**Science Faculty**

**Transformation report and plan**

**March 2014**

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**CONTENTS: Page**

1. ***Introduction*** 1
2. ***Faculty Structure*** 2

3.1 Present Structure 2

2.2 Degrees Offered 2

Undergraduate 2

Postgraduate 3

Short Courses 3

2.3 Nature/Character of the Science Faculty 4

General 4

Undergraduate Degrees 4

Postgraduate Degrees 5

2.4 Core Values and Traditions 6

***3. Staff*** 9

3.1 Academic Staff

3.1.1 Present structure and history 9

Staff Turnover 13

Staff Qualifications 15

3.2 Support Staff 16

1. ***Undergraduate Education*** 18

4.1 Undergraduate Student Numbers and Demography 18

4.2 Undergraduate education 23

Access 23

Undergraduate success rates 23

Strategies to address changes in and differences in pass rates 29

Undergraduate success by race 29

Strategies to address differential pass rates 32

4.3 The Science extended studies programme (BScF) – success and failures 32

1. ***Research and Postgraduate Education*** 36

5.1 Research activity: present levels and history 36

Strategies to broaden the base of active researchers

in the Science Faculty 41

5.2 Postgraduate Numbers and throughput 41

5.3 Postgraduate demographics 44

5.4 Research Officers, Postdoctoral Fellows and Research Groups 45

1. **Community Engagement** 48

6.1 Community Engagement: present activity 47

1. **Conclusion** 50
2. **Introduction**

The report and plan focuses in five areas, being faculty structure; the staff (academic and support); undergraduate education, including aspects of teaching & learning; research and postgraduate education; and community engagement. In each section, the report component looks at present size and shape and how we have achieved this in the recent past, while the plan explores future goals and what we will do to achieve them. Where relevant the themes of access and success cut across the five focus areas.

This report does not focus just on numbers and percentages of staff and students in different demographic groups (although these are reported and emphasised) but includes elements that are less easily quantified. These include issues of access and success, culture and values.

The report builds on the first Science Faculty Equity and Transformation Report of 2011 and will serve as a baseline against which change can be measured and as a plan to guide development. It is likely that there will be gaps which can be filled in future reports and areas which require further thought. It is also likely that the report will include unnecessary detail which can be omitted from future reports.

Transformation addresses changes in shape, form, character and nature, and engagement in transformation requires reflection on our context. Our history has been shaped by our geographical, socio-economic, political and educational contexts and these will continue to interact to shape our future. We acknowledge that we are moving away from an apartheid past and accelerating change towards greater equity and sustainability. We are therefore encouraging a vision of, and action towards, changing the shape, form, character and nature of this faculty without affecting areas in which we excel.

This broad framing allows us to consider transformation imaginatively. If discrimination was a key characteristic of a pre-democratic past, what do we mean by inclusivity and how do we change so as to be more inclusive? What are the attributes of our society, and specifically our faculty that are exclusive, or less than inclusive, less than enabling and welcoming? We suggest that a long standing valuing of diversity in approach and practice provides our best basis from which to make inclusivity an actively practiced value in the faculty.

This report provides a snapshot of a faculty engaged with change, looking forward, with a commitment to exploring and creating opportunities to make transformation processes more conscious, and to “hear” and respond to experiences of exclusion, learn from them and to continually embrace change.

The report has been prepared by the Dean with input from several colleagues in the Science faculty.

**2**. **Faculty Structure**

**2.1 Present Structure**

The Science Faculty is a grouping of 14 Departments and two associated research Institutes (The Institute for Water Research, IWR; and The Institute for Environmental Biotechnology, EBRU). The Economics Department is not part of the Science Faculty although undergraduate courses are accepted as science subjects and postgraduate degrees in economics can be taken in the Science Faculty. The departments can be grouped into broad areas including the biological sciences (Botany, Human Kinetics & Ergonomics, Ichthyology & Fisheries Science, Zoology, Entomology and Microbiology), the earth and environmental science (Environmental Science, Geography and Geology) the chemical sciences (Biochemistry, Biotechnology and Chemistry) and the mathematical and physical sciences (Computer Science, Mathematics, Mathematical Statistics and Physics). Although these groupings exist, the boundaries are not clearly defined and some departments and staff are active within more than one group. Indeed Departments and Staff in Departments collaborate with colleagues from all the other faculties in teaching, research and community engagement.

The Departments are mostly small with five to 10 Staff and the total staff complement of the Faculty is 102.

The Faculty is led by a full time Dean with the support of a part time Deputy-Dean and a Faculty Officer. The term of office for Dean is five years and for Deputy Dean, three years.

**Structure: Future Plans**

At present there are no plans to change the number of departments or any other aspect of Faculty structure. During early 2014, the role of the Deputy-Dean will be more clearly defined and quantified, and additional support given to the home department of the Deputy to cover a level of responsibility to the Faculty. It is recommended that the Science Faculty requires 12 hours per week from the Deputy-Dean which will allow the Deputy to manage a significant portfolio. An alternative that should be considered is that the Faculty elects two Deputy Deans who will share the 12 hours. This could facilitate succession planning and transformation at this level.

**2.2 Degrees Offered.**

*Undergraduate*

**BSc**: The ordinary first degree is taken over three years and is characterized by a very flexible structure that allows students to create curricula that best serve their particular interests.

**BSc (Inf Sys)** and **BSc (Sof Dev):** These two degrees are designed to meet the needs of students who wish to combine computer science with some commerce subjects, and to apply their computing expertise in a commercial environment. The curriculum has little flexibility and combines commerce subjects, computer science and information systems. Both degrees share a similar structure but the BSc (Sof Dev) includes a fourth year which is equivalent to an Honours degree.

**BScF**: This is the Science Faculty Foundation Programme (extended studies programme) which aims to give access to students whose educational, socio-economic or other experiences have not fully prepared them for university study.

*Postgraduate*

**BSc (Honours):** The Honours degree is offered in many disciplines, with some departments offering more than one Honours course.

**MSc and PhD**: At least one Master’s and one PhD degree is offered by each department. Some departments offer Master’s by course work & thesis as well as by thesis alone and some Departments offer Master’s and PhD in several disciplinary areas.

