

Futurewatch

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An information service of current international perspectives on our futures, prepared by futures scanner, Jennifer Coote, Annual dates in last two digits.

Environment

Polar concerns

A Ananathaswamy, *New Scientist*, 4 July 09, examines sea level rise and its relation to the melting polar regions. There is no doubt that as the planet warms sea levels will rise, but by how much? and how soon? Ice melt in any other parts of the world save the polar regions will only add about 33 centimetres to sea level. The thermal expansion of the oceans could continue to rise even if all emissions stopped at 450 parts per million, while if emissions continue, expansion could raise levels by 0.5 metres by 2100. The great ice sheets of Greenland and Antarctica hold enough water to add 70 metres to sea level but the speed of melt is uncertain, and data to improve predictions is now crucial. The West Antarctic ice is thinning faster than that of Greenland as melted water pours down crevasses to the base of glaciers, lubricating their descent to the sea. The ice shelves are threatened by upwelling of warmer currents in the Antarctic circumpolar current as climate change and the loss of ozone speeds the current and pushes surface water away from the coast. Another modest change in wind direction caused massive increase in ice breakup in western Greenland in 1997. Current conservative estimates of sea level rise could be 80 centimetres by 2100.

New Scientist, 31 Oct 09, pp.26-27, reports that while current predictions indicate that much of the Arctic Ocean will be ice free by 2040, half a million sq kilometres will remain till at least 2100. This is the thickest ice area, right against the northern Greenland coast and the Canadian Arctic Archipelago. It offers habitat for survival of many arctic species including polar bears.

N Cawley, *The (NZ) Listener*, 11 April 09, investigates rising pressures tourists visiting Antarctic waters, now 46 thousand people annually. Called "expeditions", their tours offer awesome experiences, despite hardships. The 28 signatory nations to the Antarctic Treaty maintain a robust stewardship over the territory. Concern is rising that poorly prepared tour operators could create serious accidents in such a remote and hostile environment, tarnishing the industry which generally operates on ethical guidelines. The presence of tourists has stimulated efforts to remove waste.

The prospect of a partially, but permanently, ice-free Arctic Ocean, is enticing many of the neighbouring states to intensify their territorial claims and produce policy directives, as have

Russia, USA and the EU, *Science*, 17 April 09, pp.339-340. While commercial interests fuel these development there are also incentives at present to maintain trust in international diplomacy and to share the crucial knowledge from scientific research in the area. Existing international statutes apply to the region, such as the Law of the Sea (though not recognised by USA), which regulates boundaries, including the limits of the Continental Shelf. Other international legal regimes cover such issues as fish stocks and shipping pollution, but the Arctic has no mandatory regulatory system which could oversee the marine ecosystem and tourism. Disputes could intensify. Some kind of agreed, effective governance system, perhaps like the Antarctic Treaty, is needed.

The Economist, 18 July 09, pp.51-52, reports on the recent establishment of a semi independent Greenland government for the 57,000 mostly Inuit residents, though Denmark still provides most of the funding and services. Like the Canadian Inuit and the Nordic Sami, they are seeking greater control of their culture and destiny, which is problematic. Old ways are failing before outside cultural and economic forces, leaving mostly youthful societies dispirited, unhealthy and poorly educated. Climate change disrupts lifestyle skills, and communities have settlements endangered by rising, stormier seas. The indigenous governments assert political challenges to companies seeking prospecting and development rights to the oil, gas and mineral wealth of the Arctic , because access to this wealth may be their best way forward.

Facing the odds

An expert group, **J Rockstrom et al**, *Summary, Nature*, 24 Sept 09, from the Stockholm Resilience Centre- www.stockholmresilience.org discusses a new approach for defining preconditions for human development. Earth's environment has been unusually stable for some ten thousand years which has enabled our age, called now the Anthropocene, to flourish. But crossing certain biophysical thresholds could have disastrous consequences for us all. Nine interlinked planetary boundaries have been identified and explored. Three of these, climate change, the nitrogen cycle and biodiversity loss, have already been overshoot. Chemical pollution and atmospheric aerosol overloading have not yet been quantified. Much more research is needed.

