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A Hundred Years after Einstein's Extraordinary Year

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Biography: Karina Kelly is the retiring President of the Royal Society of New South Wales; a position she has held for two years. It is a long standing tradition of the society that each retiring president gives a presidential address on a subject of their choice and this is one such. Karina has worked in television since 1981, first for the news department of SBS television, then Channel 7 news before joining ABC's TV science program Quantum in 1986. She left ABC in 1996 and spent five years at home with her children before re-joining ABC's Catalyst program in 2001. She has won numerous international awards for her television work, including a World Gold Medal at the New York Film and Television Festivals.

It's a hundred years since Albert Einstein had his 'extraordinary year', known by the Latin, 'Annus Mirabilis'. In 1905, he published several papers that would change the way we see the Universe forever. It was so remarkable that to mark the centenary of Einstein's work, 2005 is the World Year of Physics. The range of subject matter of these miraculous papers was staggeringly large. They would seed research in many areas of physics and help engender a wild enthusiasm for science throughout the twentieth century. Einstein himself became a hugely popular figure in his own lifetime — an exceptional achievement for a scientist in any age. It would be some time before Einstein, or anyone else, would come to understand just how remarkable his output that year was. But then, as Einstein knew only too well, time is a relative thing.

His first paper of 1905 was completed on 17th March and was in Einstein's own words, 'revolutionary'. In this paper, with the uncharismatic title 'On a Heuristic Viewpoint Concerning the Production and Transformation of Light', Einstein first put forward his theory that light was divided into 'quanta' which we now call photons. Newton had believed that light came in little bundles but by 1900 observations had shown that light behaved like a wave. By assuming that light *also* consisted of discrete packets, Einstein predicted the photoelectric effect, that changing the frequency of light would change the energy of electrons dislodged by it.

But this theory contradicted the wave theory of light which assumed that energy is infinitely divisible. This strange property of light to behave sometimes like a wave and sometimes like a particle, called wave-particle duality, formed the foundations for the development of quantum mechanics, which Einstein ironically never found satisfying. He proclaimed in a letter to Max Born in 1926 his conviction about how God would organise things. 'I, at any rate, am convinced that He does not throw dice.' This work would earn Einstein the 1921 Nobel Prize for Physics.

Just over a month later, Einstein finished his doctoral dissertation to the University of Zurich. On 30th April (after much delay) his 'New Determination of Molecular Dimensions' used the viscosity of a sugar solution to determine the size of sugar molecules. Curiously, this is Einstein's most cited work from 1905.

Then, on May 11th, the *Annalen der Physik* received another paper from Einstein. This was

his 'Brownian Motion' paper where he theorises that small particles suspended in water should show a random movement under the microscope caused by the kinetic energy of heat. If this is observed, Einstein predicted, it would also provide evidence of the existence of atoms.

As if this all wasn't enough, in June the *Annalen* received another paper from the prolific young Einstein; 'On the Electrodynamics of Moving Bodies' (or in German 'Zur Elektrodynamik bewegter Körper'). This paper introduced what came to be known as the *special theory of relativity* which combined time, space, mass and energy. It challenged the ideas that time and size are immutable and was received with not just scepticism but ridicule.

It was to captivate the science world and the broader community for the rest of the century.

Then, on 27$^{\text{th}}$ of September, Einstein produced his last remarkable paper for 1905.

Called 'Does the Inertia of a Body Depend Upon Its Energy Content?', it deduced one more aspect of his relativity theory. This was his famous equation $E = mc^2$. But if you read the original paper that equation is nowhere to be seen.

What he writes is 'If a body gives off the energy L in the form of radiation, its mass diminishes by L/V^2.' So there you have it. The $E = mc^2$ paper doesn't contain the famous formula.

In fact it would be written as $m = L/V^2$ if you followed Einstein's notation. V was the label he gave the speed of light in 1905. And $m = L/V^2$ is simply not as delightful as $E = mc^2$ as I'm sure you'll agree.

I hope I haven't ruined your day by telling you that. Anyway no matter how it was written, this was the remarkable equation which demonstrated that matter could be converted into energy and energy could be converted into matter. Even more remarkable was the huge amount of energy (mostly in the form of light and heat) that could be derived from a very small amount of matter. It wasn't until the 1930's that people made the connection that this theory could help to make one hell of a bomb.

I'm not sure what it says about humanity that we managed to turn the Equation into a real live bomb in a matter of decades but pursuing the great questions of what the universe is made of and how it works didn't get quite the same financial or political support. Perhaps Einstein himself could shed some light on this. This statement is attributed to him.