*Short Courses*

Members of Staff from a range of departments offer short courses. These are typically applied in nature and provide training to meet the needs of a particular audience. In some cases the content is relevant to undergraduate and postgraduate students who may register for the course. A full list of all short courses offered by Staff in the Science Faculty is not available and we should consider whether or not such a list is desirable.

**Degrees Offered: Future Plans.**

There are no immediate plans to change the number of undergraduate degrees offered. However, the faculty will pay attention to the possibility of extending the first degree over four years. Indeed, a four-year degree has been available in the Science Faculty for at least 10 years.

The Faculty has recently added two new course work & thesis Master’s degrees (Computer Security and Bioinformatics) and it is likely that more will be added (Forensic Science, Water Resource Management, Fish Health, Fisheries Management). We have just received the first approval for the course in Forensic Science and this will run for the first time in 2015.

We have recently been asked to consider whether we wish to offer two types of doctoral degree; the usual PhD and a more applied Doctor of X (in a particular field). It is likely that we will elect to have both on offer, particularly in the more applied disciplines such as computer science and biotechnology.

**2.3 Nature/Character of the Science Faculty.**

*General*

The nature of the Science Faculty is not easily encapsulated in a few words. It is shaped by its Staff, who they are, what they are interested in and what they do. Consequently, while we will argue that research and postgraduate education are key features of our Faculty, this does not apply equally to all Staff. Indeed it is our differences that make the Science Faculty what it is. While some Staff are passionate about applied research, others are not. For some Staff, community engagement is very closely tied to their research, for others it is not. Some Staff research and publish in science education, others do not. The Science Faculty is stronger than the component parts as a result of this diversity.

*Undergraduate Degrees*

Perhaps the key feature of the BSc is its flexibility. Within the confines set by the timetable, it is possible for students to combine subjects in myriad ways to create curricula that meet their particular interests. This flexibility includes allowing students to take a major subject from commerce, the humanities and law such that students can major in environmental science and anthropology, biochemistry and law or geology and economics. AS a Faculty, we appreciate the value that can be added by allowing students some flexibility when choosing their subjects. The BSc does not set out to educate or train a student for a particular career but rather allows for the construction of a knowledge and skills base that prepares a student for a wide range of possible careers or advanced study in their chosen subject. Emphasis is on discipline specific knowledge and skills as well as the cross cutting skills including experimental design, data collection, analysis and interpretation, and scientific communication, that form the essential base for research. The flexibility in curriculum design creates an opportunity for students to decide if they are attracted to transdisciplinary academic training and education.

By contrast, the BSc (Inf Sys) and BSc (Sof Dev) share a very specific audience that wishes to combine computer science with some commerce subjects, and to apply their computing expertise in a commercial environment. There is little flexibility in the curriculum and in first year, students take three commerce subjects (economics, accounting and management) with computer science and some maths and statistics. In both degrees, students take computer science and information systems in second year and computer science in third year. In the BSc (Inf Sys), the second major can be chosen from a range of subjects while in the BSc (Sof Dev), the second major must be Information systems. The BSc (Sof Dev) includes a fourth year which is equivalent to joint Honours in computer science and information systems.

**Undergraduate degrees: Future plans**

As a University and Faculty, we resisted pressure to adopt a programme approach to teaching undergraduates and have retained our broad, formative first degree. There is no proposal to alter this but there is scope to provide students with better guidance as to how they might combine subjects to prepare themselves for a career in, for example, astronomy, water science or bioinformatics. In 2014 we will work with departments to develop guidance material that will include suggested curricula. This material will be used on campus but could also be used to guide leaners.

A number of our courses have changed as a result of the recent curriculum change in pharmacy and these new courses were introduced in 2013.

We will pilot a reduced first semester curriculum, with augmentation in a limited set of subjects in 2014. This will be described further in section 4.

The ways that the subjects of economics and information systems are treated in the Science Faculty is different and a degree with economics as a major requires 18 credits while one with information systems as a major requires 20 credits. Both are taught by departments in the Commerce Faculty but one (economics) is accepted as a science subject while the other (information systems) is not. In 2014 we will re-open this discussion and decide if and how we wish to change this arrangement.

Our present rules allow a student to construct a curriculum that could be argued to be inappropriate for a BSc with majors such as Accounting and Economics or Information Systems and Economics. In 2014 we will propose to faculty a change in rules that treats information systems and economics in the same way and that requires students who are majoring in either Information Systems or Economics to take their second major from the available science subjects.

Further discussion on undergraduate teaching will occur in Section 4 (undergraduate education).

*Postgraduate Degrees*

All Departments offer at least one Honours course and in most cases, there is a strong emphasis on original, independent research. The Honours degree creates the pipeline into further postgraduate studies and an emphasis on research skills is appropriate.

Most departments are characterized by large and vibrant postgraduate schools. With almost 90% of the Staff with PhDs and the remainder with a Masters level qualification, departments are well equipped to train and educate up to the PhD level.

**Postgraduate Degrees: Future plans**

With the increased offering of Masters’ by coursework and thesis, an important point for Faculty to debate is the overall balance between coursework & thesis Master’s and Master’s by research. Is there an ideal balance? Should we continue to support new proposals for masters by coursework and thesis?

An argument for including a two-year Master’s by coursework and thesis is that it allows provision of *formal training* at the Master’s level in a disciplinary area as well as *research* experience. The formal training aspect supports both the reality of students with different skills-base coming in to postgraduate studies, as well as allowing an entry point for students from other disciplines who are interested in either a vocational or academic engagement in applied research. The research aspect conforms to and provides all the learning associated with independent, excellent research capacity. An argument against this is that globally, course work Master’s programmes are generally more vocationally based, with less emphasis on either deep content or excellent research. The two-year coursework Master’s, if articulated well, could be a differentiating Rhodes offering.

**2.4 Core Values and Traditions.**

Does the Science Faculty have a set of shared core values? Is it possible for a group of more than 100 academics to find common ground? From my perspective and based on what I have experienced in the Science Faculty, I would tentatively suggest the following.

