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Newsletter

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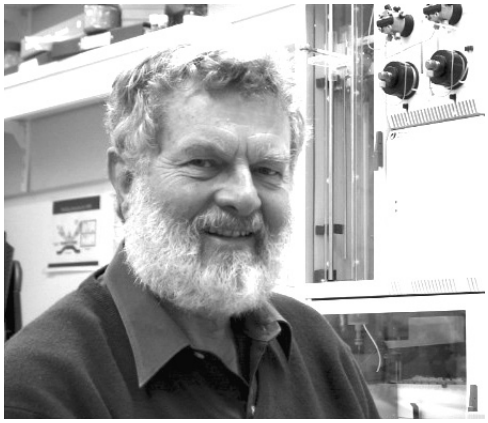
President's Report



President Colin Sanderson

In my first report I asked for immediate action to recruit new members, to establish local management committees in each State, and to send me comments about the future of the AIBiol. I received two comments (which I acknowledge with thanks) and nothing more. The previous Executive had established the principle of allocating seeding funds to State or Territory groups wishing to organise Institute activities locally, and this opportunity remains. Funds could be used for local seminars or workshops or to support an interstate speaker. Additional funds could also be advanced as a loan for local conferences, with registration fees helping loan repayment. Your local Area Representative will be able to assist in coordination.

The Executive has reviewed our publications, and wishes to acknowledge the outstanding efforts made by journal editor Bob Hill (on top of his other contributions as President!), newsletter editor Evan John, and webmaster Rhys Hill. In our view the future of the Australian Biologist in its present form needs to be justified. On the one hand, it is a communication vehicle on scientific matters for members. On the other hand, it is expensive and with very limited circulation. Evan's work on raising the quality of the Newsletter has made attractive the possibility of merging it with the Australian Biologist. This would create a range of options for style

and content, but retaining the name Australian Biologist. We are also in favour of converting it to a free access, online publication available through the website. In addition to this, the website could be set up for forum discussions, which would facilitate discussion of current scientific issues, as well as houskeeping matters like this one concerning our publications.

Bob's other commitments have made his resignation as Editor imminent, Evan John is also poised to hand over the reins. This is a good time to consider a single publication. The website needs a webmaster to keep it up to date and improve the information available to members. Our membership in WA is too small to carry all the administrative functions required to run the Institute, but there is no reason why the new Australian Biologist and web site could not be run from outside WA.

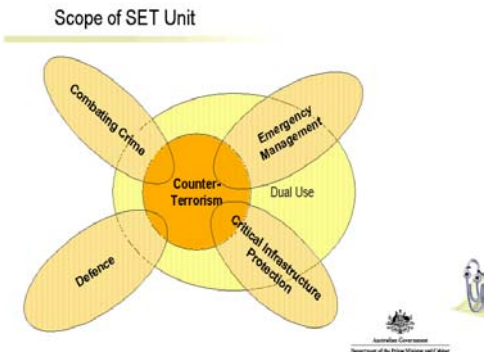
The Institute reimburses the out-of-pocket expenses to people who take on these positions. It would also consider proposals for a combination of these tasks for an honorarium payment, in that a new approach to "communications" may both, save money for the Institute and provide relevant information in a timely fashion to members.

What do members think?

Colin J. Sanderson, FAIBiol, President
(c.sanderson@curtin.edu.au)

Bulletin Board

- **Fighting terrorism!**



A Science, Engineering and Technology (SET) Unit has been established in the National Security Division of the Department of the Prime Minister and Cabinet (PM&C). Staff for the Unit have been seconded from the Defence Science and Technology Organisation, CSIRO, DEST, the AFP and the intelligence community.

The Unit will provide an overarching view of national research requirements and priorities for counter-terrorism that is currently lacking. Although some agencies with responsibility for counter-terrorism (user agencies) have means of accessing research, opportunities are being missed due to lack of knowledge of the needs or the capability of SET agencies to provide solutions.

The SET Unit:

- will provide the focus for international collaboration in this area.
- is developing a set of priority requirements for possible research based on capability gaps identified by the user agencies.
- is developing a research programme to support the best research proposals in line with the priority requirements. To this

end, it is consulting widely both in the counter terrorism and SET communities.

The SET Unit can be contacted on setu@pmc.gov.au or by phone to Susan Wishart (who provided this information) on (02) 6271 5247. More details are available at www.pmc.gov.au

- **Warmer and sicker? - global warming and human health.**

Continued warming of the planet could have significant implications for human health. Coping with extreme heatwaves will be just one of our concerns. The new Australian Academy of Science's Nova: Science in the news topic has the latest information on global warming and human health at http://www.science.org.au/nova.

According to the bulk of scientific opinion, the world is getting warmer and many scientists are convinced that increasing concentrations of greenhouse gases in the atmosphere are at least partly to blame. Perhaps the most obvious impact of global warming will be the direct effects.

In August 2003, Europe suffered its worst heatwave in recent memory. In France, temperatures peaked at about 40°C; unprepared for that kind of heat, many people - mostly the sick and elderly - succumbed. In all, nearly 15,000 deaths in France that summer were attributed to the high temperatures; across Europe, the scorching weather may have claimed as many as 35,000 lives.