S. Jackson, Energy and Resources Group, Univ. Calif, Berkeley, argues that two separate climate change treaties are needed: one to deal with the role of short and medium term pollutants, such as black carbon and methane, and a longer term one for emissions from power production, industry and road transport, *Science*, 23 October 09 pp.526-527.

J. Lovelock, interviewed *New Scientist*, 24 Jan 09, pp.30-31, is starkly pessimistic about averting the impacts of climate change. The 'green stuff', such as carbon trading with its huge government subsidies, is a game for the financial and industrial sectors. The only effective aversion method is massive burial of carbon as charcoal. This would pull the carbon dioxide levels down quickly. This needs no subsidy but farmers would profit by selling charcoal.

Environmental Health Perspectives, 2 Feb 09, pp.A71-A73, explores more of the possibilities, methods, advantages etc of biochar. It is receiving much more international attention and could be included among the UN climate mitigation strategies.

R Sullivan reports, *Ecos, Feb-March 09*, on alternatives to absorb carbon emissions. Carbon sequestration is as yet an unproven technique? New technologies are being explored but several of these could have side effects offsetting the actual carbon drawdown. Ocean fertilisation with traces of iron to stimulate phytoplankton to soak up carbon dioxide, works experimentally, but if scaled up, there are questions. such as:-how much carbon can be captured? for how long? and at what risks to the oceans? Alternatively a global effort to save, restore and develop tropical rainforest and other forests and to restore degraded rangelands is proven. Soil carbon levels could be doubled for little cost with perennial crops.

D G Victor et al, US legal and public policy experts, *Foreign Affairs, March-April 09*, argue that governments need to undertake not only serious scientific research into such options as geoengineering, but also develop international norms to govern their use, especially if one nation decides in its own interests to apply the technique. While there may be great advantages in the techniques proposed there can also be serious drawbacks, with either specific or general impacts. For example, how would some of these methods affect the serious and increasing problem of ocean acidification?

G Vince, *New Scientist, 28 Feb 09*, examines the key issues for surviving in warmer world, one that has warmed by four degrees C. Much depends on the time humanity has to adapt. If 2050 is the crucial time then much of our species may have little hope, though humans will still survive, somewhere. Large parts of the world will be uninhabitable, with one belt across Central America, S. Europe and N. Africa, S. Asia and Japan, while the second will stretch over Madagascar, S. Africa, the Pacific Islands, and most of Australia and Chile. The only areas with adequate water will be in the high latitudes, while the reminder will mostly be desert with some oases. To survive, humanity will need to rethink itself, no longer as independent geopolitical entities, but around the available resources, population, food and energy. Even so, the survivors will need to conserve living space in compact settlements.

Science, 30 Oct 09, pp.662-663, reports that Bangladesh, a prime target for projected sea-level rise and a warmer world, is already preparing its adaptive strategies. National engineering programmes to control flooding and protect farmland are in train. Researchers are working on crops to withstand floods or drought as well as to greatly increase crop yields. Greater emphasis is being given to vegetable growing for community resilience. The main threat to rice in a warmer world is sterility.

Climate change updates

The first reliable analyses of cloud behaviour over the past decade strongly suggest, but do not prove, that clouds are amplifying global warming, *Science, 24 July 09, p.376*. Clouds have been a major puzzle for researchers and climate modellers. Will they thicken and spread, shading the planet as temperatures rise, or will they thin and shrink?

A first class, recent, comprehensive modelling of the role cosmic rays may be playing in global warming shows that the effects of cosmic rays are two orders of magnitude less than what is needed to explain the power of global warming. *Science, 1 May 09, p.576*.