We embrace a common value of actively enabling those around us, both staff and students, so that we can reach our full potential.

We value diversity in its broadest sense.

Diversity within the academic Staff brings with it differences in culture, belief, opinion and ways of doing things; differences in knowledge, skills and academic strengths; different interests in and approaches to teaching, research and community engagement, all of which add to our lives within our departments and strengthen our teaching, research and community engagement.

Diversity within the student body enriches teaching and learning and research.

Diversity in the education and training that we offer (at undergraduate and postgraduate levels) reflects differences in the interests of Staff and students. While some Staff and students will argue the merits of a broad-based undergraduate curriculum, others will argue the benefits of the fixed curriculum of the BSc (InfSys). And while some Staff and students will argue the merits of a focused MSc by coursework and thesis, others will argue in favour of postgraduate study by research alone.

Diversity in research fields and a freedom to research in any area are key characteristics of the Science Faculty. The balance that exists between pure and applied research reflects the interests of the Staff and is not shaped by any top down pressure. Similarly, the range of fields in which research is undertaken is driven by the Staff. As a faculty we value the quality of the research rather than the topic or subject matter.

There is no tradition in the Science Faculty of top down pressure to develop research focus areas. Where focus areas have developed this has been driven by academic Staff members with the support of the University. It is possible that the Faculty could make a more significant impact if research efforts were focused in two or three areas but this might require some Staff to shift the focus of their research or for us to put more emphasis on research area when filling a vacancy.

The faculty values and supports excellent research practice that focuses on research being actively used (as well as research that is potentially useful) and research that actively engages with a wide range of communities

We value excellence and scholarship in both teaching and research and recognize this at Faculty meetings and celebrate it at special dinners.

Many staff members and students appreciate the cosmopolitan nature of the faculty.

We support initiatives to promote environmental sustainability.

Does the Science Faculty have any traditions? Linked to the values, members of the Science Faculty have a tradition of supporting formal and ceremonial events and of active academic citizenship. Attendance at Faculty meetings has always been good. We attend graduation ceremonies and support our students as they complete their degrees. We attend inaugural lectures and support our colleagues.

The Faculty does not have an agreed on vision or purpose and I include here the text from my presentation to the faculty which formed part of the Dean’s election process.

**Vision**

Vision statements are often problematic as they tend to become a collection of overused and currently fashionable words that simply state the obvious. In attempting to keep a vision statement short and catchy, much of the meaning can be hidden or lost and the statement loses its value.

I do have a personal vision for the faculty that can be encapsulated in a number of statements.

**The Science Faculty is:**

1. Learned, and characterised by learning and scholarship in all that we do;
2. Fit for purpose;
3. Characterised by collegiality (relating to or involving shared responsibility and power) and a real concern for the wellbeing and success of others;
4. Forward looking.

The second bullet above requires that we have a common understanding of our purpose.

**The purpose of the Science Faculty is:**

1. To educate, and through education help create the next generation of critical thinking, ethical scientists, researchers and citizens;
2. To research, and through research answer important questions that advance knowledge and improve quality of life;
3. Through education and research, promote transformation.

This statement of purpose matches the aims of Higher Education as expressed in the *Education White Paper 3: A Programme for the Transformation of Higher Education* (1997) which are: to meet the learning needs and aspirations of individuals through the development of their intellectual abilities (including to broaden access to HE and to increase the quality of teaching & learning); to address the development needs of society; to contribute to the intellectual life of the rapidly changing society through the production of enlightened, responsible and critical citizens; and to contribute to knowledge generation and sharing and to increase the quality and quantity of research and highly trained/ educated people. The vision and purpose above are aligned with the *Constitution* *of the Republic of South Africa* (1996) which commits us to the values of human dignity, the achievement of equality and human rights and freedoms as in the Bill of Rights, and the *Green Paper for Post-School Education and Training* (2012) which argues for an improved success rate of PhD students, an increased proportion of staff with PhDs, and further development of research, and to continue to address historical inequities in race and gender.

**3.** **Staff**

**3.1 Academic Staff**

**3.1.1 Present Structure and History**

In this section, data from a variety of sources have been used and as a result there are some inconsistencies in the numbers. Some data sets include only full time Staff on the university pay roll and others are more inclusive, however, the differences are relatively small.

The number of full time academic Staff (data from DMU) has changed slightly from 2003 (91) to 2013 (102; Table 1).

Table 1. Staff in the Science Faculty by demographic group and gender. (Data from the DMU; all nationalities pooled; data are numbers of staff with the percentage of total in brackets.)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Indian | | total | African | | total | Coloured | | total | White | | total | grand total |
| Year | M | F |  | M | F |  | M | F |  | M | F |  |  |
| 2003 | 1 | 0 | 1 (1.1) | 3 | 2 | 5 (5.5) | 0 | 0 | 0 (0) | 69 | 16 | 85 (93.4) | 91 |
| 2004 | 1 | 0 | 1 (1.1) | 4 | 3 | 7 (8.0) | 0 | 0 | 0 (0) | 64 | 15 | 79 (90.8) | 87 |
| 2005 | 1 | 0 | 1 (1.1) | 4 | 3 | 7 (8.0) | 0 | 0 | 0 (0) | 64 | 16 | 80 (90.9) | 88 |
| 2006 | 1 | 0 | 1 (1.1) | 4 | 3 | 7 (8.0) | 0 | 0 | 0 (0) | 61 | 18 | 79 (90.8) | 87 |
| 2007 | 1 | 0 | 1 (1.1) | 5 | 3 | 8 (9.0) | 0 | 0 | 0 (0) | 61 | 19 | 80 (89.9) | 89 |
| 2008 | 1 | 0 | 1 (1.1) | 5 | 2 | 7 (7.9) | 0 | 1 | 1 (1.1) | 57 | 23 | 80 (89.9) | 89 |
| 2009 | 1 | 0 | 1 (1.1) | 5 | 1 | 6 (6.7) | 0 | 1 | 1 (1.1) | 58 | 23 | 81 (91.0) | 89 |
| 2010 | 1 | 0 | 1 (1.1) | 6 | 2 | 8 (8.7) | 0 | 1 | 1 (1.1) | 56 | 26 | 82 (89.1) | 92 |
| 2011 | 1 | 0 | 1 (1.1) | 8 | 1 | 9 (9.6) | 1 | 1 | 2 (2.2) | 58 | 24 | 82 (87.2) | 94 |
| 2012 | 3 | 1 | 4 (4.1) | 10 | 1 | 11 (11.3) | 1 | 2 | 3(3.3) | 56 | 23 | 79 (81.4) | 97 |
| 2013 | 3 | 1 | 4 (4) | 11 | 2 | 13 (13) | 1 | 2 | 3 (3) | 56 | 26 | 82 (80.4)) | 102 |