Most computer models generated by scientists indicate that the future climate will be more variable than in the past, and that droughts and floods will be more severe. Australia's climate is naturally variable, although generally arid. The implication of an even greater variation in rainfall is likely to be profound. Apart from the ecological and agricultural impacts, the availability of water may be reduced, with implications for human health. More frequent drought conditions would increase the risk of bushfires, which can kill people, release large quantities of particulate matter that can cause respiratory problems, and degrade water catchments.

Many infectious diseases are dependent on vector organisms, which are sensitive to environmental factors and therefore will be affected by global warming. Biological modelling under various climate scenarios suggests a widening of the potential transmission zone of some disease-causing pathogens and their vectors, such as mosquitoes.

Scientists predict that sea levels will rise as the global temperature rises, due to the melting of land-based ice in the polar regions and glaciers, and the thermal expansion of the oceans. The number of Australian fatalities from coastal flooding and storm surges has historically been low. It is currently estimated that 250 people each year experience coastal flooding due to storm surges, but this number could double by 2050. For the Pacific region as a whole, however, the number of people exposed to coastal flooding could be between 60,000 and 90,000 in an average year, a 50-fold increase on today's estimates.

Considerable uncertainty remains about how the climate may change and how such changes might affect human health. Neither uncertainty nor complacency should be allowed to prevent action to reduce greenhouse gas emissions. The risk to human (and ecological) well-being is too great, and prevention will be far better - and easier - than cure.

More about global warming and human health is on the Australian Academy of Science's Nova: Science in the news website

The topic also includes a glossary; student activities; further reading; and annotated links to relevant websites.

- **Draft National Directory for Radiation Protection.**

Earlier this year, the Australian Radiation Protection and Nuclear Safety Agency invited interested parties to make submissions on the Draft National Directory for Radiation Protection, Edition 1.0.
The aim of the Directory is to provide nationally uniform requirements for the protection of people and the environment against exposure or potential exposure to ionizing and non-ionizing radiation and for the safety of radiation sources, including provision for the national adoption of codes and standards. The Directory has been developed to address the needs of radiation protection regulators but it will also benefit other sectors involved in implementing radiation controls, such as mining and occupational health and safety regulators.

The proposal for the Directory received Ministerial approval at the Australian Health Ministers' Conference on 4 August 1999. Ministers agreed that ARPANSA's Radiation Health Committee (RHC) would manage the development of the Directory. Members of the RHC include representatives from all States and Territories and the Commonwealth.

As the Directory will be completed in stages, some sections of the current edition will not contain details of radiation protection requirements or guidelines. Nevertheless, where this is the case, a short commentary has been provided on what can be expected in future editions of the Directory.
The draft edition 1.0 of the Directory and accompanying RIS can be downloaded from the ARPANSA website: (http://www.arpansa.gov.au/for_comm.htm), or you can phone (03) 9433 2207 and request a free copy.

- **ALCAN Prize & Bursaries**

Alcan have established a US$1 million annual prize for sustainability for civic/NGO organisations. In addition to the annual prize they are giving a number of bursaries for staff from NGOs to go to Cambridge uni and do a course in public-private partnerships, which may be of particular interest to Member Societies working in environmental and sustainability.
For further details, refer to the website:
http://www.alcanprizeforsustainability.com

- **A.A.S Excellence Awards**

The Australian Academy of Science is a private organisation of some 370 of Australia's leading research scientists, elected for their personal contributions to science.

The Academy recognises research excellence by conferring medals and awards on younger scientists and recognises lifetime contributions to specific disciplines by more senior scientists.

You are invited to nominate candidates for the prestigious awards of the Australian Academy of Science, with closing date of 30 August 2004.
Information about the awards is available at
http://www.science.org.au/awards

- **New CEO at ARC**

Professor Peter Høj has been appointed to the position of Chief Executive Officer (CEO) at the Australian Research Council (ARC).

Professor Høj will commence a five year term from 1 October 2004 and has been recommended by the ARC Board as an outstanding candidate for this vital position. This assessment was made following national advertising and an extensive executive search involving major ARC stakeholder

consultation.

Professor Høj was educated at the University of Copenhagen majoring in Biochemistry and Chemistry. He has a Master of Science Degree in biochemistry and genetics and a PhD in photosynthesis. Professor Høj has received fellowships from Denmark and Australia for post-doctoral studies in biochemistry. Since arriving in Australia in 1987 he has worked as a Lecturer & Senior Lecturer in Biochemistry at La Trobe University and Professor of Viticultural Science and Oenology at the University of Adelaide. In 1992 he was awarded the Boehringer-Mannheim medal by the Australian Society for Biochemistry and Molecular Biology.

Since becoming Managing Director of the Australian Wine Research Institute in 1997 he has implemented a cross-disciplinary approach to strategic research and development. The success of the Institute was recognised by an Australian Wine Industry Award in 2002. He is also a shared recipient of the SA Great Award (2002), Science category, for the National Wine Industry Research Cluster Pty Ltd establishment, and the Centenary Medal (2003) for service through wine research and science.