'Only two things are infinite; the Universe and human stupidity and I am not sure about the former.'

In Douglas Adams' *Hitchhiker's Guide to the Galaxy*, (soon to be a minor motion picture) the computer 'Deep Thought' took seven and a half million years to come up with the answer 'to the great question of Life, the Universe and Everything'. The answer, of course, was 42. From the late 1970's, we had our own ambitious 'Deep Thought' experiment. To build the grandly named Superconducting Supercollider even more grandly known as 'the window on creation' by enthusiasts. It was to be built at Waxahachie near Dallas, Texas.

It was hoped that by smashing protons together at an energy of 40 trillion electron volts, it would help us understand if particles are really vibrating membranes which exist in more dimensions than we may care to contemplate. It might also have detected a particle called the Higgs boson, which sounds like something that belongs in the *Hitchhiker's Guide*, but is very important to physicists because according to the Standard Model of Particle Physics it should exist.

All exciting stuff, but unfortunately with US$2 billion spent and a very large hole in Texas already dug, the US Congress cancelled the project in 1993. Their reasoning was that the eventual price tag of $12 billion dollars was too much to spend to find out more about the Universe. It would have provided 7,000 jobs, more than a hundred US universities wanted to be part of it, and 23,000 students had enrolled in courses that involved the eagerly awaited Superconducting Supercollider.

For a long time, the $2 billion hole did nothing more than store a lot of styrofoam cups but according to BBC online, the site is now being used for anti-terrorism firearm training.

There's no doubt that $12 billion is a lot to spend on a large physics experiment. But let's compare it with the cost to the United States of its war in Iraq. A helpful website *http://www.costofwar.com* will update you at any time.

It was just over 160 billion $US last time I looked (figures the website claims are based on Congressional appropriations) It points out that this sum is enough to fully fund a global anti-hunger campaign for 6 years, or a worldwide AIDS plan for 16 years, or immunise every child in the world for 53 years.

There is no doubt there's money to be spent. It's simply a matter of what our fearless leaders want to spend it on. Obviously, spending it on 'Life the Universe and Everything' is not high on the list of priorities.

We have made the most miraculous advances in technology in the last hundred years. We fly as frequently as if we were catching buses and use high speed cable internet to resolve disagreements at the dinner table. We 'zap' our processed foods in microwave ovens and send pictures of ourselves on videophones. Yet we seem to have advanced very little, philosophically. Some might argue that we have regressed. I made a program about Ageing some years ago, and in the course of filming, spoke to a lot of people in their eighties, nineties and one delightful woman of 105. What many of them noted to me was that these days, everyone was obsessed about money, worried about money, thought money was the only important thing. Needless to say, it was an observation made with some regret.

We have an obsession with wealth creation. We have come to believe that it is what we have all been put on earth to achieve. When the greatest minds of the twenty-third century, or the twenty-fifth, look back on us, will they praise us for our remarkable ability to create wealth by developing five hundred different models of mobile phone or damn us for our simplistic belief that as long as we have 'a beautiful set of numbers' things will be right with the world.

As Einstein said: 'We act as though comfort and luxury were the chief requirements of life, when all we need to make us happy is something to be enthusiastic about.'

It's a strange thing that we have all grown to equate everything to money as I have done just a few minutes ago in discussing the cost of the Superconducting Supercollider. We all know that the cost of the Iraq war is much more than the dollar number anyone can come up with. More than 15 hundred allied troops and possibly ten times that number of Iraqis have died and many many more have been injured. Their families will live with the consequences of the war for the rest of their lives. Some of their children will carry the trauma to the next generation. Why do we feel we must put human costs into dollars?

It is the influence and power of science which has contributed to people wanting to quantify everything. If you can measure something, you can discuss it dispassionately and objectively. It's an attempt to remove emotion and bias from decision-making. Now, if you put a price on everything, you can start to compare dissimilar things. Like the cost of the war in Iraq and a World Aids prevention campaign.

The problem is we haven't been very diligent with the calculations. Especially when it comes to things that are difficult to quantify like the price the environment is paying to make some of us rich. If polluters were presented with an accurate clean-up bill, their fabulous profits may well be turned into dramatic losses. The trouble has been that we haven't been able to work such complicated things out. But with everburgeoning computer power and increasing understanding of complex systems, we will in future be able to make these calculations and as we do, I optimistically predict there will be increasing political pressure for these extra costs to be added to our business balance sheets.