Change in the demographic profile of the academic Staff has been slow with the percentage of White staff decreasing from 93% in 2003 to 82% in 2013. The percentages of African (5.5% - 13%), Indian (1.1% - 4%) and Coloured Staff (0 – 3%) have increased slightly over the same period (Tables 1&2; Figure 1).



Figure 1. Changes in the academic Staff of the Science Faculty by demographic group (Data from the DMU; all nationalities pooled).

Table 2. Changes in staff demography (2011 – 2013). Data from Rhodes Calendar, my Staff lists and HR.)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2011 | | 2012 | | 2013 | |
|  | number | % | number | % | number | % |
| Male | 68 | 72.3 | 70 | 72.2 | 71 | 70.3 |
| Female | 26 | 27.7 | 27 | 27.8 | 31 | 29.7 |
| **Total** | **94** |  | **97** |  | **102** |  |
| South African |  |  |  |  |  |  |
| African male | 3 | 3.2 | 4 | 4.1 | 4 | 4 |
| African female | 1 | 1.1 | 1 | 1.0 | 2 | 2 |
| Indian male | 1 | 1.1 | 3 | 3.1 | 3 | 3 |
| Indian female | 0 |  | 1 | 1.0 | 1 | 1 |
| Coloured male | 1 | 1.1 | 1 | 1.0 | 1 | 1 |
| Coloured female | 1 | 1.1 | 2 | 2.1 | 2 | 2 |
| White male | 45 | 47.9 | 43 | 44.3 | 45 | 44.1 |
| White female | 19 | 20.2 | 18 | 18.6 | 21 | 20.6 |
| International |  |  |  |  |  |  |
| African male | 5 | 5.3 | 6 | 6.2 | 7 | 7.0 |
| African female | 0 |  | 0 |  | 0 |  |
| Indian male | 0 |  | 0 |  |  |  |
| Indian female | 0 |  | 0 |  |  |  |
| Coloured male | 0 |  | 0 |  |  |  |
| Coloured female | 0 |  | 0 |  |  |  |
| White male | 13 | 13.8 | 13 | 13.4 | 11 | 10.8 |
| White female | 5 | 5.3 | 5 | 5.2 | 5 | 4.9 |

The discrepancies between Tables 1 and 2 are small but highlight the need for a single, easily accessible data base for the University. Using data in Table 2, White Staff comprised 80.4% of Staff in the Science Faculty in 2013 compared to 87.2% in 2011.

In terms of gender, the percentage of female staff in the Faculty has increased from 20% (18 female academics) in 2003 to 30% (31 female academics) in 2013 (Table 3; Figure 2).

Table 3 & Figure 2. Summary of changes in the number and percentage of female academic Staff in the Science Faculty from 2003 to 2013.



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Total  academic  staff | Male | | Female | |
| number | % | number | % |
| 2003 | 91 | 73 | 80.2 | 18 | 19.8 |
| 2004 | 87 | 69 | 79.3 | 18 | 20.7 |
| 2005 | 88 | 69 | 78.4 | 19 | 21.6 |
| 2006 | 87 | 66 | 75.9 | 21 | 24.1 |
| 2007 | 89 | 67 | 75.3 | 22 | 24.7 |
| 2008 | 89 | 63 | 70.8 | 26 | 29.2 |
| 2009 | 89 | 64 | 71.9 | 25 | 28.1 |
| 2010 | 92 | 66 | 71.7 | 26 | 28.3 |
| 2011 | 94 | 68 | 72.3 | 26 | 27.7 |
| 2012 | 97 | 70 | 72.2 | 27 | 27.8 |
| 2013 | 102 | 71 | 70.0 | 31 | 30.0 |

In 2013, 66% of female staff were in the Lecturer and Senior Lecturer categories while 40% of male staff were at these levels (Table 4). Seventy nine percent of Professorial Staff and 78% of Associate Professors were male (Table 4). In January 2014, six of 14 Heads of Department were women.

In 2013, 52% of the Black Staff (South African and International pooled) in the Science Faculty were lecturers and these Staff comprised 50% of all the lecturers (Table 4). Forty three percent of Black Staff were at either Associate or Full Professor level and comprised 20% of all Staff at these levels. In 2013, two of 13 Heads of Department were Black.