In addition, Professor Høj has extensive experience as a member of various science and research committees, including the Steering Committee for the McGauchie Review in 2003 on collaboration between universities and publicly funded research agencies and the Prime Minister's Science, Engineering and Innovation Council.
Professor Høj is an exceptional candidate for the position. A researcher of international renown, he also brings to the ARC considerable experience in contemporary management and strong strategic leadership.
Professor Høj is to be congratulated on his appointment and we look forward to his leading the ARC in its efforts to achieve the highest quality research outcomes and economic and social benefits for the Australian community

- **Green ants clean and defend cashews!**

The Innovate Australia Newsletter (July 1, 2004) contained a report on how green ants are replacing chemicals in the battle against insect pests in Northern Territory cashew plantations.
The ants not only reduce costs by reducing the need for chemical controls, they help increase yields. If this were not enough, the ants also "clean and polish" cashew nuts prior to harvest.
A Rural Industries Research and Development Corporation (RIRDC) report demonstrates how Territory cashew growers can achieve annual savings of about $1500 per hectare by using the green ants native to Northern Australia.
Cashew nuts protected by green ant colonies require no insecticide and the nectar secreted by young nuts is continuously removed by the ants leaving the nuts clean and shining.
For further information visit the website:
www.innovateaustralia.com

Report on the Activities of FASTS (The Federation of Australian Scientific and Technological Societies)

- **Bradley Smith appointed new Executive Director, FASTS**

Bradley Smith

We welcome Bradley Smith to FASTS. He started work at the Dome on 2 February 2004 as Executive Director. Bradley was formally a policy advisor on the staff of the leader of the Australian Democrats, where his main portfolio responsibilities were higher education, science and biotechnology, R&D and innovation.

He successfully negotiated improvements to more than 30 bills and regulations affecting science and technology including the R&D Tax Concession in 2001, the Research Involving Human Embryos Act and the Australian Research Council Act.

Before that, he was the President of the Council of Australian Postgraduate Associations (CAPA) and a doctoral candidate in the history and philosophy of science.

Bradley says that he relishes the opportunity to assist FASTS to build on its achievements, to further strengthen the organisation and enhance its capacity to successfully influence Government, media and community understanding and support of science and technology.

- **Top Ten Policies for 2004 announced**

2004 is an election year, and FASTS is encouraging the Australian Government to bring on *Backing Australia's Ability (II)*. This is its most important policy object.

In 2001 the Australian Government announced the $2.9 billion *Backing Australia's Ability* investment package to boost Australia's research and innovation capacity. This was a positive step, and one essential for the nation's future prosperity and well being. Most of the investment through *Backing Australia's Ability* is set to end in 2006. After the many reviews conducted in 2003 into Science and Innovation, the government should be ready to announce *BAA (II)* in this year's budget.

FASTS has previously applauded the Government's investment in *Backing Australia's Ability* which brought about a sea change in Australia's investment in science and technology. However Australia still lags behind most of our OECD competitors in terms of investment in research and innovation. The European community has recently set a target for investment in research of 3 per cent of GDP by 2010, and the US and our other international competitors are moving in the same direction. Australia is currently investing about half that amount. We need a national strategy to boost this investment in the next stage of *Backing Australia's Ability (II)* to remain competitive.

FASTS Ten Top Policies for 2004

1. Bring on "Backing Australia's ability (II)

BAA was a first step to invest in Australian science. It's time to take the second step and

increase our national investment to match the OECD average.

2. Retain our bright young research scientists

Recent science graduates have plenty of employment opportunities, but postdoctoral researchers have run into a career bottleneck. The best ideas will flourish if BAA (II) creates attractive career opportunities in research and industry.

3. PhD science graduates to invigorate industry

BAA (II) should provide matching Government funds to employ new PhD graduates in industry for 2 years, to bring fresh scientific ideas for new methods and new products, and to forge science-based industry career paths.

4. Encourage industry to be more inventive.

Give increased tax breaks on a sliding scale to reward companies prepared to increase their investment in research, because enterprising and inventive companies grow and provide more jobs.

5. Attract venture capital into new industries

Venture capital is in short supply. Make it more attractive to invest in new ideas and new industries that have long term payoffs by lowering capital gains tax for long term investments.

6. Now we have the map, Australia needs a compass

The National Mapping exercise has shown us where we are. We should create a plan for up to 10 years into the future that sets goals and national directions, including national action plans on limiting climate change and on sustainable energy strategies.

7. HECS breaks for science and mathematics teachers

Science and maths teachers are in short supply in Australia, but they pay higher HECS fees than other teachers and thus take home less pay. Bring in HECS breaks for science graduates when they take on teacher employment.

8. Collaboration, not competing silos

Destructive competition between separate research organizations for the funding dollar limits research outcomes. Provide more collaborative funding incentives to build on the different strengths of universities and Government funded research agencies.

9. Quality science graduates

Quality science and technology graduates are vital to Australia's economic and environmental future. We need measures to ensure that the new Higher Education funding arrangements help reverse the current decline in Higher Education science enrolments.