Of course not everything can be quantified in this way. Some things simply have value to our souls.

Einstein is quoted by famous physicist, Max Born as saying 'It would be possible to describe everything scientifically, but it would make no sense; it would be without meaning, as if you described a Beethoven symphony as a variation of wave pressure.' (Born 1966). (As an aside ... what famous Australian is related to Max Born? Answer: Olivia Newton-John. Her mother was Max Born's daughter.)

PSYCHOPATHS

I've just been reading a book written by John Clarke. Not the Comedian but a Sydney Psychologist.

The book's called 'Working with Monsters' (Clarke 2005) and it's about workplace psychopaths whom Clarke claims are much more numerous than the serial murder type who end up in the papers and on the television news. In fact he says that one in a hundred people might fall into this category. (Incidentally, twice as many of them are men as women.) The definition of such a person (sometimes also called a 'sociopath') is that they have no conscience or remorse, no empathy for other people whom they love to dominate. They are prepared to go to almost any lengths to get what they want, and their goals are short-term. They don't have the same reservations as most people about the risk of being caught for doing the wrong thing. These are not people any of us would like to work alongside.

Now think about how the workplace has changed in the last few decades. There is much less security, we work longer hours, there's less loyalty expressed between employer and employee. The only thing that matters is to cut costs and increase efficiency. Has this environment provided fertile ground for the workplace psychopath?

Many employers, employ people for nine months of the year. They lay them off for three months over Christmas so they don't become permanent employees with all the benefits to the employee (and costs to the employer) that would entail. If companies and large organisations only care about profits or cost-cutting and not the welfare of their workforce, they create a culture where psychopaths, who are prepared to get a result without worrying about detrimental impacts on employees, can prosper. In fact, one of the studies Clarke cites in the book is the different ways three groups of people respond to a test. The three groups were: normal (non criminal, non psychopaths), criminal (non psychopaths) and diagnosed psychopaths.

There were three ways to train the subjects to do something.
1. physical punishment (an electric shock) — you have to ask yourself about the psychopathic tendencies of the psychologists, but that's another matter
2. social punishment (the tester saying 'wrong')
3. loss of money (taking money away from the subject that they had earned for correct answers they'd given previously).

The interesting result of these tests was that normal people could learn from all three forms of punishment - the physical, social and monetary.

The criminals who weren't psychopaths could learn from two forms of punishment the physical and the monetary but didn't seem to respond much to the social punishment; being told that what they were doing was wrong.

And the psychopaths learned only one way. The only thing that taught them a lesson was taking the money away. Even the physical pain of an electric shock didn't help them to change their ways.

Think about that. Now imagine we take that lesson and apply it to society rather than individuals. What I'm asking is how does modern western society 'learn' to do things or not do them? Do we respond to 'social' punishment when we know something is 'wrong'? Have we responded to the AIDS epidemic in Africa where more than 25 million people are now infected, where 3.1 million new infections occurred in 2004 and there were 2.3 million deaths in the

last year? (Note that the new infections outnumber the deaths rather ominously indicating that things are only going to get worse.) Have we recognised that this is intolerable and we must act? Have we responded to the growing gap between rich and poor between and within countries and tried to stop it?

I hope you'll allow me a digression here to explore that gap.

These figures are for the United States (from their Census Bureau) and when it comes to income distribution, it seems that 1968 was the 'Annus Mirabilis'. This is the year when the gap between rich and poor was smallest. The bottom 20% of wage-earners in 1967 earned $7,419 per annum and the top 20% earned $81,883. But by 2002, thirty five years later (more than a generation) the numbers for the bottom 20% have not increased much at all. The bottom 20% of families are earning $9,990 while the top 20% are earning $143,743. What that means is that poor family incomes have increased by just under 35% in the last thirty five years. But rich families have increased their income by more than twice that: They are better off by more than 75%.

Now in researching this subject I came across the arcane world of income inequality calculation.

One paper talked about the 'gaussian kernel density function for the worldwide distribution of income.'

There are various different systems for calculating income inequality. There's the mean logarithmic deviation, the Theil index, the variance of log-income, two Atkinsons indexes, the coefficient of variation and the Gini coefficient. (I'm not making this up.) The most popular seems to be the Gini coefficient which can be written as:

$$G = |\sum_{k=0}^{k=n-1} (X_{k+1} - X_k)(Y_{k+1} + Y_k)|$$

where G = the Gini coefficient; X = the cumulated proportion of the population variable and Y = the cumulated proportion of the income variable.

