treated in some quarters with derision, but one is included here because it provides an arresting image to act as a mnemonic for the serious point subsequently made.

‘Old-aged termites go out with a bang, it appears. While ageing, the insects brew a backpack of deadly chemicals, which they use to self-destruct when under attack, taking out any enemies with them... When the spotted termites were physically unable to defend themselves with their jaws, they would commit the ultimate sacrifice and burst a pouch on their backs, releasing a toxic liquid that quickly paralysed and killed any other termites it touched’(p14).

The moral is: if you haven’t got long to go, make the most of what you have. It has long been asserted that offenders are liable to high levels of future discounting, characterised by the preference for short-term rewards over larger long-term rewards (Daly and Wilson 2005). They apply an evolutionary lens to the issue. They interpret future discounting in terms of realistic anticipation of future life. They found homicide to be most frequent amongst those with least to lose, unemployed and unmarried men, with divorced and widowed men reverting to higher rates of homicide. They interpret this in terms of the deployment of reproductive effort as a gamble. If one anticipates the non-trivial probability of an early death, or other form of removal from the ranks of the reproductively active, one chooses a strategy of attempting risky and frequent and if necessary coerced impregnation, and the pursuit of short-term reputation and the acquisition of status symbols by acquisitive crime. Wilson and Daly argue that life expectancy itself may be a psychologically salient determinant of risk-taking.

Clearly linked to anticipations of future life is the decision known as ‘Dads or cads’, referring to the choice of reproductive strategy amongst males (Cashdan 1993). Cads seek to impregnate as widely as possible, making no contribution to child-rearing. Dads stay with the woman or women

with whom they have conceived children. Cads will be the more effective survival vehicles if more of their children survive and reproduce. Otherwise the genes of Dads win out in the next generation. If Wilson and Daly are correct in placing life expectancy at the centre of strategy choice, the implications are clear in engendering hope of life and possible success in adolescents, especially adolescent males. This clearly has implications beyond the narrowly criminological.

Domestic violence against women

According to the 2009/10 British Crime Survey (BCS) seven per cent of women aged between 16 and 59 years in England and Wales were victims of domestic abuse over the course of one year, the majority of the violence being 'non-sexual' abuse by a partner. Although only fourteen per cent of the total 2,087,000 violent incidents estimated by the BCS for that year were described as domestic violence, equivalent figures have been found to be up to five times higher where participant 'self-completion' was used. Domestic violence is ubiquitous and as such if we are working to prevent violent crime than we can best make inroads by focussing on intimate partner violence. For example, a study in England and Wales (1995-2000) showed that 30 per cent of all the homicides were 'femicides'. Moreover, 57 per cent of these female victims were killed by an intimate (or ex-intimate) male sexual partner (Brookman, 2005).

How can an evolutionary informed violence prevention strategy help reduce domestic violence? The first step, as always, should be to try and understand what is going on.

Male 'sexual jealousy' is the most frequently given explanation for intimate partner violence (Daly and Wilson, 1988; Buss, 2005) and so will only be briefly mentioned here. For example, research consistently points to male on female violence as being primarily motivated by 'jealousy/control' on the part of the male. Put simply, men appear to use violence against women as a tactic to restrict their sexual behaviour, primarily as means of enforcing sexual (i.e. reproductive) 'exclusivity' (Daly and Wilson, 1988). Fiona Brookman found that more than 80 per cent of femicides occurred where the female was either planning to leave her partner, or where he perceived her at least to have been 'unfaithful' with another sexual intimate, thereby compromising sexual exclusivity (Brookman, 2005).

The foremost writer on this topic from an evolutionary perspective is Anne Campbell. Campbell makes the observation that in trying to explain the gender difference in crime the male-centred approach has dominated evolutionary psychology, where there appears to be a broad consensus

that the motivation to achieve status and 'surplus resources' is more critical to male than female reproductive success (Campbell, 2009). However, where a female-centred approach is taken a different perspective on male on female violence is achieved, where her most important proximal goal is to stay alive for her present (and future) off-spring (Campbell, 2009).

Reproduction (and therefore sexual intercourse), poses more of a risk to female safety and survival than for males (Campbell, 2009), a kind of male-female genetic arms race in which females must evolve defences against the lethal potential of the sex drive of males. Intimate partner violence being one such defence, as when women kill it is more often than not an intimate (or previously intimate) partner who is the victim (Daly and Wilson, 1988).