10. We are now 20 million and growing

Australia is a fragile continent with an expanding population. We need to develop a scientifically based population strategy that takes into account limits to growth determined by, for example, water resources and soil salinity.

These issues will form the core of FASTS policy priorities in this election year.

Book Review

Recoding Nature. Critical perspectives on genetic engineering.

Richard Hindmarsh and Geoffrey Lawrence (editors).
UNSW Press 2004, pp246, ISBN 0 86840 741 0

As a young medical researcher in the 1960s with a broad interest in the arts, I read C P Snow's "The Two Cultures", which detailed his perceived rift between science and humanities. The two cultures of today are science and pseudoscience, and many of the contributions to this book are in the latter category.

The academic tone of the book is set by Mae-Wan Ho in the Forward. Coming across sweeping statements like "the much touted embryonic stem cells carry cancer risks and are prone to uncontrollable variation in culture" and "..having been thoroughly discredited by scientific finding", I hastened to the list of references hoping to find some evidence to support the statements. I was disappointed, the references were simply to the same statements in previous writings by Ms Ho.

The editors, Hindmarsh and Lawrence (Chap 1) make fun of an experiment where piglets were made to glow by transgenesis (we are spared the misuse of GE in the glowing aquarium fish). It is impossible to judge the merit of the pig experiment, because the reference given is to a newspaper article, but reporter genes (in this case a fluorescent protein) are important in understanding how genes work. The authors appear to give an overview of genetics but simply trivialise it.
Hindmarsh and Hulsman (Chap 3) selectively quote a UK study and claim that GM canola and GM sugar beet were more harmful to plant and animal life. In fact the UK report deserves careful reading. The harm to weeds came from herbicides not the GM crop, and the number of "invertebrates" was proportional to the number of weeds in the crop. Indeed GM maize, because the herbicide could be applied later, was judged to be better for "farmland wildlife" than non GM maize. The message from the study is clear, if you want farmland wildlife, grow weeds.

Hoping for something better I turned to a scientist whose position as "a Director of the Institute of Health and Environmental Research (SA)" suggested some credibility.
Dr Davies (Chap 4) raises concern about plants engineered to produce pharmaceuticals, suggesting that consumption at unspecified doses may be harmful.
Many pharmaceuticals come from plants (morphine is an example), and similar protocols will be used for GM plants: containment conditions and the active ingredient purified and put into bubble wrapped tablets. He also quotes, uncritically, experiments where Bt (a protein toxic to insects, but not to higher animals) containing maize pollen was fed to and killed Monarch butterflies. He fails to mention that these butterflies do not feed on maize, nor to quote studies showing that Bt maize encourages butterflies because less broad spectrum insecticides are used. There is no discussion of the more important environmental and human health benefits (especially in developing countries) of Bt crops resulting from decreased exposure to insecticides. It is hard to take the writer seriously.
Dr Carman, another director of the above Institute, addresses the question (Chap 5),

"Is GM food safe to eat?" She argues for more testing even of plants that have been consumed for years without any ill effects. She is worried that some of these genes may be transferred to humans by bacteria, but if that was possible we would all have genes from the plants and animals that we eat. She is even concerned that we could all get sick and nobody would know!

Scott Kinnear, an organic food retailer, rightly draws attention to the salinity problem in Australia (Chap 7), but does not understand that it is largely due to removing deep rooted native trees and replacing them with short rooted crops which allows the water table to rise. Organic or not the problem is the depth of the roots. There is no understanding of the problems of certified organic production, particularly expanding it to feed more than just the well off minority. There is simply not enough animal shit, and even that comes from animals fed on feedstuffs produced with "chemical fertilisers". If somebody did not use "chemical fertilisers" organic farming would collapse.

"Deleting sadness" (Chap 8) by Rosaleen Love is a shallow and confusing discussion of the complex issues of human cloning and germline transgenesis. As much as some find these abhorent, if they become safe and reliable, people (largely the wealthy) will find a way to use them.
The issues need to be discussed in the context of the impact on individuals as well as on the species. Richard Hil and Barbara Hocking address the issue of genes for crime (Chap 11) with detailed descriptions of discredited claims and eugenics (earlier forms of psuedoscience) to imply that modern genetics is similarly unreliable. There is not, so far as I am aware, any evidence for genes associated with criminality, not least because of the difficulty in defining criminals. The more important issue is, if a link was found between genes and social behavior what would we do about it? Shoot the messenger? Unfortunately this is what they attempt to do with a study from the highly respected Institute of Child Health in London. Again the reference is to a newspaper article and not to the published study.
Adrienne Hallam is critical (Chap 9) of the Human Genome Project, she forgets that it was a publically funded project which has made the data freely available to all. It is an amazing resource for those of us in medical research. Her creditability is not helped by referring to the misuse of human growth hormone as "genetic enhancement". While few would argue against a role for living standards and environment in health, she builds a picture of modern medicine totally focussed on "biomedicine"
(= pharmaceuticals). She promises "other (alternative) health approaches" citing their popularity as justification for their use. Surely efficacy is more important than popularity.
I re-read this book asking myself was there anything in it for anyone. Frankly, there is too little sound information to help a reader understand the issues around genetics or genetic engineering. It certainly confirmed my membership of the other culture.
Most of the arguments have been run by the media, and at least some media outlets attempt to give a balanced view of the big biological issues of our times.

