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ASSOCIATION FOR WOMEN IN THE SCIENCES

Encouraging women to use and develop their scientific abilities to achieve their full potential

Women in Science
A 2011 Snapshot

www.awis.org.nz






INTRODUCTION

This booklet contains a snapshot of Women in Science in New Zealand in 2011. It is not an in-depth analysis of trends, problems or achievements but is intended to provide the reader with a quick glance as to the current state-of-play. We have decided to track what is happening at each stage of a woman's life, from early childhood through to an established career track, to try and see what situations face today's women at all their different life stages.

We believe that it is important that women are represented in all areas of science, not only due to a fundamental belief in equality but also for the ultimate health of the nation as a whole. Evidence shows that diversity brings different sets of skills and solutions into an organisation or workplace. In tough economic times, such as those being faced around the world at the moment, doesn't it make sense to have the best brains on the job, regardless of gender, race, age or religion? The government continues to link possibilities in future economic growth and well-being to science and technological development. Therefore, we need talented people applying their skills to scientific problems. It is also true that women continue to be the primary caregivers for our younger generation, shouldn't someone charged with such an important task be well-educated and able to stimulate curiosity? Adequate access to education and science within that education is vital to ensure the long term health of society in New Zealand.

This work was undertaken by Dr Belinda Bray and Emma Timewell on behalf of the Association for Women in the Sciences (AWIS). Both Belinda and Emma are active within this organisation but also hold independent roles outside of AWIS. Belinda works for The University of Auckland as a lecturer in Science Communication (despite gaining her PhD in Toxicology) and is also the Women in Science Equity Officer for this organisation. Emma is the Senior Communications Advisor for Plant & Food Research, a field she moved into after her initial studies in Biological Sciences.

The authors would like to thank their respective employers for their help and support in developing this resource and also the Association for Women in the Sciences for providing financial backing.

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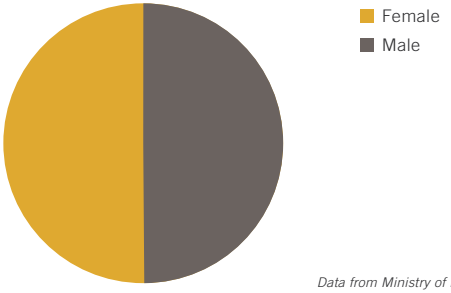
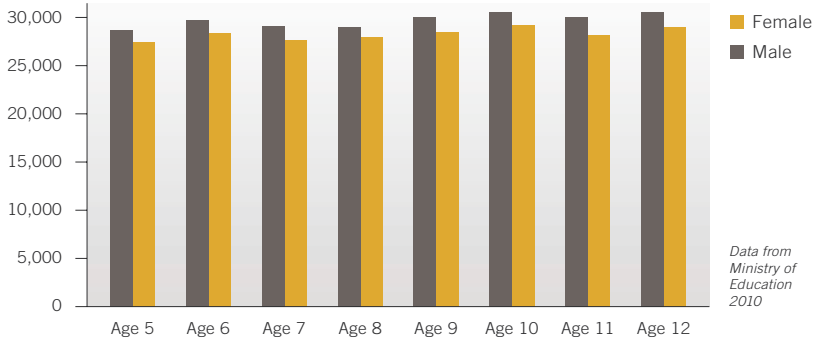
EARLY EDUCATION PARTICIPATION

Early childhood education participation



Data from Ministry of Education 2010

Participation in primary education by gender

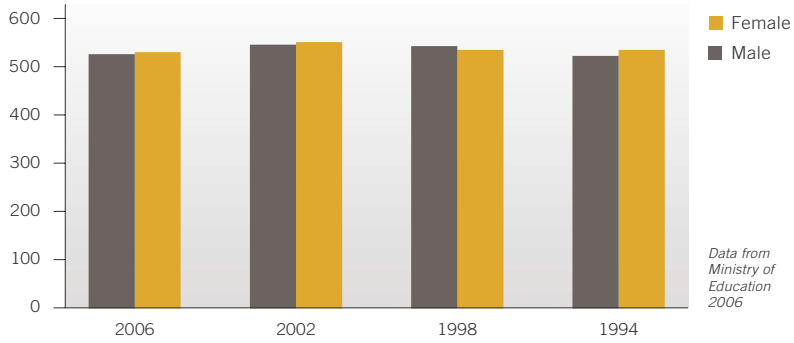


Data from Ministry of Education 2010

At the start of their life, male and female students are able to participate equally in education. Statistics show that women have equal, or nearly equal, representation across the early childhood and primary school systems.

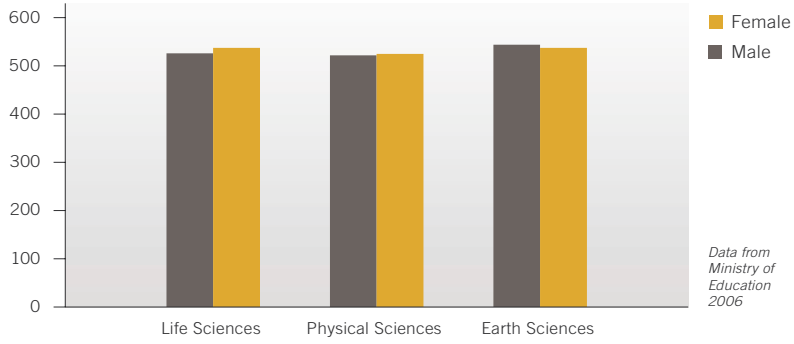
PRIMARY SCHOOL PARTICIPATION AND ACHIEVEMENT

Achievement of Year Five (9 year olds) in science



New Zealand students compare well internationally at the year five level (9 year olds). The Trends in International Maths and Science Study (TIMMS) compares science knowledge across 59 countries. New Zealand ranked 22nd overall and on average students were within the average range. At this level there is no difference in achievement between male and female students.