One practical lesson which the writers take from the Campbell perspective is the significance of women's refusal to press charges or report violence committed against them by intimates. If their 'wired-in' aim is survival with support (however flawed) this becomes more comprehensible. Perhaps the most common of police officer reactions to the victims of domestic violence who refuse to proceed down a criminal justice route is deep frustration, with a 'why bother' bottom line. Understanding the survival perspective, alongside legal changes to maximise chances of conviction even when the victim has become unwilling to proceed, seem justified.

Epigenetics

Evolutionary history is written in our genome but does not determine our behavior. Surely all competent scholars now accept that both genetic (nature) and environmental (nurture) factors play crucial interacting roles in human development. With regard to crime and anti-social behaviour, Moffitt and Caspi (2006) assert that familial inheritance is always both the result of genetic endowment and environment, but environments are made, and are often correlated with the dispositions of those who inhabit them. Of particular current interest is the gene variant MOAO which lowers the expression of the enzyme monoamine oxidase A and which seems implicated in violence. This relationship is stronger amongst maltreated children (see Caspi et al. 2002). In brief, the effects of abuse are more pernicious in those with a particular genetic makeup. Rescue of all children from abuse is the only defensible child protection objective, but this is made more acute by the recognition that some of those children are genetically 'primed' towards violence. Failure to rescue such children from abuse has a consequence in their, and their victims' later misfortunes. Despite a sense of urgency for the work of the Moffitt-Caspi team to be

incorporated into the child protection literature, as far as the writers have been able to determine after questioning relevant domain experts and practitioners, the implications of the Moffitt-Caspi work has not yet been translated into practice. So what are the implications for child protection? We may discard the notion of being indifferent to the parental practices imposed on those children whose genotypes afford them some protection against the acquisition of violent personalities! Rather it places an extra premium on ensuring as far as possible the quality of child-care generally. Not to do so is effectively to collude in allowing preventable harm, which compounds the effects of the genetic lottery itself. A parallel may perhaps be drawn with phenylketonuria (PKU), where screening on neonates allows management, and avoidance of the progressive mental impairment which otherwise ensues.

It has been speculated that the mechanism underlying the MAOA-abuse interaction may be epigenetic in nature. Epigenetics is concerned with the role that environments, including intra-uterine environments, play in gene expression (see Francis, 2011; Wortley, 2011). This, both in the sense of responsivity to the cues which make primary crime reduction effective, and in the particular sense of empathy (or its lack) will be a crucial point of departure for research which seeks to link applied criminology and evolution.

What has epigenetics got to do with evolution? The background to this question lies in very recent advances in genetics and related disciplines whereby much of what was hitherto regarded as 'junk' DNA, (ie DNA which does not code for proteins) in fact consists of a huge array of switches regulating gene expression. These switches can be thrown in pregnancy to yield enduring characteristics of the foetus, as was vividly revealed by the research following the Dutch 'hungry winter' famine of 1944, in which the phase of pregnancy during which women went without food had long term effects on the resulting child's personality (Francis 2011).

Evolution requires many generations to yield change. It would aid a foetus' prospects to get some idea of what awaits outside the womb. Epigenetic changes allow the possibility of switching genes on or off depending upon the clues which the environment gives. This makes evolutionary sense for both in utero and childhood clues. In the Caspi-Moffitt research, parental aggression is an early indicator of how aggressive one needs to be to prosper in the adult world. This form of gene regulation seems to be primarily under matrilineal control and has likely evolved partly to co-

ordinate in-utero development with maternal resource availability. The defensible next step will be to reanalyze longitudinal studies of criminality (the Cambridge study now incorporates data from three generations) to test epigenetic hypotheses. The literature on this topic continues to expand rapidly.

Evolution without Tears: Natural Selection as Analogy

Assuming the reader is wholly unpersuaded by everything written here so far, the writer's remaining hope is that evolution as analogy may be seen as an unthreatening heuristic device. The approach of selecting amongst varying designs on the basis of performance is an engineering technique known as genetic programming, the title brilliantly obscuring from those who would otherwise reject the approach on religious grounds the fact that it is in essence a simulation of biological evolution used in product design. In any event, evolution as analogy requires a user only to consider that it represents a way that improvement could occur, not necessarily the way it did occur. In this way, the theological teeth are drawn!