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Reprinted with permission from the Journal of Australian Studies (JAS) Review of Books, Issue 24, June 2004.
www.api-network.com/cgi-bin/reviews/
There are many other interesting reviews on this website

Organ and Tissue Transplantation: An Australian Perspective

In January 2004, the untimely death in Melbourne of one of South Australia's well known former test cricketers, David Hookes, drew a great deal of media attention. His wish was to donate his body organs to those who would benefit, and as a result, the importance of organ donation was publicly highlighted.

The following article, prepared by Libby John, RN, the South Australian Liver Transplant Coordinator and her colleagues, gives a brief outline of the issue, its history, and its current status.

INTRODUCTION

The current era of successful organ and tissue transplantation reflects many years of research and clinical expertise, and is now an accepted treatment for many medical conditions.
Since 1965 there have been more than 30,000 Australians who have received some form of life saving transplant. Due to a scarcity of donor organs, extensive medical and psychological assessment of potential recipients is carried out pre-transplant, to ensure organs are allocated appropriately and transplant outcomes are maximised. (5)

This article outlines the history and advancements that have been made and highlights the processes involved in this exciting and challenging field of medicine.

HISTORY OF TRANSPLANTATION

Records of transplantation can be found dating back as far as 800BC with reports of grafted noses being created from skin flaps. (12)
Whilst tissue grafting was performed in 1870 by a Swiss surgeon, it was not until 1912 that Alexis Carrel developed methods to anastamose (join) blood vessels, making it feasible to transplant organs. Carrel also developed preservation fluids which enabled organs to be maintained outside the body. (15)

An important development occurred between 1978 and 1985, when legislation was passed in Australia permitting the declaration of 'brain death' based on the cessation of cerebral function. (5). This legislation enables the retrieval of organs from a brain dead, "beating heart" donor maintained on a ventilator. (5)

Table 1: Organ Sources

Beating Heart Cadaveric (Brain Dead)	Next of kin consent obtained after tests confirm brain death– donor wishes known through family discussion, National Donor Registry or Driver's License. All organs and tissues can be considered for transplantation.
Non-Beating Heart	Death is determined by absence of heartbeat and not by brain death. Bones, tissues, corneas, and some organs (kidneys) can be retrieved for transplantation.
Living Donor (related and unrelated)	Legally competent people who have undergone an independent medical/psychological review. Organs which may be donated include kidney, liver (lobe) and lung (lobe).
Xeno – transplantation	Transplantation of tissue from one species (eg pig) to a different species (eg human). Procedure not currently performed in humans.

(11)

THE ORGAN DONATION PROCESS

Despite having some of the most successful transplant units in the world, Australia has the world's second-lowest rate of organ donation, with only 10.4 donors per million population (dpmp). Spain has the highest level of organ donations with 33.7dpmp. (5)

Table 2:Donor rates

Figure 1

Number of Donors 1998 - 2002 **

	1998		1999		2000		2001		2002	
Queensland	40	(12)	20	(6)	37	(10)	48	(13)	44	(12)
New South Wales +	63	(10)	48	(8)	55	(9)	47	(7)	55	(8)
ACT *	2	(4)	2	(4)	5	(10)	7	(14)	6	(12)
Victoria	40	(9)	42	(9)	44	(9)	40	(8)	47	(10)
Tasmania	0	(0)	6	(13)	1	(2)	3	(6)	6	(13)
South Australia	35	(24)	30	(20)	30	(20)	25	(17)	31	(20)
Northern Territory	3	(16)	3	(16)	2	(10)	2	(10)	2	(10)
Western Australia	13	(7)	13	(7)	22	(12)	13	(7)	15	(8)
Australia	**196**	**(10)**	**164**	**(9)**	**196**	**(10)**	**185**	**(10)**	**206**	**(10)**
New Zealand	**46**	**(12)**	**39**	**(10)**	**41**	**(11)**	**37**	**(10)**	**38**	**(10)**

( ) Donors Per Million of Population

\+ NSW population excludes residents of the NSW Southern Area Health Service

* ACT population includes residents of the NSW Southern Area Health Service

Medical services in the ACT service the NSW Southern Area Health Region

Population data - June 2002 - ABS 3101.0

Refer to Appendix for the number of donors by State and Hospital and population

** This figure relates to the number of donors for whom the retrieval operation commenced for the purpose of transplantation. This includes donors who may have been deemed medically unsuitable at the time of surgery or after removal of organs.

(21)

Each organ has a specific maximum ischaemic time and is transported to the recipient accordingly. The shorter the ischaemic time for all organs the better the outcomes for the recipient. The solid organ is flushed with cold preservative solution and kept cold at 4°C, usually in an esky with ice. This procedure allows for a maximum ischaemic time of 4-6 hours: heart, 6-8 hours: lung, < 24 hours: liver, and 72 hours: kidneys and pancreas. This must be considered when transporting organs across Australia.