However complicated this may look to the non-statisticians among us, the concept is fairly simple.

When the Gini ratio is low this means there's less of a difference between the rich and the poor. When the Gini ratio is high, it means there's more of a gap between rich and poor. A graph of this Gini ratio for the United States shows that inequality has been on the rise since the late 1960's. But according to Jack Rasmus, who is chair of the San Francisco Writers' Union (Rasmus 2005), the shift has been dramatically with the very richest in society. He claims that 90% of America's households have had a 15% drop in the share of America's income since the 1970's, and that only a few percent have had dramatic increases. The top-earning one percent of America's households, according to Rasmus have had a 47% increase in their share.

Here in Australia, (Leigh 2004) this ANU study shows the Gini index rising more sharply here since the early 1990's than in the USA and the UK. That means the gap between rich and poor in the last decade has widened more rapidly in Australia than it has in the US and UK.

The argument about the gap between rich and poor countries is a little more complex. The figures are skewed rather dramatically by the massive industrial revolution underway in China. The huge economic changes taking place in China in the last decade or so have turned this trend around worldwide. I was surprised to learn that on 2003 figures (*http://www.infoplease.com*), the GDP per capita in China is $5,000 US. And that's a population of well over 1.3 billion people. The economy is now worth $6.5 trillion US, which makes it twice as large as Japan's economy and more than half the size of the United States'. So the next decade will be very interesting.

The Chinese curse 'may you live in interesting times' could be very apt, although the phrase has Chinese scholars puzzled. They believe the source to be American.

Certainly, US President, John F. Kennedy used it in a speech in Cape Town in 1966. The Chinese think it might be a miss-translation of the Chinese proverb 'It's better to be a dog in a peaceful time that be a man in a chaotic period.' But that doesn't have the same ring does it?

But back to rich and poor countries. While China is so big that what's happening there can skew the figures, I note that the poorest countries in the world, have a per capita Gross Domestic Product of only US$500 to $700 a year. These countries are East Timor, Somalia, Sierra Leone, Tanzania, Malawi, Afghanistan and Ethiopia. The richest countries such as the USA, Norway, Switzerland, Denmark, Canada and Australia have per capita GDP of around $30,000 US. That's 40 to 60 times the income per person of the poorest countries. And things are set to get worse. The inflation rates of the poor countries are on average five times that of the rich ones. And that means money in poor countries won't go as far next year as it did this year.

Now that was a rather long digression, I'll admit. The question I asked before was: Have we responded to the growing gap between rich and poor and tried to stop it? I think the answer is a resounding NO. We do not seem to be able to respond to something just because someone reminds us that it is wrong.

What about physical punishment? (You'll recall that in the tests there were social, physical and monetary punishments) Let's think about the sorts of physical punishment we are enduring?

One to two billion people on earth are now malnourished — more than ever in history just as obesity is becoming a major health problem in the West. We are salting up our land and using up our water without thought of where it will come from in the future. We are extinguishing species before they are discovered (choose a number here between 500 total and 27,000 a year) and chopping down 20 million hectares of forests.

And then there's global warming — the most powerful country on earth doesn't think it's worth signing the Kyoto Agreement in spite of the now alarming news that the global warming we have so far experienced of 0.6 of a degree may have been seriously masked by the effect of 'global dimming' caused by the unhealthy particulates traditionally produced with the burning of fossil fuels. The theory is that as we clean up our use of fossil fuels and reduce particulates, a much more dramatic warming will occur bringing with it extreme and unpredictable weather patterns which will be very unpleasant to live with.

And just last week came a massive report card. Called the 'Millennium Ecosystem Assessment' it was commissioned by the United Nations in 2000 to look at the future of the world's natural assets and human well-being. This is not the ramblings of a band of lefty tree huggers. It involved the work of 1,360 experts from 95 countries and has been scrutinized by governments and independent scientists. It's basically an audit of our natural assets and what's happened to them in the last fifty years or so. Here's one of the sober statements from the board.

'At the heart of this assessment is a stark warning. Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted.'

Here are some of the numbers.

§ Water withdrawals from rivers and lakes for irrigation, household and industrial use doubled in the last 40 years.

§ In some regions such as the Middle East and North Africa, humans use 120% of renewable water supplies (due to the reliance on groundwater that is not recharged).