Z Hausfather, Yale Forum on Climate and the Media www.yaleclimatemediaforum.org reports on recent scientific research which finds that black carbon aerosols in the atmosphere and their deposits on regions of snow and ice causes much more warming than was realised. It is the second largest anthropogenic contributor to warming, increasing the carbon dioxide levels by 55 %. In the polar regions the black carbon deposits have an albedo effect, where the snow and ice absorb more of the sun's heat.

A focus on reducing these carbon levels would have immediate climate benefits and also contribute to relieving the health burden of many developing countries.

It is produced from incomplete combustion of biomass, such as forest fires and cooking stoves, and fossil fuels from vehicles. Small particles can remain airborne for reasonable periods while travelling considerable distances. The major source areas are South and S.E. Asia and China . Highly efficient combustion in modern power plants produces relatively less black carbon. See also *Nature*, 2 July 09, pp.29-32.

Redd

Protection of the tropical forests, both for their biodiversity and for their value as carbon sinks, takes a major step forward as the UN Climate Change summit in Copenhagen, 2009, debated the trading system for forest conservation credits. Reducing Emissions from Deforestation and Forest Degradation (REDD) builds on pilot projects whereby developed nations paid the poorer ones to protect rather than to remove their forests. REDD will operate on a national rather than a project-size scale. Developing nations will have to manage their forest nationally, number their trees, improve their scientific and managerial capability, and find ways to control land use at the local level, if they are to reap the financial benefits. This will involve a whole behavioural change at many levels in many countries. *Nature*, 5 Nov 09, p.11, pp.26-29; *Nature*, 22 Oct 09, pp.1048-1052. *New African*, June 09, pp.65-6,7 reports on the bonanza which many African states could reap, if they can learn how to manage the dynamics of REDD.

Waters of life and death-on land

The Economist, 11 April 09, pp.52-53, reports that while globally there appears to be plenty of water for human settlements, sound analysis is sketchy. Much depends on how water is returned to the natural system or held in aquifers. Concern is growing that limits are being reached, as already water stresses have affecting national politics, fish stocks in fresh water systems are reported down 30% and half the global wetlands are lost. The potential massive increase of global population, plus the change in diets in emerging economies, will intensify water consumption. Climate change affects the way plants grow, aggravates problems of water management, and has led to the western emphasis on crops for biofuels. Improving efficient use of water requires major changes in human consumption habits, and in development and implementation of sound water policies, which most governments cope with very badly. The suggested introduction of "virtual water", the amount of water embedded in trade goods, is already being considered in some nations.

In the oceans

World Wildlife Fund NZ published 2009, a **Future Seas** scenarios project to assist in understanding the NZ's vast marine environment, how to protect and manage it and the role of marine reserves in this. www.wwf.org.nz Two scenarios:- Selling by the Litre, and Acting Local, explored timeframes 2007- 2022, then 2023-2038 and 2039-2059. The former saw gradual decline in marine conditions under a relatively neglectful policy, with increasing emphasis thereafter on industrial activity with weak controls, and consequent degradation of marine systems, until finally attention to sound environment management developed as economic conditions improved. The latter operated in a worst-case, climate change environment, where economic growth booms and then collapses. In the mid term, sea level rise accelerates beyond the adaptive resources of infrastructure while the last stage sees tipping points crossed and a marine ecological collapse.

Australian and NZ marine researchers, *Dominion Post*, 13 May 09, p.B5 and 14 May 09, p.B1, foresee the death of the marine resources of the Coral Triangle, the ocean region north of Australia, which supports some 150 million people. This region contains 75% of the global reef-building coral species and a third of the world's coral fish. Climate change is causing increasing amounts of carbon dioxide in the oceans to acidify, dissolving the shells of many organisms. Acidity is expected to rise between 30 and 70 % over this century, but in the Southern Ocean it has accelerated in the last few decades.