The allocation of organs within Australia is facilitated by donor agencies that are located in each State and Territory. For extra renal donations the donor state has first option to use that organ. If the donor state cannot use that organ (eg no suitable recipient match) or does not perform that transplant, then the allocation is rotated to the other states. Kidneys are allocated via a National Organ Matching System (NOMS), which is a computer database that matches kidneys to recipients across Australia. This database is maintained by the Red Cross Tissue Typing Laboratories.

Table 3: Patients Awaiting Transplant by State of Origin at January 2 2004.

	QLD	NSW/ ACT	VIC/ TAS	SA/ NT	WA	TOTAL
Kidney	83	758	412	100	135	1488
Liver	47	33	16 *	9	5 *	110
Heart	13	30	15	2	5	65
Lung	27	29	45 *	10	13 *	124
Pancreas	1	17	3	2	6	29
Pancreas Islets	1	7	-	-	-	8
Total	172	874	491 *	123	164	1824

(21)

- **TISSUE TRANSPLANTATION**

Tissue Banking is the term used to describe retrieving, processing, storing and distributing cardiac, ocular, musculoskeletal and skin tissue for use in transplantation. Donated tissue is used in many operations to improve quality of life. Cardiac allograft is used in heart valve replacement surgery and to repair congenital outflow abnormalities in children. Bone allograft is used to reconstruct joints, bone damaged from either cancer or trauma and to improve mobility. Skin allograft is used mostly in the treatment of burns patients and is considered a life saving procedure. It is a biological dressing providing a cover over the burn and preparing the area for further treatment. All tissue allografts are cryopreserved and can be stored for at least 5 years. The exception is ocular tissue which is transplanted soon after retrieval. Cardiac and skin tissue is stored in the vapour phase of liquid nitrogen and musculoskeletal tissue is stored in a -80 degree freezer or can be freeze dried. Since the early 1990's tissue banks have been overseen by the Australian Government which has deemed human tissue to be a therapeutic good under the Therapeutic Goods Administration. (1)

- **BONE MARROW TRANSPLANTATION**

This form of transplantation is predominately used for malignant diseases but is indicated in some autoimmune conditions. Bone marrow or stem cells can only be collected from living donors and infused intravenously after high dose chemotherapy.

Donors can include the recipient (autologous), a twin (synerneic), a relative, or unrelated donor (allogeneic). Grafts (bone marrow or stems cells) must be matched for Human Leukocyte Antigen (HLA). Mis-matched grafts can be given with higher risks of graft versus host disease and rejection.

The recipient will have 7-14 days where no bone marrow function occurs. During this time they will be highly susceptible to infection and bleeding. Blood product support and antibiotic cover is paramount to their survival. Once engraftment occurs the recipient takes on the donor's blood type and immune status. Because of this, donor marrow (if not autologous) can reject the host's surviving immune cells/tissue (as opposed to organ transplantation where the host rejects the organ). Rejection can occur in any organ of the body but is seen commonly on the skin, gut and liver. Immuno-suppressive therapy is only used for approximately 100 days in bone marrow transplantation as the graft becomes the recipient's natural immune system.

- **RENAL TRANSPLANTATION**

The first kidney transplant was performed in 1965 at the Queen Elizabeth Hospital, South Australia. (20)
Cadaveric renal transplants account for two thirds of all kidney transplants with the remaining third coming from living donors.
The waiting time is three to four years after commencing dialysis for a cadaveric renal transplant. A live donor transplant can be performed before the recipient needs dialysis. Primary cadaveric transplant survival in Australia in 2002 was 97% and the transplanted kidney survival at one year is 94%.(19) Live donors are traditionally blood relatives . However, due to the low cadaveric donor rate in Australia, transplant units have extended these boundaries to include spouses/partners or "good friends" as kidney donors. (7)

- **LIVER TRANSPLANTATION**

The first successful human liver transplant was performed in The United States in 1963. There are five liver transplant centres in Australia and one in New Zealand. Survival rates show it is a viable option for those with liver failure, with an average one year survival rate in this country of 85%. (2)

Liver transplantation is carried out for liver failure both acute (such as viral infections or paracetamol and other drug toxicity), and chronic liver failure. Chronic liver failure usually results in cirrhosis and failure of the liver. Some of the causes of liver cirrhosis include hepatitis B and C, alcohol, autoimmune diseases, and metabolic disorders. Liver transplantation may be carried out for some types of hepato-cellullar carcinoma.

Donor livers are matched to recipients by blood group and weight. The actual liver transplant operation is a complex process and can take between 6-12 hours. Liver allografts can be implanted whole, as reduced size grafts ("cut downs"), or as split grafts (where the right liver lobe is implanted into an adult and the smaller left lobe into a paediatric recipient). Due to a scarcity of cadaveric donor livers, some centres have undertaken live liver donation. A living donor undergoes liver resection to provide a segment of liver for transplantation.
Post operative complications can include rejection, infection, hepatic artery thrombosis or biliary obstruction or leak.