Perhaps the earliest proponent of this way of using Darwinian theory in relation to crime was Paul Ekblom, psychologist and polymath. He wrote in 1999

“But natural evolution is not simply a matter of ‘medieval warfare’ with increasingly better-armoured prey slogging it out against equally-improving armour-piercing capability of carnivores. The less dramatic struggle between plants and grazers is equally important (and may be a better model for property crime). The even longer struggle between *pathogens and immune system* has resulted in dynamic and adaptive strategies on each side. This has culminated in such sophisticated attackers as the HIV or smallpox viruses. Smallpox has about a hundred genes that interact with human defence mechanisms. In fact it has evolved *counter-countermeasures* to cope for example with a ‘virus alert’ chemical produced by infected cells, whose function is to warn nearby *uninfected* cells to activate their defences against virus attack.” (p29)

Ekblom details the links between other evolutionary struggles and specific crime types (see Table 1 below). The co-evolutionary analogy has more recently been taken up by Raphael Sagarin and Terence Taylor in their book *Natural Security: A Darwinian Approach to a Dangerous World*

(Sagarin and Taylor 2008) and applied to risk assessment in general and the threat of terrorism in particular.

TABLE 1. *Some other evolutionary struggles*

| Realm | Struggle | Description and possible crime equivalent |
|-------------------------------|---|---|
| <i>The natural world</i> | <i>Prey versus predators</i> | (confronters, trappers, dupers), mainly resembling crimes against the person – assault, robbery, homicide |
| | <i>Plant versus herbivore</i> | grazing- taking stored energy and materials from plants, resembling theft |
| | <i>Host versus parasite</i> | parasitism by insects, tapeworms etc – resembling theft |
| | <i>Host immune system versus pathogen</i> | infection by bacteria etc resembling robbery (overcoming host's defences) |
| | <i>Host immune system versus viral pathogen</i> | infection by viruses, resembling fraud or embezzlement in misappropriation of resources for and control of production; computer hacking (breaking access and control codes), and computer viruses themselves |
| | <i>Natural 'theft or robbery'</i> | within or between species – eg birds taking each others' nest sticks, or robbing others' food in mid-air attacks |
| | <i>Natural 'fraud'</i> | birds taking nectar by pecking a hole in the side of the flower to avoid the effort required to pass on pollen, orchids pretending to be female wasps and cheating males of reproductive effort and opportunity |
| <i>Humanity versus nature</i> | <i>Natural 'threat, assault' or killing</i> | conflict over territory, mates, food |
| | <i>Disease control</i> | hygiene, public health, inoculation, vaccination, antibiotics – resembling prevention of theft/robbery |
| <i>The human world</i> | <i>Pest control</i> | rats etc spoiling/stealing crops or livestock, spreading human diseases, acting offensively – resembling prevention of theft/damage, disorder/nuisance |
| | <i>Military arms races and (counter)terrorism</i> | arms versus armour, missiles versus electronic countermeasures, manoeuvrability – resembling assault and prevention of assault, homicide, disorder, theft of property, coercion, control of production |
| | <i>War-games</i> | military training; evolution of new strategies in chess; computer-games of tactics and strategy |
| | <i>Economic warfare</i> | outgrowing the enemy or disrupting their economy (shading into real crimes like forgery or extortion) |
| | <i>Hacking</i> | shading into serious computer crime |
| | <i>Espionage</i> | military/industrial, to steal information on resources, products, tactics and strategy, shading into theft of information/obtaining it in preparation for crime |

Conclusions

Reluctance to apply an evolutionary perspective to problems of crime and criminality may be attributed to fundamentalist religious beliefs, the ascription of eugenic horrors of the past to Darwinian theory, and the notion of biological determinism erroneously laid at Darwin's door. E.O. Wilson (1978) infamously wrote 'genes hold culture on a leash' (p172). While containing a grain of truth, it turns out that there are multiple leads, very long and very twisted (see Pagel 2012).

There are enough results of interest produced by researchers operating within a Darwinian framework to offer recommendations for crime reduction policy, alongside social policy of other kinds. It turns out that these recommendations are by and large recognisably liberal. They include the need to nourish pregnant women well, to seek to ensure that adolescents have a realistically long life expectancy and some anticipation of later success in order to minimise early pregnancies and profligate and coercive sex. It emphasises the absolute need to eliminate child abuse, given the genetic priming for violence of some so abused. It argues for recognition of the disincentive to report domestic abuse, given the pre-eminent family survival agenda of abused women. In the only clear enforcement item on the agenda, it argues for the particular monitoring of step-parents given their markedly greater prevalence of abuse against children within the home, always mindful of the fact that most step-parents behave well towards the children for whom they care. These recommendations represent the low-hanging fruit of the evolutionary perspective applied to crime, but given the marginality of such research within the discipline to date, it is surprising there is so much already. The wider question of whether the evolutionary perspective requires the abandonment of the discipline of criminology in favour of a perspective which encompasses the whole of the prosocial-antisocial continuum has been dodged here, but is probably crucial.