Ecosystem-Based Management for the Oceans, Eds. **K McLeod, H Leslie**, Island Press, 09, is an essential tool for many professionals, managers, stakeholders and concerned but non-expert supporters, with over 40 diverse contributions including case studies. Several contributions call for an expansion of the professional world-views to integrate local and traditional knowledge.

Nature, 14 May 09, **Insight**, features **Microbial Oceanography**, with expert commentary and four expert specialist studies. Predicting marine futures in such a time requires deeper understanding of the present marine world's chemistry and biology. Oceanic microorganisms are crucial to oceanic change because they are so abundant that they form the basis of all the food chains. Advances in large-scale genomic analyses have overcome many of the previous problems in examining these microbial communities. Yet we learn how little we know.

On conservation

Science 31 July 09, **Special Section, The Rise of Restoration Ecology**, explores projects and issues in this developing field, which draws on long-term insights from the past, complex understanding of the present ecosystems and balances reality with ideals. Well done restoration consistently enhances biodiversity and eco-system services. NZ contributor **D A Norton** discusses the lessons from New Zealand experience in battling species invasions in ecological restorations.

Conservation Psychology: Understanding and Promoting Human Care for Nature, **S Clayton, G Myers**, Wiley-Blackwell, 09. Two psychologists explore the psychological literature to illuminate the various aspects of human relationships with the natural world, concluding with the psychology of hope.

Economic/Business

Really new thinking

T Jackson, Economics Commissioner, Sustainable Development Commission (UK), www.sd-commission.org.uk has just produced **Prosperity Without Growth: The Transition to a Sustainable Economy**, 09. This builds on several years of Commission work and provides a critical analysis of the relationship between prosperity and growth which questions ever-rising incomes for the already rich in a world already constrained by ecological limits. The recent crises offer an opportunity to question the growth paradigm and seriously reflect on financial and ecological sustainability. A path of relative decoupling sees resource impacts decline relative to GDP. Keeping economic activity within ecological limits requires absolute decoupling. For social and ecological justice there needs to be a new approach, building on pioneering work on the conditions for a steady-state economy, maintained by a low, sustainable rate of material throughput. Two models are explored to take this approach further, showing that a new macro-economics for sustainability is possible.

The Commission on the Measurement of Economic Performance and Social Progress reported to French President Sarkozy, September 09. He had established it to investigate alternatives to GDP as the major economic measurement. Economists **J Stiglitz, A. Sen and J-P Fitoussi**, authors, propose new instruments to be adopted as measurements of national wealth, with a reduced emphasis on GDP and more detailed assessment of Net National Product which take into account depletion of capital, including human and natural. More work will be done by the French economic statistics institutes, and there are calls for a wider range of stakeholders to be involved. France will need to find other states to jointly take up the results.

Hollow economies

C R Littler, UK international Management academic, *Labour and Industry*, April 09, draws on long-term analysis of banking process to highlight important twenty-first century developments for organisational and management theory.

Firstly, "de-knowledgeing", the hollowing out of firm and institutional knowledge, with the loss of key skills and competencies, is having significant impacts on business performance across UK, US and Australia. There is a disincentive to provide training. A "cesspool syndrome" emerges where less qualified employees rise to the top. There are assumptions that increasing development of databases means that an increase of information compensates. But the loss of soft personal data results in weaker skills in evaluation of risk.

Secondly, more research and theoretical analysis is needed on firms and how organisations interact. Communication models do not work in today's nanosecond space. The pressure on stock prices, mergers and acquisitions require managers to position their firms as signal-makers. Investors and other firms hang on the significance of signalling contradictions. Yet the underlying information may be asymmetric, stripped down, or even false. Interpretation is ambiguous.

Banks and finance firms, in the increasing pressure to make profits, have turned to fees for services to individuals, chiefly for consumption. Citizens are "de-subjec-

tivised." Their identities include a new financial dimension, their credit identity, based on their income habits and assets, details of which are stored in the databases, with numerical scores attached. These are ghosts in the machines, which can be stolen.