§ More land was converted to cropland since 1945 than in the eighteenth and nineteenth centuries combined, and now approximately one quarter (24%) of Earth's terrestrial surface has been transformed to cultivated systems.

§ Since 1980 approximately 35% of mangroves have been lost, while 20% of the world's coral reefs have been destroyed and a further 20% badly degraded or destroyed.

§ At least one quarter of marine fish stocks are overharvested.

§ In some areas, the total weight of fish available to be captured is less than a hundredth of that caught before the onset of industrial fishing.

The authors include Lord Robert May, (a recipient of the Royal Society of New South Wales' Edgeworth David Medal) formerly a professor of Physics at the University of Sydney who went on to work on chaos theory and ecosystems in the Department of Zoology at the University of Oxford, then became Chief Scientist in Britain and is now President of the Royal Society of London.

Here's what the authors say.

'Although evidence remains incomplete, there is enough for the experts to warn that the ongoing degradation ... is increasing the likelihood of potentially abrupt changes that will seriously affects human well-being. This includes the emergence of new diseases, sudden changes in water quality, creation of "dead zones" along the coasts, the collapse of fisheries, and shifts in regional climate.' (Millenium 2005).

The future sounds pretty painful to me unless we can turn these trends around. But so far, we don't seem to be moved by the threat of this kind of physical punishment.

That just leaves us with the money. It is the one thing which seems to sway decisions in our modern world. Decisions are regularly made in response to the threat of the money being taken away.

Now back to our psychopaths. Apart from not having a conscience, psychopaths also have an overly grand sense of themselves and their own abilities and their most well known characteristic is that they get pleasure from the pain and suffering they cause.

So, if I apply the criteria of the psychologists to modern society, I'm afraid this amateur psychologist, must diagnose western society to be psychopathic. Where are we getting pleasure from pain? On just about every reality television program you might care to watch. They are all based on ritual humiliation. And we don't seem to be able to get enough of them.

So how does a whole society get psychiatric help? That's a hard one. Call me incurably optimistic if you like, but I'm sure it's possible. One of modern society's most powerful tools is science. But we must direct this powerful tool at the appropriate tasks. That is our challenge. Science needs to be done to solve the important problems we face. If we simply harness it for profit creation we are not using it properly. It's like using your only horse to run in the Melbourne cup, instead of getting it to pull a plough. It might have a chance of making a lot of money, but you could starve to death in the meantime.

So how are we using science in Australia? Let's take a look at trends in where the money's going. These figures come from the Federal Government's Department of Education, Science and Training, 2004. First the good news.

We are spending a larger percentage of our Gross Domestic Product on research than we used to. This is good. In 1978-9 it was 0.93% of GDP and in 2002–3 it was 1.62%. That's a 74% increase.

But here's the bad news. It's less than most other countries are spending. Australia is near the bottom on 1.62% of Gross Domestic Product. Sweden is at the top with 4.27, the US is on 2.67, OECD average is 2.26 and the EU15[1] is on 1.93. So we are not matching other advanced countries in putting money into scientific research. (By a back of the envelope calculation, Australians together would need to spend another five and a half billion dollars on research to reach the per-capita level of the United States)

[1]The EU15 is the existing 15 European Union countries

Now let's look at the breakdown of where the money comes from and where it goes. If we look at who's doing the research between 1978/9 to 2002/3 we find that overall higher education is pretty constant over the period at about 30% (it's dropped nearly 3% as a percentage but it's higher than it was in the early 90's). The amount of research being done by the government sector, that's the CSIRO and other dedicated government research bodies, has had a remarkable change from 44% in 1978/9 to 20.3% in 2002/3. That means that less than half the research, as a percentage of GDP, is being performed by the government research bodies compared with the late 70's.

The figures for the source of funds have changed correspondingly. Government has contributed a diminishing proportion of R&D funding, the percentage falling from 76.5% in 1978/79 to 44.4% in 2002/3. Business investment has increased over the same period from 20.6% to 46.4%

I was a little curious whether these figures of business spending on R&D included the tax concessions given to business by government for undertaking the research. These concessions are 125% for research undertaken for under three years and sometimes as high as 175% for research continuing over three years. According to my telephone conversation with the compiler of the statistics (pers. com. Shi 2005) these concessions are not included as they are not direct expenditure but government income foregone. In fact the figure which doesn't make it into the above data is 375 million dollars for the 02/03 tax year. But even that is only the 'extra' 25% in the 125% tax deduction. So the total amount in tax deductions is five times this amount which is about 1.8 billion dollars. I mention this because if these numbers were taken into account, the data would show a substantially greater amount of government money going into funding research which is being carried out by business. In most countries, the tax rebate is 100% and not 125%, yet even with this incentive, Australian business is not investing in scientific research as much as business in other countries. The grand total for both business and government expenditure on research in 2002/3 was twelve and a quarter billion dollars which is just slightly less than Australians spend on gambling each year.