Related Entries

Age-crime curve, domestic violence, empathy and offending, evolutionary theories of criminal behaviour, genes crime and antisocial behaviours, genetic basis to self-control, innovation and crime prevention, Moffitt's developmental taxonomy of anti-social behaviour, prenatal and postnatal interventions

References and suggested reading

- Brookman, F. (2005). *Understanding Homicide*. London: Sage Publications Limited.
- Buss, D.M. (2005). *The murderer next door*. New York: Penguin Press.
- Campbell, A. (2009). Gender and crime. In A. Walsh and K.M. Beaver (Eds.) *Biosocial criminology: New directions in theory and research*. New York: Routledge.
- Cashdan, E. (1993). Attracting mates: Effects of paternal investment on mate attraction strategies. *Ethology and Sociobiology*, 14, 1–23.
- Caspi, A., McClay, J., Moffitt, T.E., Mill, J., Martin, J., Craig, I., Taylor, A. and Poulton, R. (2002) 'Evidence that the cycle of violence in maltreated children depends on genotype.' *Science*, 297: 851–4.
- Coyne J.A. (2009) *Why Evolution is True*. Oxford: Oxford University Press.
- Daly, M., and Wilson, M. (1988). *Homicide*. Hawthorne, NY: Aldine de Gruyter.
- Daly, M., and Wilson, M. (1998). *The Truth about Cinderella: A Darwinian view of parental love*. London: Orion Publishing.
- Daly, M. and Wilson, M. (2005) Carpe diem: Adaptation and devaluing the future. *The Quarterly Review of Biology*. 80, 55-60.
- Daly, M., & Wilson, M. (2007). Cinderella effect controversial? A case study of evolution-minded research and critiques thereof. In C Crawford & D Krebs, eds., *Foundations of evolutionary psychology*. Mahwah NJ: Lawrence Erlbaum.
- Darwin, C. (1871). *The Descent of Man and Selection in Relation to Sex*. London: John Murray.
- Dunbar, R. I. M. (1992). Neocortex size as a constraint on group size in primates. *Journal of Human Evolution*, 22(6), 469–493.
- Eklom, P (1999) 'Can we Make Crime Prevention Adaptive by Learning from other Evolutionary Struggles?', *Studies on Crime and Crime Prevention*, 8/1: 27-51.
- Francis, R.C. (2011). *Epigenetics: How Environment Shapes Our Genes*. New York: Norton and Co.
- Gluckman, P., & Hanson, M. (2006). *Mismatch: The Lifestyle Diseases Timebomb*. Oxford: Oxford University Press.
- Griggs, J. (2012, July 26). Suicidal termites use chemical weapons to defend colony. *New Scientist*.

- Johnson, S., & Bowers, K. (2009). Permeability and Burglary Risk: Are Cul-de-Sacs Safer? *Journal of Quantitative Criminology*. doi:DOI 10.1007/s10940-009-9084-8
- Katzman, Martin T. (1980) 'The contribution of crime to urban decline.' *Urban Studies* 17, 277-286.
- Moffitt, T.E., and Caspi, A. (2006). Evidence from behavioural genetics for environmental contributions to antisocial conduct. In P.O.H. Wikström and R.J.Sampson (Eds.) *The Explanation of Crime: Context Mechanisms and Development*, Cambridge: Cambridge University Press.
- Nowak, M. (2011). *Super Co_operators*. Edinburgh: Canongate.
- Packer C. and Pusey A. (1983) 'Adaptations by Female Lions to Infanticide by Incoming Males'. *American Naturalist*, 121, 716-728.
- Pagel, M. (2012). *Wired for Culture*. London: Allen Lane.
- Sagarin R. and Taylor T. (2008) *Natural Security: A Darwinian Approach to a Dangerous World*. Berkeley: University of California Press.
- Seligman, Martin E.P. & Csikszentmihalyi, Mihaly (2000). "Positive Psychology: An Introduction". *American Psychologist* **55**, 5–14.
- Weisburd D., Groff E. and Yang S.(2012), *The Criminology of Place: Street Segments and Our Understanding of the Crime Problem*. Oxford: Oxford University Press
- Wilson, E. O. (1978). *On Human Nature*. Cambridge MA: Harvard University Press.
- Wilson, E. O. (2012). *The Social Conquest of Earth*. New York: Liveright.
- Wilson, J and R. Hernstein (1985), *Crime and Human Nature*. Simon and Schuster, New York.
- Wilson, M., and Daly M. (1997) "Life expectancy, economic inequality, homicide, and reproductive timing in Chicago neighbourhoods." *British Medical Journal* 314. 1271.
- Wortley R. (2011) *Psychological Criminology*. London: Routledge.