Table 4**.** Gender and appointment level of academic teaching Staff in the Science Faculty in 2011, 2012 and 2013. The Black column includes both South African and International Black Staff.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | 2011 | | | | 2012 | | | | 2013 | | | |
| Male | Female | Total | Black | Male | Female | Total | Black | Male | Female | Total | Black |
| Lecturer | number | 16 | 10 | 26 | 5 | 19 | 11 | 30 | 11 | 16 | 8 | 24 | 12 |
| % of all staff | 17% | 11% | / | / | 19% | 11% | / | / | 16% | 8% | / | / |
| % of gender/ demographic group total | 24% | 38% | / | 42% | 26% | 41% | / | 61% | 23% | 24% | / | 52% |
| % of total for level | 62% | 38% | / | 19% | 63% | 37% | / | 37% | 67% | 33% | / | 50% |
| Senior  Lecturer | number | 17 | 11 | 28 | 2 | 17 | 9 | 26 | 2 | 12 | 14 | 26 | 1 |
| % of all staff | 18% | 12% | / | / | 18% | 9% | / | / | 12% | 14% | / | / |
| % of gender/ demographic group total | 25% | 42% | / | 17% | 24% | 32% | / | 11% | 17% | 42% | / | 4% |
| % of total for level | 61% | 39% | / | 7% | 65% | 35% | / | 7% | 46% | 54% | / | 15% |
| Associate  Professor | number | 11 | 1 | 12 | 2 | 10 | 3 | 13 | 2 | 14 | 4 | 18 | 3 |
| % of all staff | 12% | 1% | / | / | 10% | 3% | / | / | 14% | 4% | / | / |
| % of gender/ demographic group total | 16% | 4% | / | 17% | 14% | 11% | / | 11% | 20% | 12% | / | 13% |
| % of total for level | 91% | 9% | / | 14% | 77% | 23% | / | 15% | 78% | 22% | / | 16% |
| Professor | number | 24 | 4 | 28 | 3 | 24 | 4 | 28 | 3 | 27 | 7 | 34 | 7 |
| % of all staff | 26% | 4% | / | / | 25% | 5% | / | / | 26% | 7% | / | / |
| % of gender/ demographic group total | 35% | 15% | / | 25% | 34% | 14% | / | 17% | 39% | 21% | / | 30% |
| % of total for level | 86% | 14% | / | 11% | 86% | 14% | / | 11% | 79% | 21% | / | 20% |
| Total | | 68 | 26 | 94 | 12 | 70 | 27 | 97 | 18 | 69 | 33 | 102 | 23 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Diversity profiles for the 13 Departments are summarised in Table 5.

Table 5. Summary of levels of demographic and gender diversity in the academic departments of the Science Faculty.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Department | Total  academic staff | | Black  (all nationalities) | | SA Black | | SA White Female | | Total Female | |
|  | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 |
| BMB | 11 | 11 | 2 | 2 | 2 | 2 | 5 | 5 | 7 | 7 |
| Botany | 5 | 5 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Chemistry | 10 | 10 | 5 | 5 | 4 | 4 | 2 | 2 | 3 | 3 |
| CSC | 11 | 12 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 3 |
| Env sci | 5 | 6 | 2 | 2 | 0 | 0 | 1 | 2 | 1 | 2 |
| Geography | 5 | 5 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 3 |
| Geology | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| HKE | 5 | 6 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 3 |
| Ichthy | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maths | 8 | 8 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 |
| Physics | 7 | 7 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 1 |
| Stats | 8 | 9 | 1 | 2 | 0 | 1 | 2 | 3 | 3 | 4 |
| Zoo/ Ento | 10 | 11 | 2 | 2 | 2 | 2 | 0 | 0 | 2 | 2 |
| TOTALS | 97 | 102 | 18 | 20 | 12 | 13 | 19 | 22 | 28 | 31 |
| % |  |  | 18.6 | 19.6 | 12.4 | 12.7 | 19.6 | 21.6 | 28.9 | 30.4 |

The Science Faculty has used supernumerary development posts with some success. In the recent past, we have had Staff appointed to Mellon or Kresge posts in six departments. Three of these Staff are now in permanent positions, one was not successful and a further three are still in the development post. Departments within the Science Faculty should look carefully at whether or not they can make greater use of these development positions. Certainly some departments have expressed an interest and this has been followed up on in 2013. A development post has been made available to the Department of Ichthyology & Fisheries Science.

*Staff Turnover*

Staff turnover for the period July 2011 to June 2012 was less than 10% of the total staff complement (Table 6). In most cases, turnover was in departments and at levels where it was possible to attract applications from members of designated groups. Turnover in 2013 has been higher than expected and not all vacancies have been filled. We have two vacancies in Mathematical Statistics, one in Chemistry, one in Mathematics and one in Environment Science. Our experience shows that it is very difficult to attract staff into statistics and it is unlikely that we will be able to fill either post with a member of a designated group. By contrast, I expect the vacancies in the other departments to attract considerable interest from South African academics.

Table 6. Summary of Staff (professionally qualified) turnover over 12 months (July 2011 – June 2012) and for 2013. Data from HR Division and my records.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | 2011/2012 | | 2013 | |
|  | | terminations | recruits | |  |  | | --- | --- | | terminations |  | | recruits |
| Male | African | 0 | 3 | 1 | 1 |
| Coloured | 0 | 0 | 0 | 0 |
| Indian | 0 | 0 | 1 | 0 |
| White | 5 | 1 | 4 | 3 |
| International | 1 | 1 | 1 | 2 |
| Total male | | 6 | 5 | 7 | 6 |
| Female | African | 0 | 0 | 0 | 1 |
| Coloured | 0 | 1 | 0 | 0 |
| Indian | 0 | 1 | 0 | 0 |
| White | 1 | 0 | 1 | 2 |
| International | 0 | 1 | 0 | 1 |
| Total female | | 1 | 3 | 1 | 4 |
| Grand totals | | 7 | 8 | 8  (+5 new posts) | 10  (+ 3 posts still to fill) |

Tables 1 - 6 indicate that there have been changes in the demographic diversity of Staff in the Science Faculty and that where opportunities have presented themselves through retirement, resignation or the provision of a supernumerary post, we have been able to increase diversity. In spite of this, there is a great deal more work required in this area.

The underrepresentation of members of minority groups and continued underrepresentation of members of historically underrepresented groups is a worldwide issue that has been the topic of numerous reports. A great deal of very useful information is available and rather than reinventing the wheel, the Science Faculty should use these resources to develop its own plan for increasing diversity. For example, it is widely accepted that there are multiple interacting factors that serve as barriers to the participation of women in academia and particularly science, and addressing these requires an integrated strategy that includes a role for National Government, University and Faculty. At a University level there is much that we should consider and an excellent starting place could be the Athena SWAN Charter for Women in Science which provides discussion, case studies and best practice. We are already implementing some of the ideas but there are many that we could consider. Similarly, reports from The National Science Foundation, Royal Society and American Association for the Advancement of Science could serve as starting points for a faculty discussion of ways to encourage greater diversity in Staff and students.