- **HEART TRANSPLANTATION**

Heart transplantation is now standard treatment for end-stage heart disease. There are currently four heart transplant units within Australia, with around 80 transplants being performed each year. In 1966, the first heart transplant in the world was performed in South Africa, by Christiaan Barnard. (15) In Australia today, more than 80% of heart transplant recipients will be alive at one year, 75% at five years and around 60% will be alive at 10 years. The longest survival for a heart transplant recipient is more than 23 years. (10)

The most common indications for heart transplantation are ischaemic heart disease and cardiomyopathy. The majority of heart transplantations performed are orthotopic, where the recipient's heart is totally removed except for the posterior section of the atria, leaving the inflow tracts of the systemic venous system (pulmonary veins) intact. (10)

Post operative complications can include primary graft failure (usually resulting in the need for a heart pump or urgent re transplantation), atrio-ventricular block (requiring cardiac pacing), rejection and renal dysfunction.

- **LUNG TRANSPLANTATION**

There are currently three lung transplant units within Australia, with around 100 transplants being performed each year. In 1963, Dr Hardy performed the first human lung transplant, for an isolated cancer of the lung. (16) Progress in lung transplantation was not as rapid as that for other solid organ transplants. In the early years of lung transplantation, the procedure was viewed as improving quality of life only, not extending life. Today, lung transplantation has evolved from an experimental procedure to a legitimate mainstream therapy which offers the chance of ongoing survival and quality of life.

According to data from the International Society for Heart and Lung Transplantation (ISHLT) 1 year survival for bilateral and single lung transplant is 70% and 69% and 5 year survival 48% and 40% respectively.

Lung transplantation is a very painful operation and the routine postoperative care intensifies pain experience. (16) Management of pain is extremely important in this group of patients.

- **PAEDIATRIC TRANSPLANTATION**

Solid organ transplantation has been a viable treatment option for paediatric patients since the mid 1980's and bone marrow transplant since the mid 1970's. (20) Transplantation offers the paediatric patient who has end stage disease a chance at long term survival. In Australia renal, liver and bone marrow transplants are the most common types of transplants performed on children and adolescents. Heart transplantation in children is a rapidly growing specialty. Lung transplantation is usually performed on adolescents with cystic fibrosis. (20)
Children and their families undergo a rigorous pre transplant work up to assess their suitability to be listed for transplantation.

Generally, children requiring a heart or lung transplant wait longer for a suitable donor due to size mismatch. Paediatrics requiring a donor liver can receive both paediatric cadaveric organs and also adult organs. New surgical techniques allow for the adult donor liver to be cut down and a portion given to a child or the graft is split and half is transplanted into an adult and the other half into a child.

COMMONLY EXPERIENCED MEDICAL COMPLICATIONS POST TRANSPLANT

- **INFECTION**

Infection is a significant complication post transplant, and is a major cause of post transplant mortality. Singh (1997) states that "the spectrum of infectious complications in organ transplant recipients, however, has continued to evolve." (p.410). Patients are immunosuppressed to prevent rejection. This significantly increases the risk of infection, therefore prevention of infection is paramount.

Post transplant infections are most commonly viral or bacterial. Viral infections include the following: Herpes viruses, Epstein Barr Virus (EBV), Varicella Zoster Virus and Cytomegalovirus (CMV). CMV infection is more common in donor CMV positive - recipient CMV negative mismatches. (19) CMV is often treated prophylactically for many weeks post transplant with agents such as Ganciclovir if there is a CMV mismatch.
The incidence of infections caused by gram-positive cocci (Vancomycin Resistant Enterococci and Methicillin Resistant Staphylococcus Aureus) has increased and opportunistic mycoses (e.g. invasive Aspergillosis) continue to be associated with very high mortality rates. (19)

- **REJECTION**

Rejection is a key factor in graft loss and patient death post transplant. Rejection is the body's response to recognising a foreign antibody (eg a donor antibody) and the body mounts an immune response to fight the antibody. Immune suppression decreases the body's immunologic response.
Immunosuppression plays a vital role in preventing and controlling rejection episodes. Most solid organ transplant recipients are commenced on a triple therapy programme post transplant to prevent rejection. (13)

Triple therapy consists of corticosteroids and immunesupressants. Corticosteriods such as Prednisolone interfere with the immunological inflammatory response, therefore decreasing the incidence of graft rejection and damage. Immunosuppressive agents commonly used include Cyclosporin, Tacrolimus, Mycophenolate Mofetil and Azathioprine. These drugs act on the body's many different immune response pathways, preventing the physiological responses that cause rejection.(4)

There are three types of rejection that can occur following solid organ transplant.

1. *Hyperacute rejection.* This happens immediately after the organ is transplanted, the organ necroses and then fails.
2. *Acute rejection*. This occurs within days to months and is a hypersensitivity reaction. Reversal of acute rejection is possible with timely and appropriate treatment.
3. *Chronic rejection.* This occurs beyond six months post transplant and the phenomenon is not fully understood. Chronic rejection can lead to graft failure over time.

Treatment of rejection includes increasing the triple drug immunosuppressive therapy regime and the administration of intravenous high dose steroids which are given over a number of days.

- **HYPERTENSION & LIPIDEMIA**

Pre-existing cardiovascular risk factors may affect post transplant outcome, and should be managed appropriately. Risk factors such as hypertension and hyperlipidemia may occur post transplant, as side effects of the drug therapies required to prevent rejection. Regular screening for these risk factors is crucial post transplant, and early intervention is recommended.