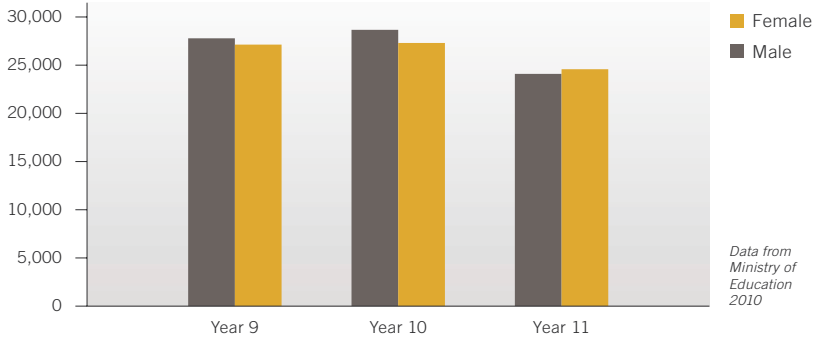
Achievement of Year Five students in different science domains



When comparing knowledge in three different science domains, Life Sciences, Physical Sciences and Earth Sciences, no gender differences appear. Male and female students at the year 5 level perform equally well in science across the curriculum.

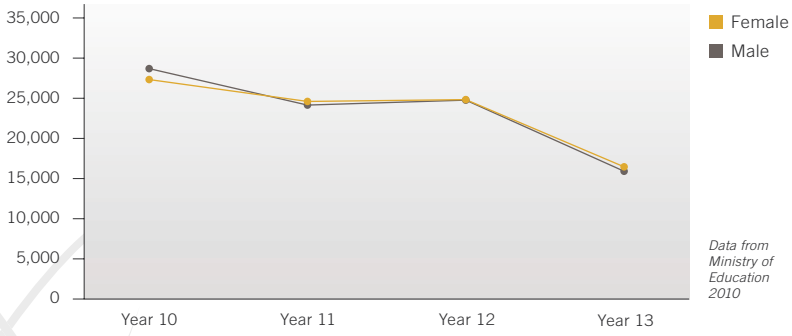
SECONDARY SCHOOL PARTICIPATION AND ACHIEVEMENT

Enrolment in science by gender at the beginning of secondary school

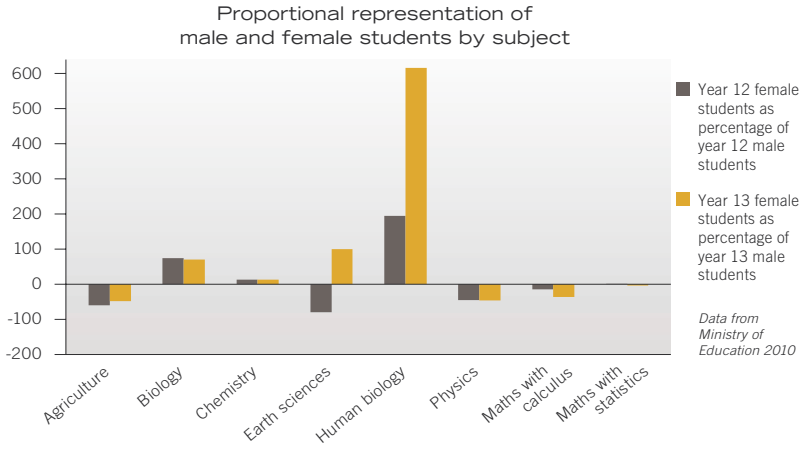


During the early years of secondary schooling the balance of genders is equal in science. This is not surprising as science is a compulsory part of the curriculum for all students at years 9 and 10. There is some degree of choice for schools at year 11 as to whether science remains a compulsory subject, most schools in New Zealand choose to either make science compulsory at year 11 or arrange their timetable to strongly encourage continued participation in science by all students.

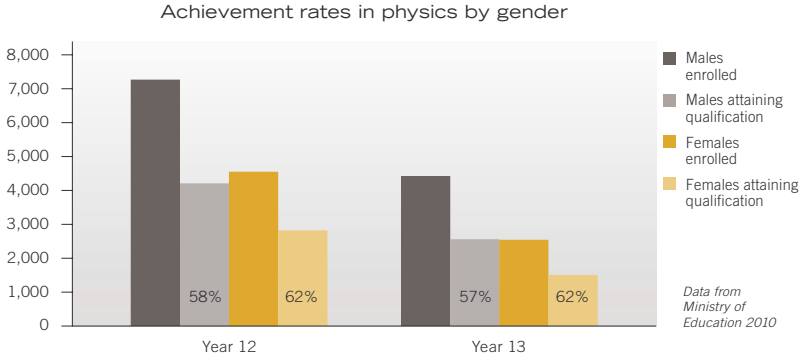
Total number of students progressing in science after Year 10



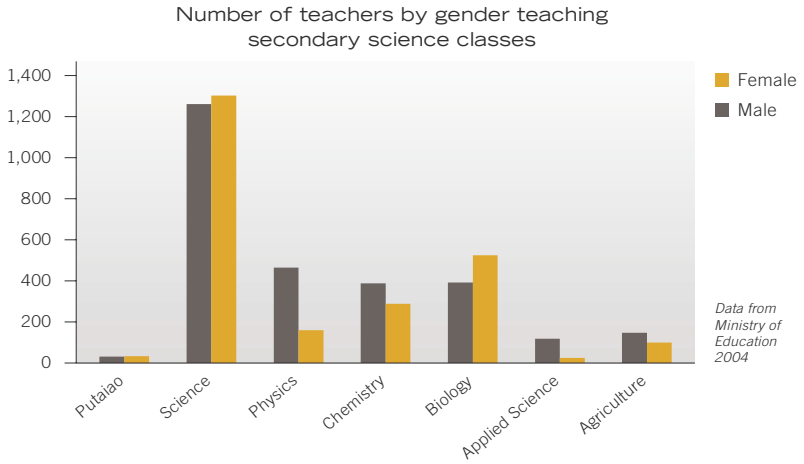
After year 11 the number of students choosing to take science subjects declines. However, the number of male and female students who continue to choose to enrol in at least one science subject is essentially equal.