*Staff Qualifications*

The majority of staff in the Science Faculty have a PhD and the percentage with a PhD has increased from 73% in 2004 to 87% in 2013 (Table 7; Figure 3). This is a very high percentage and is a real strength of the Science Faculty. For the University as a whole, 51% of staff have a PhD (data for 2012 from the Stats Digest)

Table 7 & Figure 3. A summary of the number and percentage of staff with PhD. (Data from the Statistical Digest, the DMU and my Staff lists).



|  |  |  |  |
| --- | --- | --- | --- |
|  | Staff number | With PhD | PhD (%) |
| 2003 | 91 |  |  |
| 2004 | 87 | 64 | 73 |
| 2005 | 88 | 64 | 73 |
| 2006 | 87 | 66 | 76 |
| 2007 | 89 | 68 | 76 |
| 2008 | 89 | 64 | 72 |
| 2009 | 89 | 67 | 75 |
| 2010 | 92 | 70 | 76 |
| 2011 | 94 | 81 | 86 |
| 2012 | 97 | 86 | 89 |
| 2013 | 102 | 88 | 87 |

**Academic Staff***:* **Future Plans**

**Staff complement:** In the last 5 years, we have appointed additional permanent Staff in Chemistry, Mathematical Statistics, Mathematics, Entomology and Physics. We have also made contract positions and development posts available in a number of departments and research institutes. We will continue to explore the possibilities of appointing new Staff in other Departments where student numbers justify this.

**Diversity**: Retirements and resignations are rare occurrences and each one is used to the best possible effect. At present we use a number of strategies to ensure that the vacancy is widely known. We start the process as early as possible to ensure that the advertisement can remain open for one month and that we can re-advertise if there are no applicants from designated groups. We use a range of electronic media including web sites, newsletters and distribution lists of learned societies. We use word of mouth and a personal approach from the Head of Department. Selection Committee decisions are guided by the requirements of University Policy and the Employment Equity Act. Where suitably qualified and experienced members of designated groups are not available, we make appointments to ensure that the department can continue to function.

In 2013, three offers to staff who would have increased diversity (two Black African and one Coloured South African female) were not accepted after we were unable to match the salary expectations.

The other avenue open to us is the appointment of staff to development (Kresge, Mellon or University) positions. A number of departments have successfully followed this route and we will continue to explore this possibility.

The Dean meets with the Director of Human Resources Division and the Head of each academic department individually. These very constructive discussions are used to explore all staffing issues in the department, to highlight upcoming retirements or possible resignations, to talk about succession planning for the HODship, and to talk about careers and likely applications for promotion of all staff. Transformation is highlighted and the challenges that this poses for the department are explored. The possibility of employing someone in a development post, against an upcoming retirement is discussed. in my experience these are extremely positive discussions and must continue.

**Retention**: I have started to meet with all new staff within the first three months of arrival and again at the end of their first year. I use this as an opportunity to discuss a wide range of issues and hope that it will allow me to identify and possibly resolve problems before they become too serious. Part of this discussion will be to establish if the new staff member wants and has a mentor within the department.

The issue of promotion is a cause of frustration for some staff. Staff are made aware that I am available to discuss career development and plan and prepare for promotion and where staff take up this offer, we work closely together to try and ensure success.

**Qualifications**: Of the 14 Staff who do not have a PhD, only three are perhaps unlikely to complete this degree and most of the others are registered for the PhD. Finding the time to complete a PhD is challenging and the Faculty is fortunate to have Claude Leon funds that can be used to create time for Staff to focus on their PhD.

* 1. **Support Staff**
     1. **Present Structure**

Most departments in the Science Faculty are heavily reliant on technical support and there are almost as many support staff as there are academic staff (Table 8). As might be expected, demographic diversity is greater amongst the support staff than the academic staff although at grades 11-16, 16 of 19 staff are white. It is clear from discussions with the Director of HR and Heads of Departments that many departments are being proactive in this area and supporting more junior staff so that they can at least be considered for filling more senior technical positions as they become available. This practise is to be encouraged. There is the opportunity for the Science Faculty to develop more formal training courses for technical staff and this should be explored in 2014.

Table 8. Demographic and gender diversity of the Support Staff in the Science Faculty (June 2013 data).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | African | | Coloured | | Indian | | White | | totals |
| Grades | male | female | male | female | male | female | male | female |  |
| 1-5 | 16 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 6-10 | 14 | 4 | 4 | 2 | 0 | 0 | 0 | 4 | 37 |
| 11-16 | 0 | 0 | 2 | 0 | 1 | 0 | 10 | 6 | 19 |
| totals | 30 | 12 | 6 | 2 | 1 | 0 | 10 | 19 | 80 |

1. **Undergraduate Education**

**4.1 Student Numbers and Demography: Present structure and history**

Between 2002 and 2013, undergraduate numbers increased by 27%, postgraduate numbers by 99% and all students by 53% (Table 9; Figures 4 & 5) while staff numbers increased by 12%. Although this section focusses on undergraduate students, postgraduate numbers are included here to allow comparison.

Table 9. Summary of the changes in numbers of undergraduate and postgraduate students from 2002 - 2013. (Data from the statistical digest, DMU and scifac web site for 2011 - 2013)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Undergrads | Postgrads | Total | Pg/Ug ratio | Staff members |
| 2002 | 604 | 341 | 945 | 1:1.8 | / |
| 2003 | 633 | 341 | 974 | 1:1.9 | 91 |
| 2004 | 591 | 357 | 948 | 1:1.7 | 87 |
| 2005 | 592 | 350 | 942 | 1:1.7 | 88 |
| 2006 | 562 | 387 | 949 | 1:1.5 | 87 |
| 2007 | 600 | 395 | 995 | 1:1.5 | 89 |
| 2008 | 591 | 405 | 996 | 1:1.5 | 89 |
| 2009 | 756 | 463 | 1219 | 1:1.6 | 89 |
| 2010 | 763 | 518 | 1281 | 1:1.5 | 92 |
| 2011 | 799 | 484 | 1283 | 1:1.7 | 94 |
| 2012 | 847 | 621 | 1468 | 1:1.4 | 97 |
| 2013 | 767 | 681 | 1448 | 1:1.1 | 102 |



Figure 4. Changes in numbers of undergraduate and postgraduate students in the Science Faculty. Postgraduate numbers are included to allow comparison.