What all this means is that taxpayers are paying for more of the research than they know, but are not able to dictate or even lobby or protest about where the money's going. And this is a phenomenon that is taking place around the world. We are using the powerful tool of science to create wealth. And there's nothing wrong with that as long as it's not at the expense of more important missions. Unfortunately, I'm afraid it may well be.

Of the twelve and a quarter billion dollars we put into research 63% was aimed at economic development, compared to about 6 and a half percent each for non-oriented research (the purple wedge) and the environment (in green).

When you break down the economic development portion (a sum of nearly eight billion dollars) manufacturing took the lion's share of 38% and if you add in mineral resources, energy resources and energy supply research you're well over 50%.

Finally, while Australia's average expenditure on R&D is 1.62%, research data shows that New South Wales is lagging sadly behind. Only 1.41% of this state's GDP is being spent on research, well below South Australia, Tasmania and Victoria. (ACT is so high because it has more than its fair share of CSIRO laboratories and the ANU Institute of Advanced Studies.) This alone should stir us in the Royal Society of NSW to lobby the State Government for increased funding for scientific research in NSW and of course for funding for the Royal Society as ours is the only state Royal Society *not* receiving any government support.

THE ROYAL SOCIETY

I sometimes say that I would like the Royal Society of New South Wales to become so prestigious that it no longer wants me as a member (with apologies to Groucho Marx). But I have

been a member for a number of years and I'd like to take a short time to tell you about developments at the Society in recent times.

In July 2004 The Royal Society of New South Wales moved office. This has only happened a handful of times in the last hundred years. We are now well settled at 121 Darlington Rd, Darlington in a Victorian terrace owned by the University of Sydney. We are indebted to Vice Chancellor, Gavin Brown for his support in providing us with a new home. The University also regards us as part of the University Community, which means we can use its venues without being charged normal commercial rates.

Our lectures are now being attended by a respectable number of people and the numbers are on the increase. We are still not as successful in Sydney at attracting an audience as we are in the Southern Highlands branch of the Royal Society of New South Wales, but Sydney's gaining. Increasing numbers to lectures is a great achievement in Sydney where working hours are long and travel times to and from work are growing all the time. I have also noticed that members and friends are talking animatedly before and after lectures and more are enjoying dinner with the speaker later in the evening.

On December 4th 2004, all the State Royal Societies met for what we believe is the very first time. It was an historic occasion and came about with the encouragement of the Governor-General, Major General Michael Jeffery, who hosted a function for the attendees at Admiralty House in Kirribilli. It was inspiring and interesting to see the diversity of activities being undertaken by the different societies. Delegates described scientific expeditions, environmental conferences and a wide range of publications. We heard of member excursions to places of a scientific interest and contributions to the science policy debate. One of the matters discussed was whether we should resurrect the Royal Society of Australia, granted royal approval in 1931, as an umbrella organisation to help the Royal Societies on national matters.

There is much ahead to do. We need to attract funding to support our office, as the generous support of our benefactor, Clive Wilmot will come to an end at the end of this year. We need to attract a grant to work through the more than thirty boxes held by the State Library of NSW and to better document the history of the Society. But most importantly, we need to make sure that the Royal Society of New South Wales makes a substantial contribution to the intellectual life of NSW.

TIME

Now briefly back to time. Despite the promises of the 70's that we would have more leisure in the future, the truth is we don't. In fact we have so little time, working people can't do voluntary work, look after sick relatives, or get organised politically. We sleep shorter hours than previous generations and go around permanently sleep deprived in spite of warnings that this impairs our performance more than alcohol. Mobile phones and home computers mean we are 'on line' all the time, available at any hour. We fill our lives with chores and ephemera and impose the same regime on our children. Their time is so structured they need permission to sit and dream. I don't know what Einstein would have made of it. Not much I think. But here's his simple explanation of relativity.

'When a man sits with a pretty girl for an hour, it seems like a minute. But let him sit on a hot stove for a minute and it's longer than any hour. That's relativity.'

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