US Business and Management academics **G P Pisano, W C Shih**, *Harvard Business Review, July-August, 09*, examine the deficiencies which handicap US industry even as the nation seeks to regenerate its wealth the face of mountainous debts. Destructive outsourcing, and faltering investment from government and investors are causing the nation to lose its ability to develop and manufacture new, high-tech products. Government and business must work together to rebuild the "industrial commons", that collective R & D, engineering and manufacturing capability which sustains innovations. More funding is needed for pure and applied research, focused on society's big problems. Management practices and governance structures need radical overhaul to correct the destructive outsourcing decisions.

S Coffey, CEO IRL (Crown Research Institute) at **Motu Seminar**, Sept 09, echoed the above concerns. Laments regarding lack of investment and isolation, handicapping NZ high-tech, require a change of mindset. The national must foster its industrial commons. There are clusters from which more innovation could spring-board right now, and an unmet need for R & D. Creative mindsets are needed to support funding systems, government investment needs to increase to 1% with emphasis on valuable university courses. CRIs need to focus on core missions and obtain equity investment, with clear priorities set by government, and more commercial bridging finance is needed. www.mutu.org.nz

Local

Rethinking the present defective tax system in NZ, led economist **G. Morgan**, *The Listener, Jan 30 2010, p.17*, to propose "Big Kahuna". This would significantly lower the tax on labour through the replacement of all welfare benefits by a guaranteed minimum of \$10,000. All earned income would be taxed at 25%. All income tax rates for companies, trusts individuals and portfolio investments would be aligned to 25% tax. This tax reduction would be funded by a rise in the tax on capital via a poll tax on the stock of capital (not just land).

H. Keane, *Te Karaka, 09*, examines Iwisphere, the emerging economic force of iwi based business in Aotearoa/NZ. By 2006 statistics show that Maori contributed 75.35% to local GDP, with one in three Maori aged 35-44 as an entrepreneur. Iwi? commerce is based on the fundamental iwi purpose, "to ensure the survival of Maori, of iwi, of language and Maori worldview" There is strong emphasis on social equity and cultural affirmation. Private joint ventures, PPPs with governments are acceptable, for example for schools, hospitals and possibly roads. Since iwi are community focused, and in for the long haul, the nation gains from such joint asset development, which will reach from the basic worker to governance. NZ's capital markets have been underdeveloped and the nation is greatly reliant on foreign capital, making a greater Maori contribution long-term to the productive side of the economy welcome. For iwi the big decisions are: the design of the governance and executive structures, the level of commercial risk and the extent of annual distribution to iwi constituents.

Alternatives

Sustainable Investing: The Art of Long-term Performance, Eds. C Krosinsky, N Robins, Earthscan, 08 is a comprehensive analysis of this whole new species of investment, which has been outperforming much mainstream investment. It has lower risk profiles through positioning for the potential of environment change. Covers:-The Emergence of such investing; Confronting New Risk and Opportunities; Sustainability Across the Other Asset Classes; and Future Directions and Trends.

Mindful Economics: How the US Economy Works, Why it Matters and How it Could be Different, J Magnuson, Seven Seas, 08. A US economics academic offers an excellent overview of the capitalist system, but advocates for radical change. The mindful economy is rooted in democracy, socially controlled by an alert and active citizenry and with the core values of environmental sustainability, economic justice and stability. First steps are to create democratic institutions that govern, control and regulate economic activity and which are owned and controlled by members of that community and based on a local monetary system.

The poor world

Dead Aid: Why Aid is Not Working and How There is Another Way for Africa, D. Moyo, Farar/Straus/Giroux, 08, is an African born, Oxford-trained woman economist's? assessment of sixty years of failure of western development programmes. The tide is turning with new possibilities, as countries such as China are investing in Africa in search of desired commodities such as oil and minerals. Capital for development is needed, but it can come from bond markets, local microfinance systems, venture capital and liberalised trade. This can also stimulate better local governance.