Figure 5. Changes in student numbers, staff numbers and FTE/SCU ratio. (Data from the Statistical Digest.)

As a result of the greater than expected intake of first year students into the Science Faculty in 2009, the proportions of students in each academic year have been changing such that in 2012 we had the largest third year classes ever, comprising 38% of all BSc students (Table 10). As these students have left the system, the total number of BSc students has declined as has the number and proportion in third year.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | number | | | percentage | | |
| BSc1 | BSc2 | BSc3 | BSc1 | BSc2 | BSc3 |
| 2007 | 174 | 126 | 145 | 39.1 | 28.3 | 32.6 |
| 2008 | 159 | 167 | 135 | 34.5 | 36.2 | 29.3 |
| 2009 | 268 | 160 | 191 | 43.3 | 25.8 | 30.9 |
| 2010 | 238 | 214 | 170 | 38.3 | 34.4 | 27.3 |
| 2011 | 216 | 240 | 221 | 31.9 | 35.5 | 32.6 |
| 2012 | 218 | 217 | 265 | 31.1 | 31.0 | 37.9 |
| 2013 | 202 | 206 | 238 | 31.3 | 31.9 | 36.8 |
| 2014 | 248 | 223 | 226 | 35.6 | 32.0 | 32.4 |

Table 10. Changes in the numbers and percentages of BSc students in the three academic years.

The demographics of the undergraduate students have changed over time with decreasing proportions of White and Indian students and increasing numbers and proportion of African students (all nationalities pooled; Table 11; Figure 6).

Amongst the undergraduate students, there has been a substantial increase in the proportion of female students (Figure 7; Table 11).



Figure 6. Changes in the demography of the undergraduate student body. (Data from the Statistical Digest, DMU)



Figure 7. Changes in the gender of undergraduate students. (Data from Statistical Digest, DMU)

**Student numbers and demography: Future Plans**

The proposed undergraduate growth rate for the next planning cycle (2014-2019) is 0.5% per annum. This is based on a number of factors including infrastructure constraints and particularly space in teaching laboratories, our experience dealing with the peak intake of 2009, trends in the teaching of mathematics at schools and some worryingly high failure rates in first year courses. The proposal is to limit undergraduate growth and to concentrate on improving what we do. We expect to see a continued increase in the proportion of Black South African students and will explore the reasons for the decline in numbers of Indian students. More can be done to attract top Black South African students and we will work more closely with the Recruitment Office and groups such as the Mobile Biology Lab and the Maths and Science Club, to identify top scholars. Other opportunities such as working more closely with the Dinaledi Schools must be explored.

In 2013 we have received almost 1000 applications for admission to the Science Faculty from which we have made about 350 offers.

Table 11. Undergraduate numbers by race and gender. The final column shows the ratio of postgraduate to undergraduate students. (Data from the statistical digest; all nationalities pooled, DMU )

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Undergraduates | | | | | | | | | | | | | | | |
| Year | Indian | | African | | Coloured | | White | | Male | | Female | |  | | |
|  | total | % | total | % | total | % | total | % | total | % | total | % |  | total | Pg/Ug ratio |
| 2002 | 45 | 7.5 | 147 | 24.3 | 19 | 3.1 | 393 | 65.1 | 351 | 58.1 | 253 | 41.9 |  | 604 | 1:1.8 |
| 2003 | 52 | 8.2 | 165 | 26.1 | 20 | 3.2 | 396 | 62.6 | 371 | 58.6 | 262 | 41.4 |  | 633 | 1:1.9 |
| 2004 | 45 | 7.6 | 179 | 30.3 | 12 | 2 | 355 | 60.1 | 356 | 60.2 | 235 | 39.8 |  | 591 | 1:1.7 |
| 2005 | 32 | 5.4 | 184 | 31.1 | 14 | 2.4 | 362 | 61.1 | 320 | 54.1 | 272 | 45.9 |  | 592 | 1:1.7 |
| 2006 | 24 | 4.3 | 169 | 30.1 | 11 | 2 | 358 | 63.7 | 298 | 53 | 264 | 47 |  | 562 | 1:1.5 |
| 2007 | 21 | 3.5 | 208 | 34.7 | 9 | 1.5 | 362 | 60.3 | 300 | 50 | 300 | 50 |  | 600 | 1:1.5 |
| 2008 | 17 | 2.9 | 227 | 38.4 | 10 | 1.7 | 337 | 57 | 294 | 49.7 | 297 | 50.3 |  | 591 | 1:1.5 |
| 2009 | 26 | 3.4 | 313 | 41.4 | 15 | 2 | 402 | 53.2 | 386 | 51.1 | 370 | 48.9 |  | 756 | 1:1.6 |
| 2010 | 21 | 2.8 | 315 | 41.3 | 15 | 2 | 412 | 54 | 385 | 50.5 | 378 | 49.5 |  | 763 | 1:1.5 |
| 2011 | 19 | 2.4 | 328 | 41.1 | 15 | 1.9 | 437 | 54.7 | 402 | 50.3 | 397 | 49.7 |  | 799 | 1:1.7 |
| 2012 | 23 | 2.7 | 376 | 44.4 | 16 | 1.9 | 432 | 51.0 | 421 | 49.7 | 426 | 50.3 |  | 847 | 1:1.5 |
| 2013 | 19 | 2.5 | 355 | 46.3 | 11 | 1.4 | 382 | 49.8 | 392 | 51.1 | 375 | 48.9 |  | 767 | 1:1.1 |
| 2014 | 24 | 3.4 | 299 | 42.9 | 17 | 2.4 | 357 | 51.2 | 329 | 47.2 | 368 | 52.8 |  | 697 |  |

Notes:

1. For the University as a whole in 2012 38% of undergraduate students were White.
2. For the University as a whole in 2012 58% of undergraduate students were female.