At years 12 and 13 (the last years of secondary school) students are free to choose to study subjects within different science domains. It is at this level that a gender preference begins to emerge. Female students are over-represented in biology subjects (shown as bars above the horizontal axis) whereas male students are over-represented in physics and calculus (shown as bars below the horizontal axis). Interestingly, the preference for Earth Science appears to flip with more males preferring this subject in year 12 and more females preferring it in year 13.

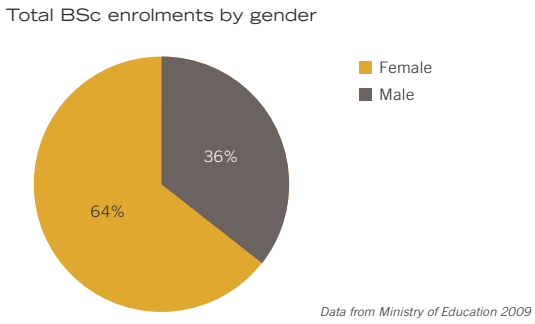


Despite fewer females choosing to study physics during years 12 and 13, those females that do study it, do well. Overall pass rates in NCEA physics are marginally higher for female students than for male students.

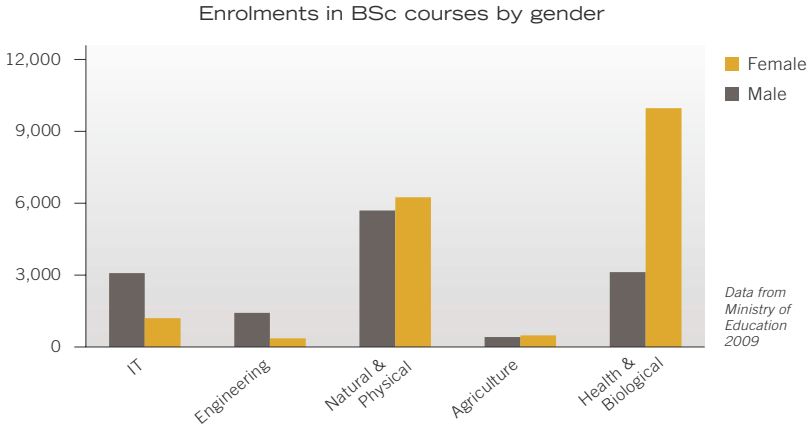


The differences in student preferences is echoed in teacher preferences. Overall there are equal numbers of male and females teachers of science at the secondary level. However, there are more male teachers in physics classrooms and slightly more female teachers in biology classrooms. At the lower levels, where science is taught as one subject rather than in separate domains, gender representation of teachers is equal (science bar on above graph).

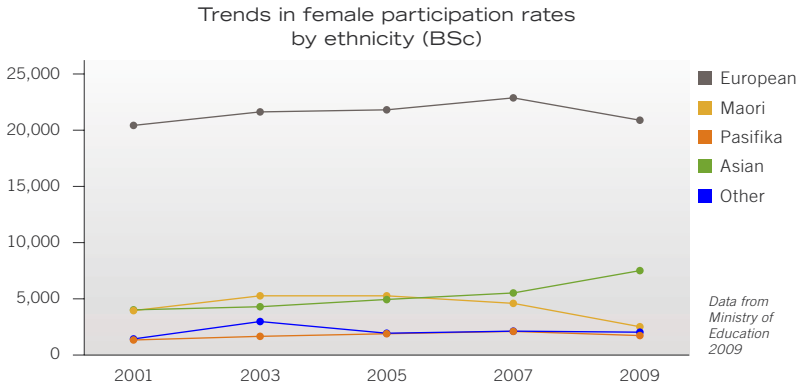
TERTIARY PARTICIPATION AND ACHIEVEMENT



After high school 80% of students who complete NCEA level 3 or higher progress to University. The representation of women in tertiary study is increasing every year and now females are over-represented overall in Bachelor of Science courses.



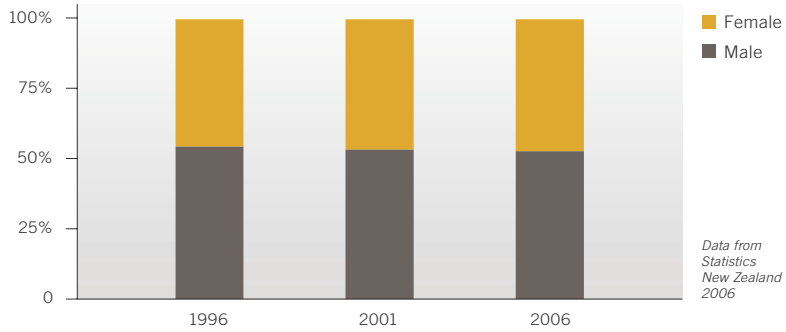
While the numbers of female students are now higher overall, the subject choices continue to reflect preferences developed during secondary school. Female students continue to preferentially study biology-based subjects and stay away from IT and engineering. Numbers in the natural and physical sciences are beginning to approach equal gender representation.



Tertiary science education is dominated by students who identify as being European or from European descent. Maori females represent approximately 7% of total BSc female enrolments (cf 14% of total NZ population). Pasifika females constitute approximately 4% of total female BSc enrolments (cf 6.9% of population).