K. Raja, *Third World Resurgence no 216, Aug 08*, discusses UNCTAD's Report 2008, (UN Conference on Trade and Development) which examined the continuing puzzle which has confronted mainstream economic theory. The capital-poor countries have been exporting more capital to the rich world than they have received in aid. The theoretical model needs adjusting to realities, poor countries should focus more on financing investment from enterprise profits and domestic bank credit rather than on capital imports and domestic savings. Appropriate exchange rate policies are needed to overcome dependence on overseas capital, which can foster currency appreciation.

Futures Thinking

What will be "normal"?

D Gelles, *The Futurist, Jan-Feb 09*, explores the Transhumanist movement, a Silicon Valley convergence of faith, science and philosophy, focused on the potential for radical life extension and "enhancement." The human body is a work in progress, as technology is increasingly applied to improving bodies, minds, lifespan and human happiness. The name comes from the work of earlier twentieth century biologist **J. Huxley** and later developed as "cryonics" by US immortality enthusiast and scientist **R Ettinger**. Key metaphors for the movement are the body as a machine and the brain a computer, a logical extension of the core business of Silicon Valley. The develop-

ment of computer with real intelligence and personality will usher in The Singularity, popularised by **R Kurzweil**, a time when the pace of technological change will be so rapid and advanced that human life will be irreversibly transformed.

Canadian medical academic **G. Wolbring** asks what next for the human species? How will we change over the few decades and what implications does this have for our societies, for equity and our understanding of ourselves and for human diversity? Society as a whole is still coming to terms with the disabled people's rights movement and their emphasis on the value of human diversity. The meanings of normal and impairment are contested. In a future society where everyone will essentially be expected to be "enhanced", those not so will be regarded as impaired. What then is "normal"? what kinds of "disableism" are they likely to encounter? The human rights of those "not able" will become increasingly contested. Society needs today to counter such trends and emphasise the value of diversity. In *Development Dialogue, Aug 09* Whole Issue:- **What Next?** A report on several years of expert study and discussion, sponsored by the **Dag Hammarskjold Foundation, Sweden**. Project Initiator **N Hallstrom** and others contribute, including **P Bidwai**, (Fundamentalisms), **G. Raveaud**, Univ. Paris economics teacher (Revision of economics teaching), **V Shiva**, (On resilience and local systems and knowledge).

Listings

Strong Sustainability for New Zealand: Principles and Scenarios, Sustainable Aotearoa New Zealand (SANZ), 09. This tool for understanding the full scope of strong sustainability includes a study on the transition to such an outcome, and the human, economic and infrastructural impacts.

The Vanishing Face of Gaia: A Final Warning, J Lovelock, Allen Lane/Basic Books 09. Highly readable yet foreboding, this last publication from an eminent pioneer of earth system science foresees Earth tipping into a hotter and irreversible climate regime where only a few million people can survive. How will humanity respond?

M Scheffer et al, *Nature*, 3 Sept 09, examine the potential for early-warning signals to herald critical transitions. Complex dynamic systems such as ecosystems or financial markets, can experience tipping points, with a sudden shift to a contrasting regime. It is very difficult to predict such transitions before they occur, but work in several different scientific fields suggest that now early warning signals may be received from a wide class of systems.

Science/Technology/Space

Four hundred years after Galileo turned his telescope on the heavens and Kepler showed planetary orbits to be elliptical, the International Astronomy Union met in Rio, *The Economist*, 15 August 09, pp.61-62. The rate of astronomical discoveries is accelerating, with massively bigger and more costly telescopes and projects. Small science can also work with the big boys, as happened with the discovery of "dark energy", but they need more opportunities. By 2018 three gigantic telescopic projects will come to fruition, the Giant Magellan, (joint US, Australian and S.Korea) in Chile,

the bigger Thirty Metre (joint US/Canada), probably in Hawaii, and the European Extremely Large, probably in Canary Is or Chile. Possibilities to be explored are:- detection of gravitational waves, further work on detection of neutrinos, and work on interpretation of cosmic rays.