- **DIABETES**

Diabetes is well recognised as a complication of organ transplantation, with incidence being reported as high as 53% in some centres. (8) While there are many risk factors for the development of new onset diabetes post transplant, immunosuppressive therapies are thought to play a significant role in inducing hyperglycemia.(8)

- **RENAL DISFUNCTION**

The onset of renal dysfunction following organ transplantation is a significant concern both in the early postoperative phase (acute renal failure) and to long term survival outcomes (chronic renal failure). In particular, the incidence of chronic renal impairment has been reported as high as 48% in cardiac transplant recipients three years or more post transplant. (9) Pre transplant risk factors for post transplant renal impairment must be carefully explored and managed during the transplant assessment phase. Calcineurin inhibitors such as cyclosporin and tacrolimus are thought to play a role in renal impairment together with other additive nephrotoxic agents such as anti-viral or anti-fungal agents.

- **BONE DISEASE**

Osteoperosis is another widely recognised potential complication of transplantation. Contributing factors to post transplant bone disease include the use of immunosuppressive agents, particularly glucocorticoids. Management of post transplant bone disease involves regular bone mineral densitometry assessment, administration of anti-resorptive agents such as calcitriol or bisphosphonates, and the maintainance of good nutrition, physical exercise and normal body weight. (6)

- **MALIGNANCY**

There is a proven higher incidence of malignancy in the post transplant population, compared to the general population, which may be considered as "the price of immunotherapy". (14) Lymphorolipherative malignancies and carcinomas of the skin are the most common forms of post transplant cancers, and treatment of malignancy in the immunosuppressed individual can be challenging. Early detection of malignancy is crucial, and patients should be educated regarding regular screening and preventative measures, particularly against skin cancers.

LIFESTYLE ISSUES FOR THE TRANSPLANT RECIPIENT

The goal of transplantation is to restore quality of life to the recipient. There are however some lifestyle changes that transplant recipients need to initiate to maximise their opportunities for good health. Transplant health professionals endeavour to educate and assist recipients with self care practices that help prevent the development of complications.

Transplant recipients are instructed how to monitor their temperature at home, and how to recognise signs of infection. They are often advised to have annual flu vaccinations, to maintain good personal hygiene and avoid close contact with people who are unwell. While transplant recipients are encouraged to return to work or study, and to lead "normal lives", they must be aware of the need to avoid situations that may put them at risk of acquiring an infection. They must also be aware of the risk of rejection occurring if they do not comply with their immunosuppressive medication, which must be taken for the rest of their life.

Recommendations regarding alcohol consumption after transplantation will vary depending on the type of transplant received and the medical condition of the patient. Liver transplant recipients are usually advised to avoid alcohol intake. All transplant recipients should be counselled regarding the risks of cigarette

smoking, particularly when in an immunocompromised state.

Successful pregnancies have been reported following all types of transplantation, however recipients must talk with their transplant team about the effects some medications may have on fertility and foetal development, and the impact pregnancy may have on their health.

It is important that recipients and their families are prepared psychologically for the transplant process. Waiting for a transplant can be a stressful and anxious time. After transplant, feelings can alternate between relief, hope and anticipation, through to frustration, helplessness and even anger if progress is hampered. Medication can have side effects that affect the recipient's mood, and they are encouraged to talk to their transplant team about any psychological issues that arise.

Organ and tissue donation is an anonymous, unconditional gift. Legislation is in place to ensure privacy, and prevents the passing of information that may reveal the identity of the donor and recipient to one another. Many transplant recipients feel a strong wish to express their thanks to the donor family for their "gift of life", and this can be done by means of anonymous correspondence, the process of which is facilitated by transplant coordinators. In a 1996 study of the families of organ and tissue donors, 90% said that receiving correspondence from their recipients was a comfort to them during their time of grief. (3)

CONCLUSION

Organ and tissue transplantation is now a routine medical treatment, and many lives have been saved and the quality of many others greatly improved through transplantation. Excellent survival rates have been achieved for the types of transplants mentioned earlier in this article, however new challenges in the field of transplantation include intestinal (small bowel) transplantation, and multi organ transplantation (e.g. simultaneous heart-lung-liver transplants for patients with cystic fibrosis).

Unfortunately people still die on transplant waiting lists when suitable donor organs do not become available in time. Unless the cadaveric organ donation rate in Australia increases, other options for the provision of transplantable organs and tissue must continue to be explored. These include the development of living related liver transplantation, living related lobar lung transplantation and the expansion of live kidney donor programmes. Research is underway in the area of xenotransplantation, and stem cell research is currently exploring the feasibility of "growing" organs and tissues for transplantation.
Ultimately the key to improving organ donation rates is through public awareness and dispelling the myths and uncertainty associated with the donation process. Information regarding organ donation (and how to register your intention to donate) can be obtained through the Australian Organ Donor Register.
http://www.hic.gov.au/yourhealth/our_services/aodr/faqs.htm

or from your state Organ Donation Agency.

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