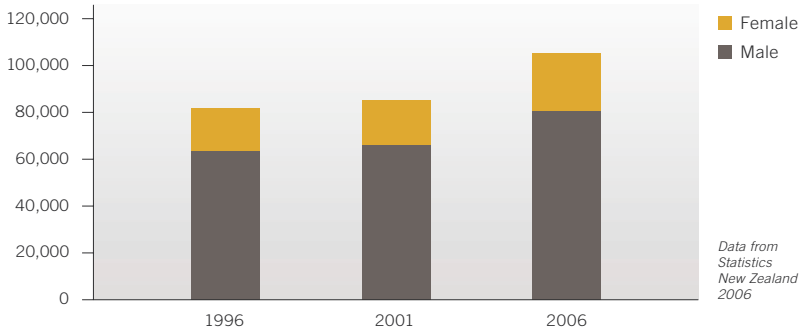
WORKING AND BEING IN THE WORKFORCE

Percentage of women and men in the scientific workforce since 1996



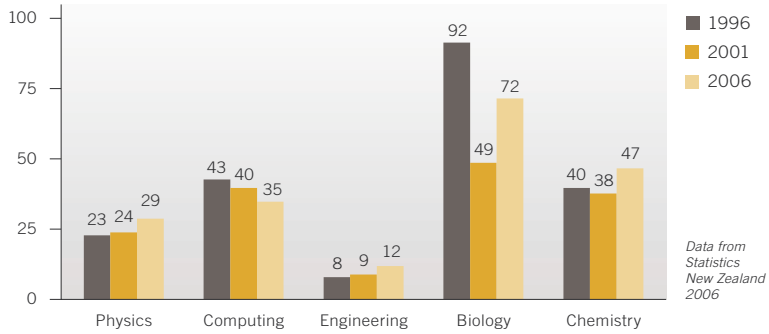
Since 1996 women have represented just under 50% of the total scientific workforce.

Numbers of women and men in the scientific workforce (excluding the medical and veterinary sectors)



However, when careers relating to medicine or veterinary medicine are removed from the analysis, the picture is quite different. This reflects the pattern that began in secondary school with women showing a strong preference towards the biological sciences.

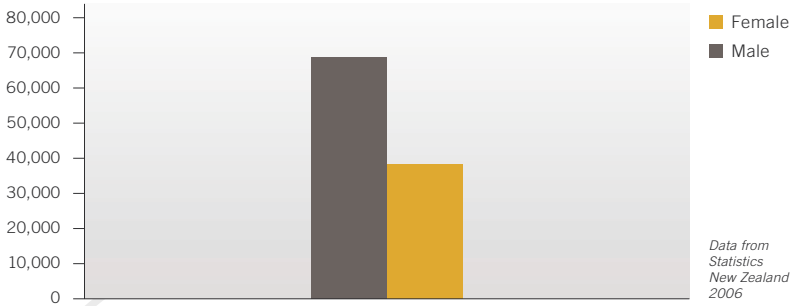
Percentage of women working in different science sectors



Data from Statistics New Zealand 2006

Indeed, men continue to dominate careers related to physics, computing and engineering. Women are gaining ground in chemistry related careers, coming very close to 50% representation in 2006 (most recent date for which data is available). On the other hand, computer science shows a downward trend over the 10 year period analysed. Biology related careers remain popular with women. The sharp decrease in 2001 is likely to be a statistical anomoly related to changes in self-reporting practices in this year.

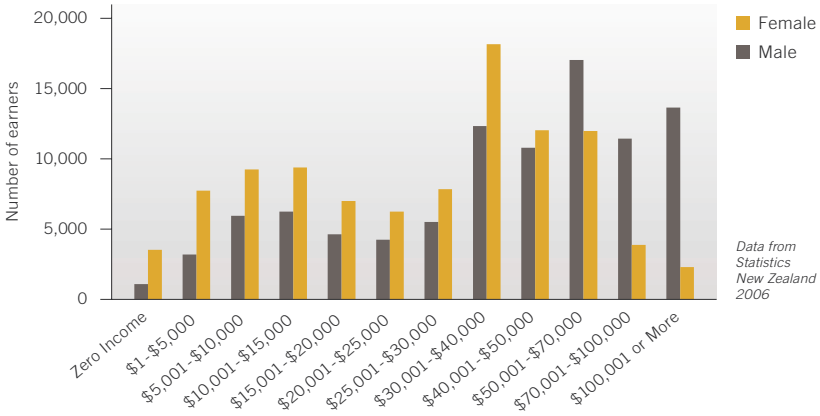
Average income for BSc graduates



Data from Statistics New Zealand 2006

When census data is cross-matched from highest degree obtained to current salary it is possible to compare salary rates for graduates with comparable degrees. This shows that women continue, on average, to earn less than men. This is despite having equivalent qualifications. However, this data will be highly influenced by both the type of work being undertaken and whether or not a woman has chosen to stop working to accommodate family responsibilties. It does not necessary indicate that women are being paid less for equivalent work.

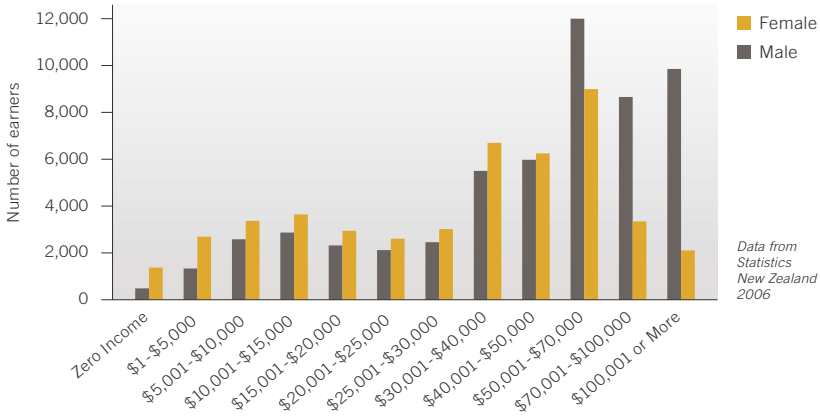
Income distribution for BSc graduates



Data from Statistics New Zealand 2006

When the numbers of male and female earners in each salary band is analysed it becomes obvious that women are over-represented in the lower sections (under $50,000pa) while men are over-represented in the higher sections (above $50,000pa). The number of female BSc holders who are not earning, either by choice or circumstance, is three-times the number of male non-earners. All workers on this scale hold a BSc degree.