Oxford cosmologist **P Ferreira**, *New Scientist*, 1 Aug, 09, explains how the largely-known shape and history of the universe are now understood to be intertwined with the recently discovered mystery, dark energy. Clarifying the relationship is crucial to space exploration. The geometry of space needs more accurate determination. There are three possible forms, each related to the total amount of matter and energy in each unit-volume of space. If there is too much stuff, the universe will have a positive curvature, and could collapse in a big crunch. Too little and the curvature will be negative and fly apart unfettered by the gravitational pull. Only if the universe has exactly the right density will it be flat and expand forever because of the balance of gravitational pull and the constituent parts.

By 2000 there was sufficient confirmation that the geometry of the universe is exactly flat. The new puzzle was a deficit in the total energy in the universe, now understood to be dark energy. Einstein had proposed a "cosmological constant", or lambda, a completely smooth form of energy which never dilutes as the universe expands, but we do not know if this is dark energy. To know the geometry of the universe, we need to know what dark energy is, but to know how much there is, we need to know its geometry. New experiments to clarify this are seeking to probe the deepest part of the cosmos using a gigantic radio telescope to be developed in Australia or S.Africa, the Square Kilometre Array.

M Head, *Dominion Post*, 21 Aug 09, p.B5, reports on NZ involvement in the bid to develop a NZ\$2 billion international astronomy project, the Square Kilometre Array. Apart from its role in providing insights into crucial questions about our cosmos, there is huge economic potential. It is a mega science project with lucrative commercial spinoffs because of the technological and engineering challenges. NZ makes a significant difference in the Australian bid because it is geographically perfectly located to host a couple of array-stations, thus extending the baseline and the resolution of the telescope. S. Africa, the other strong bidder, could also extend into Ghana, but this has much greater infrastructure and political problems.

A new science of human behaviour?

Science, 7 Nov 08, **Special Section, The Genetics of Human Behaviour**, provides several expert contributions on recent developments in this field. **J H Fowler, D Schreiber**, argue that recent advances in the biology and in the political and social sciences call for much greater cross linkages between these disciplines and sub fields. A new science of human nature is required. **G E Robinson et al**, provide the Review paper on genes and social behaviour. Two key vectors of influence link genes, the brain and behaviour:- social information alters gene expression in the brain to influence behaviour, and genetic variation influences brain function and social behaviour.

The Age of Empathy: Nature's Lessons for a Kinder Society. **F de Waal**, Harmony Books, 09. This primatologist draws on his own research with primates to demonstrate that our animal nature is characterised by as much by kindness and col-

laboration as it is by competition and conflict. Empathy is the bond which holds communities together.

Complexity

Complexity: A Guided Tour, M Mitchell, OUP, 09, provides an expert but readable survey of the field of complex system science, its development, and a survey of recent developments in theory and applications.

Science, 24 July 09, **Special Section, Complex Systems and Networks**, provides News, overviews and expert contributions from across several disciplines. These cover molecular biology, social systems and behaviours, such as terrorism and financial exchanges, climate change, sustainability and networks.

Listings

What is Life? Investigating The Nature of Life in the Age of Synthetic Biology, E Regis, Farrar/Straus/Giroux, 08 .Over the past three decades synthetic biology has expanded, creating many new organisms and modifying concerns about risk. This readable survey examines the differing perspectives among scientist and the achievements in a context of the development of contemporary biology.

The Carbon Age: How Life's Core Element Has Become Civilization's Greatest Threat, E. Rostom, Walker & Co,08. An experienced science writer weaves together from a vast array of sub-disciplines, a survey, largely centred on USA , useful as the context for understanding climate change, but also as a grand tour of the universe.

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