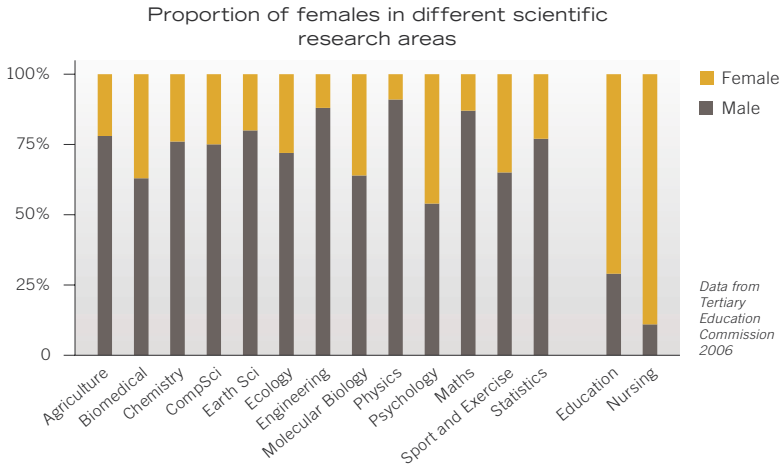
Income distribution for PhD graduates



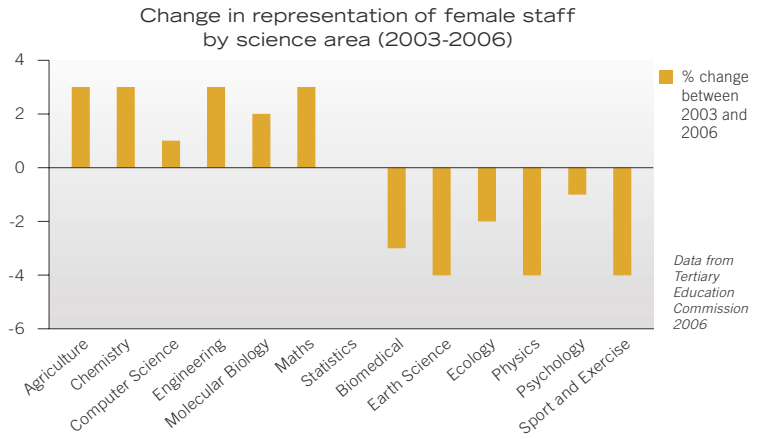
Data from Statistics New Zealand 2006

A similar trend is seen for graduates of advanced degrees (PhD), although the differences are less pronounced. Due to limitations with the data this information draws from all PhD graduates, not just science PhDs.

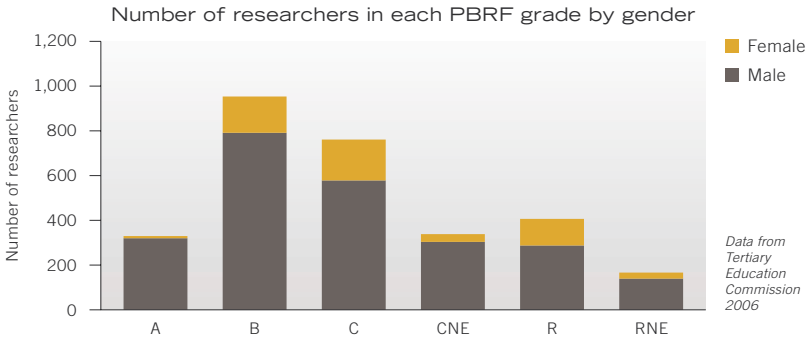
WOMEN IN RESEARCH CAREERS



In the 2006 PBRF research assessment exercise 41% of researchers overall who submitted a profile were female. Within science, women remained under-represented across all subject areas at all levels of the PBRF exercise. As can be seen in the above graph, the greatest proportion of female science researchers is in psychology and molecular biology. However, even in these fields they fail to reach 50% representation. In contrast, within the research fields of education and nursing, women are over-represented.



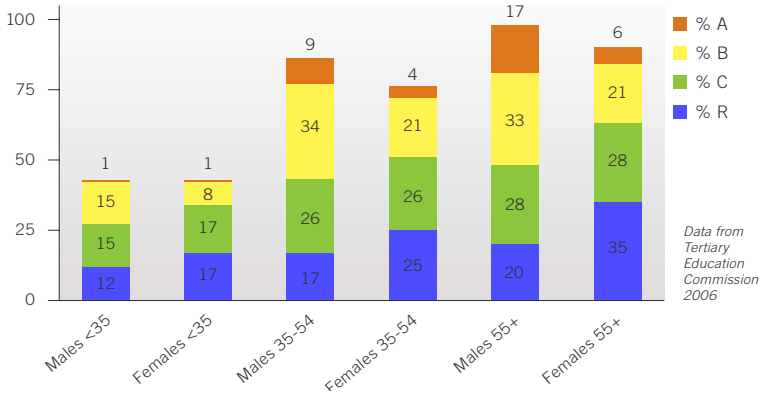
There has been some recruitment into areas of science that show historical patterns of under-representation. Between the 2003 and 2006 PBRF rounds, increased proportions of female staff were achieved in agriculture, chemistry, computer science, engineering and molecular biology. However, decreases in the proportion of female staff were seen in the biomedical sciences, earth sciences, ecology, physics, psychology and sport science.



Overall in the 2006 PBRF statistics there are less female researchers (42%) than male researchers and female researchers tended to be in the lower research categories. There are less women in the "A" research category with only 3% of all female researchers achieving this grade (10% of all male reseachers obtained an "A" PBRF grade). In contrast, 29% of female researchers were ranked "R" or research inactive, compared to 18% of male researchers.

(Note: NE stands for new and emerging, a sub-category introduced in 2006 for "C" or "R" researchers)

Percentage of researchers by gender achieving different PBRF grades



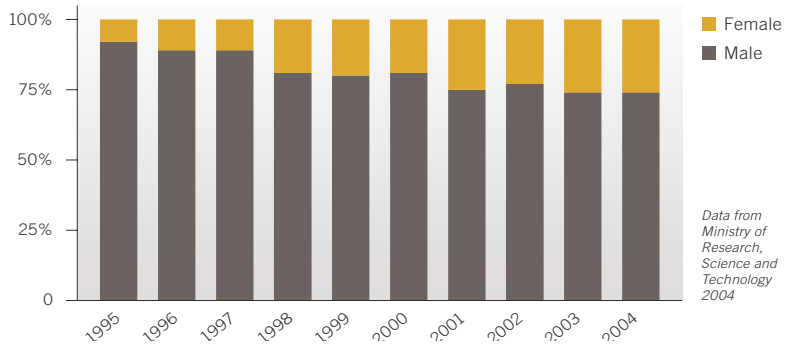
The PBRF grades are loosely associated with age, with less than 1% of <35 year researchers obtaining “A” ratings and approximately 80% of researchers <35 achiving “C”, “CNE”, “R” or “RNE” grades. However, when comparing achievement within age groups, women tend to be over-represented in the lower grades and under represented in the higher grades. This suggests that even when women are employed at a equivalent age and employment status to male counterparts, they achieve lower ratings.

6% of female researchers in the 55+ age group achieved an “A” rating as compared to 17% of male researchers.

Younger female researchers are more likely to be ranked as a “R” or a “C” (34% of all female researchers) as compared to younger males (27% of male researchers).

15% of male researchers under the age of 35 achieved a “B” rating but only 8% of female researchers were ranked “B” within this age group.

Proportion of female principal investigators on succesful Marsden Fund grants

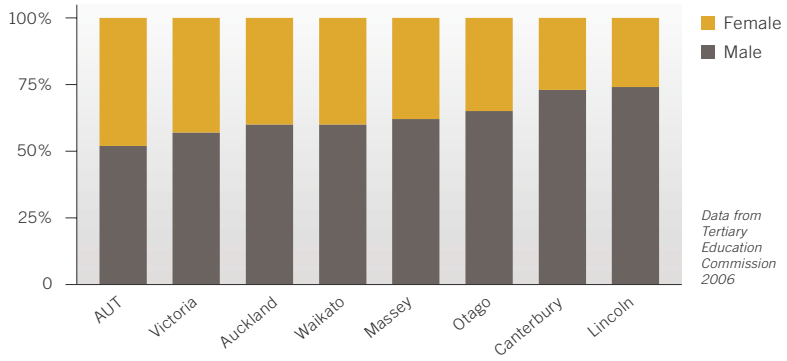


Data from Ministry of Research, Science and Technology 2004

Women continue to make up less than 30% of all successful applications to the Marsden Fund. This fund is one of the largest in New Zealand for basic (non-applied) research and success is widely associated with prestige within the research community.

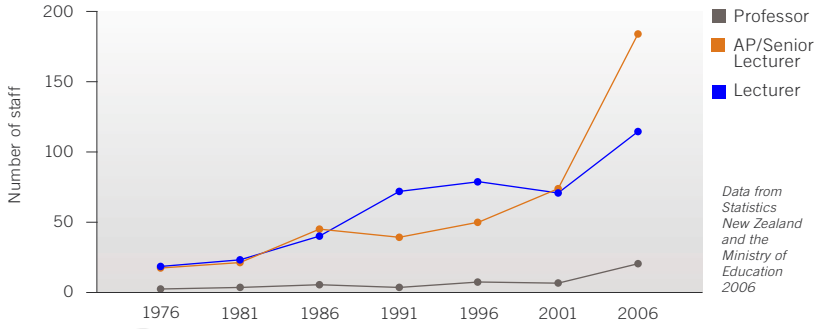
WOMEN WORKING IN UNIVERSITIES

Proportion of PBRF accountable staff by gender and University



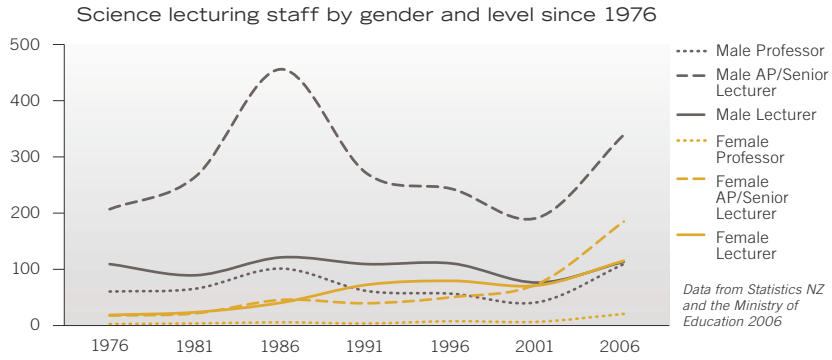
Women remain under-represented in research staff at all Universities in New Zealand except AUT (48% female research staff across all faculties). Canterbury and Lincoln Universities report less than 30% research staff.

Estimated numbers of female science lecturing staff since 1976

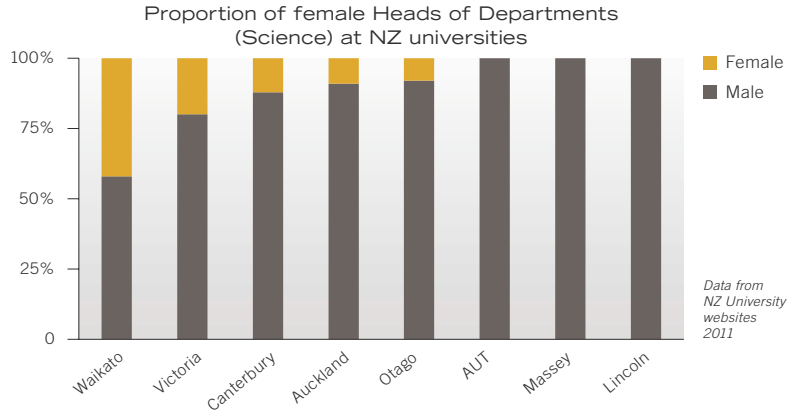


Note: While detailed numbers of female science staff are not available it is possible to estimate these from the total University staffing levels and the relative size of science faculties within universities. Since 1976 both enrolments and staffing of science faculties has hovered at around 17% of each university (averaged across all NZ institutions). Using published data of gender representation at each promotion level it is possible to analysis the trends of female staff levels in science faculties.

In general female representation is increasing. Recruitment to the level of professor remains low but a general upwards trend can be seen for the proportion of female science staff at the lecturer and associate professor (AP) / senior lecturer scale.

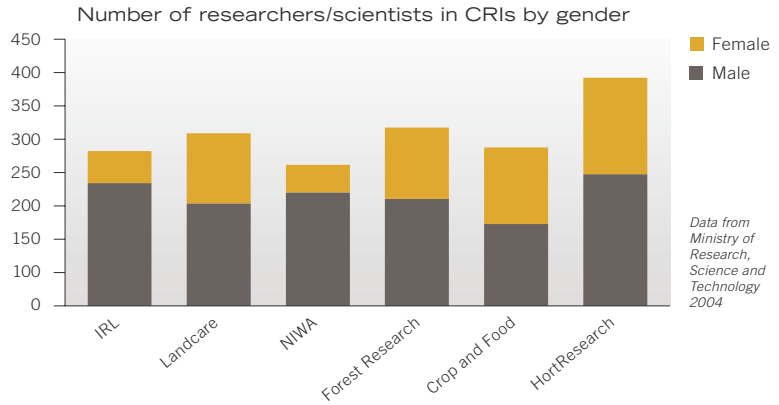


However, female science staff levels remain lower than male science staffing levels. In 2006 the numbers of female lecturing science staff approached equivalency with males. However, at all the higher levels of promotion, females remain under-represented.

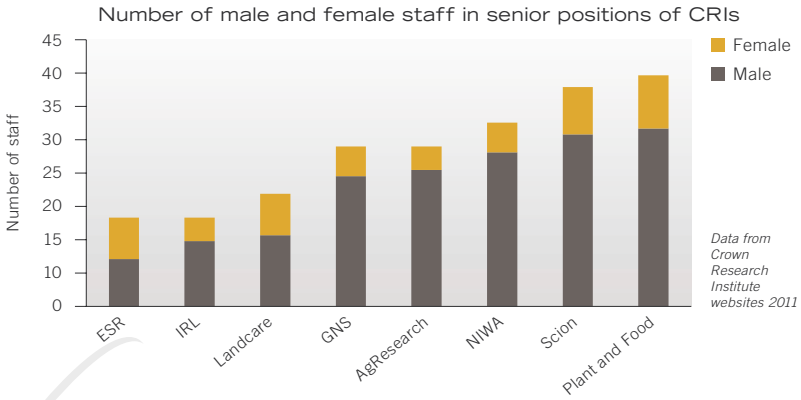


In line with the trend that female staff are under-represented in Universities at the highest levels, there are very few female Heads of Departments (HoDs) within science faculties across the country. Waikato comes the closest to 50% representation with 42% of their HoDs being female. AUT, Massey and Lincoln all record no female staff at the science HoD level.

WOMEN WORKING IN CROWN RESEARCH INSTITUTES

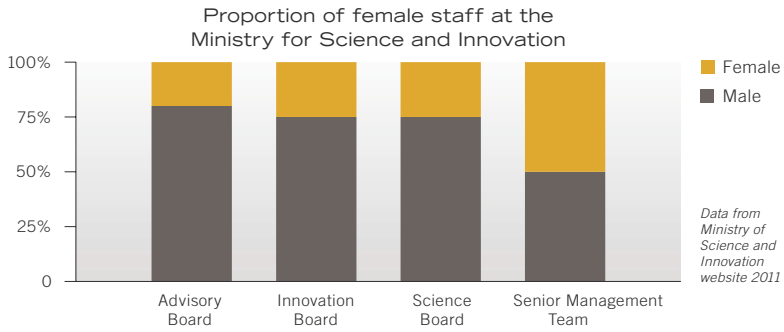


In 2004, 36% of staff employed by Crown Research Institutes were female. Proportionally more female staff were employed by Crop & Food Research and Landcare. Small numbers of female staff were employed by National Institute for Water and Atmospheric Research (NIWA) and Industrial Research Limited (IRL).



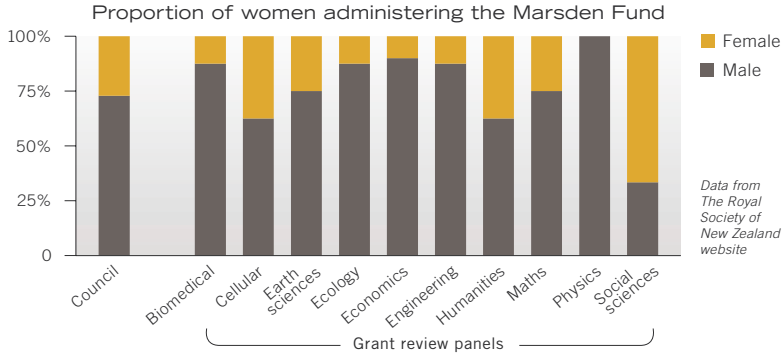
These are the combined totals of male and female staff from the Boards, Senior Management Teams and Executive Teams of the 8 Crown Research Institutes in 2011. It is clear that the proportion of senior female staff is remains well below 50% across all the institutes. Environmental Science and Research (ESR) comes closest to proporational representation with 7 women out of a total of 15 senior staff. Plant and Food records only 9 women in a management team of 39.

FEMALE REPRESENTATION AT THE LEVEL OF DECISION MAKING



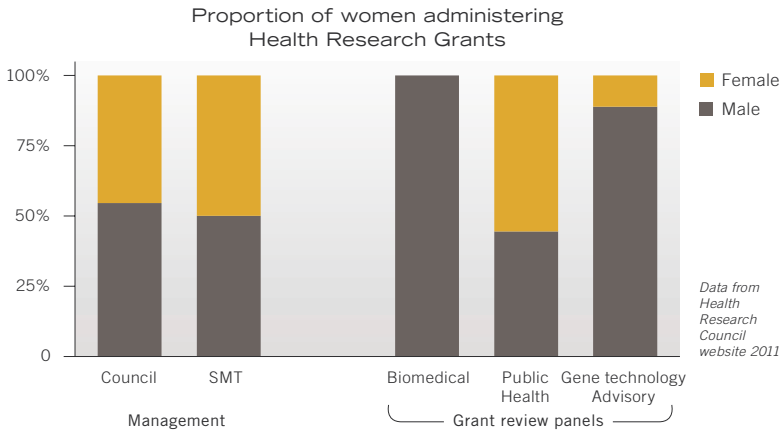
The newly established Ministry of Science and Innovation has 50% female representation on its senior management team but has less than 25% representation on the individual boards. The innovation board and the science board are responsible for making funding decisions regarding the government's investment into research and development.

Footnote: The Ministry of Science and Innovation (MSI) superseded the Ministry of Research, Science and Technology (MoRST) in 2011. It conducts work on behalf of the New Zealand Government in promoting and supporting science and technology. It has an oversight role in terms of management and funding for the eight Crown Research Institutes as well as managing $514 million worth of financial investment into research and development.



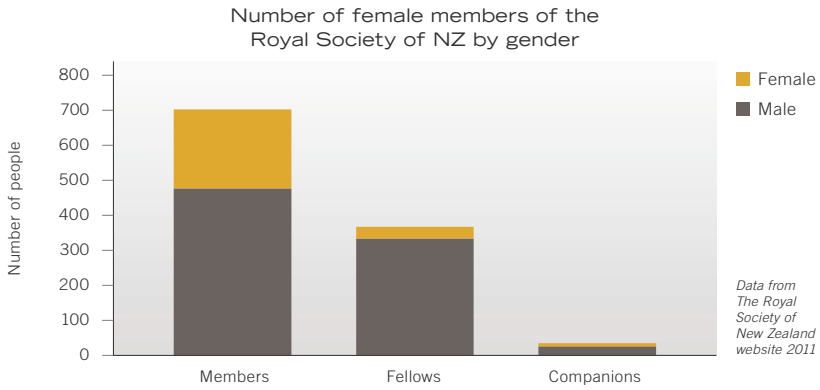
Only the social sciences panel of the Marsden fund achieves 50% female representation. None of the other 10 panels have gender equality. Physics is the least equitable with no female representatives currently sitting on this funding panel.

Footnote: The Marsden Fund allocates $60 million annually to fund research in New Zealand. This equates to approximately 7% of the total government spend on science.The Marsden Fund is part of the Ministry of Science and Innovation portfolio and is administered by The Royal Society of New Zealand.



Within the health sector the Health Research Council (HRC) is a major supporter of research initiatives. Across the management teams of the HRC the proportion of female representatives is equitable at 50%. However, on both the Biomedical and Gene Technology Advisory panels, representation for females is low (under 10%).

Footnote: The Health Research Council allocates $83 million annually to fund health research in New Zealand. The board of the HRC reports to the Ministry of Science and Innovation.



The Royal Society of New Zealand exists for the promotion and enhancement of science, technology and the humanities. There are three levels of membership. Basic membership (Members) is open to any person able and willing to subcribe. Fellowships are conferred by the society for achieving distinction in research or the advancement of science, technology or humanities. The title of Companion is conferred by the society for achieving a high level of eminence in the promotion or encouragement of science, technology or the humanities.

Within these categories 32% of Members are female; 9% of Fellows are female and 26% of Companions are female. This suggests that females still lag behind their male counterparts in achieving recognition within their chosen disciplines.

WOMEN WINNING RECOGNITION

Number of science female science prize recipients

Prize (broad area of science recognised)	Year of first award	Number of Female Winners	Number of Male Winners	Percentage of female winners
Hamilton Memorial Lecture Series (Outstanding beginner)	1934	8	50	16%
Hector Medal (Chemistry)	1915	4	98	4%
Hutton Medal (Earth, Planet and Animal)	1911	3	41	7%
Rutherford Discovery Fellowship	2010	2	8	20%
Marsden Medal (Lifetime achievement)	1997	2	14	14%
NZ Association of Scientists Research Medal (Outstanding research)	1997	2	14	14%
Leonard Cockayne Memorial Lecture (Botanical)	1965	1	15	7%
Prime Ministers Emerging Researcher Prize	2009	1	1	50%
TK Sidey Medal (Outstanding research)	1933	0	19	0%
Cooper Medal (Physics)	1958	0	21	0%
Thomson Medal (Leadership and contribution)	1985	0	16	0%
Rutherford Medal (Lifetime achievement)	1991	0	19	0%

Prize (broad area of science recognised)	Year of first award	Number of Female Winners	Number of Male Winners	Percentage of female winners
RJ Scott Medal (Engineering)	1997	0	8	0%
Sir Charles Hercus Medal (Molecular and BioSciences)	1997	0	8	0%
Shorland Medal (Major and continued contribution)	1999	0	12	0%
Pickering Medal (Technology)	2004	0	7	0%
Rutherford Foundation Distinguished Fellow Grant	2009	0	1	0%
The Prime Ministers Science Prize	2009	0	2	0%
Jones Medal (Maths)	2010	0	1	0%

Data from the following websites: The Royal Society; The New Zealand Association of Scientists and The Prime Ministers Science Prizes;

The above data is ordered by number of female winners (decreasing) then by the number of years that the award has been running (most recently instigated medals last).

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www.scientists.org.nz

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The Prime Minister's Science Prizes website
www.pmscienceprizes.org.nz

The Royal Society of New Zealand website
www.royalsociety.org.nz

NOTES

ASSOCIATION FOR WOMEN
IN THE SCIENCES

www.awis.org.nz