**4.2 Undergraduate Education**

*Access*

Students are admitted to the Science faculty based on their performance (APS) in school leaving examinationsand a range of additional factors. When the APS is above 40 points, the additional factors play a lesser role but for students with points between 35 and 40 we look very carefully at all of the socio-economic information that is available on the form and the applicants ability to express him/ herself in writing. Based on this, we make decisions as to whether or not to make an offer and whether or not this is to the BSc or the Science Extended Studies Programme. The Extended Studies Programme (BScF) serves to broaden access and its success is reviewed later. Admission to the BScF is decided on by the Dean and Head of the Extended Studies Programme. At present admission is restricted to Black South African learners who have taken and passed the required subjects (maths and either biology or physical science) with at least 35 points but whose schooling, socio-economic status, home background, or some other life experience has left them poorly prepared to cope with mainstream BSc.

There have been discussions around the possibility of extending the BScF and increasing the number of students and these discussions will continue in 2014.

*Undergraduate success rates*

As a Faculty, we have monitored success rates for a number of years so that we can detect changes, highlight success and deal with problems.

At first year level important indicators are the average number of credits gained per student, the percentage of students passing fewer than 4 credits (the minimum needed to avoid exclusion) and the percentage passing 6 or more credits (at least 6 credits are required to move into second year). The average number of credits per first year student reached a low of less than six in 2009 and has fallen below six again this year (Figure 8). The percentage of students passing more than 5 credits increased from 2009 to 2011 but decreased in 2012 and 2013 (Figure 8). Students who pass six or more credits should complete their degree in three years while those with five or fewer will take at least four years.



Figure 8. Changes in success rates for 1st year students. Data are gathered before the January supps are written and the final pass rates will be slightly higher.

We also track changes in pass rates for each first year course (Figure 9; Table 12). Data are collated immediately after the November exams so do not include the results of supplementary exams written in January. The average pass rate for all first year subjects per year has varied between 73% in 2009 and 79% in 2010, however it is the pass rates per subject that are of particular interest.

While Geology 102 had the lowest mean pass rate, it also had a large standard deviation indicating substantial variation in annual pass rate. Indeed, student success in Geology 102 is better in 2013 than 2012. While it is reasonably easy to gather these data, the crucial next step is to ensure that we use them to address whatever issues may exist.



Figure 9. Pass rates per first year course for the period 2009-2012. (Data are from Pat Terry and are means with 1SD for the years 2009-2012.)

Table 12. Summary of pass rates (%age of students passing) in first year exams. Note that the percentages are calculated before the January supplementary exams are written and as a result, pass rates for second semester subjects will increase while those for first semester subjects should not.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course** | **2009** | **2010** | **2011** | **2012** | **2013** |
| Botany 102 | 60 | 64 | 82 | 62 | 65 |
| Cell Biology 101 | 68 | 82 | 73 | 85 | 82 |
| Chemistry 101 | 77 | 88 | 91 | 90 | 71 |
| Chemistry 102 | 91 | 89 | 78 | 66 | 82 |
| CSC 101 | 81 | 75 | 88 | 85 | 97 |
| CSC 102 | 63 | 71 | 73 | 70 | 81 |
| Earth Science 101 | 61 | 75 | 76 | 86 | 81 |
| Geography 102 | 84 | 90 | 83 | 62 | 63 |
| Geology 102 | 35 | 85 | 73 | 40 | 64 |
| HKE 101 | 81 | 65 | 85 | 80 | 85 |
| HKE 102 | 72 | 97 | 84 | 73 | 83 |
| ICT 1L1 | 94 | 70 | 83 | 98 | 92 |
| ICT 1L2 | 86 | 62 | 74 | 91 | 79 (csc 112) |
| Maths 1C1 |  |  | 58 | 65 | 46 |
| Maths 1C2 |  |  | 62 | 65 | 66 |
| Maths 1P | 63 | 68 | 65 | 79 | 96 (mat 1S) |
| Maths 1L | 75 | 72 | 78 | 79 | 90 |
| Physics 101 | 86 | 90 | 94 | 89 | 87 |
| Physics 102 | 88 | 100 | 73 | 77 | 57 |
| Physics 1E1 | 65 | 80 | 91 | 72 | 83 |
| Physics 1E2 | 93 | 87 | 79 | 85 | 68 |
| Stats 101 | 81 | 79 | 79 | 85 | 67 |
| Stats 102 | 53 | 62 | 64 | 63 | 69 |
| Stats 1D | 64 | 71 | 75 | 71 | 73 |
| Zoology 101 | 55 | 86 | 90 | 70 | 77 |

In second year, our students are expected to pass six courses and have a total of between 12 and 14 credits at the end of the second academic year. We have only been tracking the performance of second year students since 2010 and the data indicate a slight increase in success (Table 13).

Table 13. Changes in the success rates of second year students.

|  |  |  |
| --- | --- | --- |
| Year | % passing <6 | % passing 6 or more |
| 2010 | 39.1 | 60.9 |
| 2011 | 40.7 | 59.3 |
| 2012 | 42.5 | 57.5 |
| 2013 | 38.0 | 62.0 |

At third year level, we record the number of students completing their degree as a percentage of all those who could have completed their degree at the start of the year, and the percentage of the completers who complete their degree in three years (Figure 10). The percentage that complete has remained at about 90% but the percentage who complete in the minimum time has continued to decline (Figure 10).



Figure 10. Success rates of third year BSc students.

Recent cohort analyses of BSc students have shown that between 33 and 38% of those who start never complete a degree (Table 14). About 40% of BSc students complete in three years, 15% in four years and 7% in five years (Table 14). Considering that our entrance requirements are relatively high, the high failure rate is a cause concern and will be the focus of particular attention from 2014. Data for the Faculties of Commerce and Humanities show a similar pattern with between 50 and 60% of those students who start a degree completing it within five years (data from the 2012 Statistical Digest).

Table 14. Data from the DMU for BSc, BScS, BScD students. Note that analyses for the cohorts starting in 2009 & 2010 are not complete and the dropout rate is artificially high.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Dropped out or  not obtained | | Degree obtained in X years | | | | | | | |
| Year | Registered  new | 3 years | | 4 years | | 5 years | | 5+ years | |
|  |  | # | % | # | % | # | % | # | % | # | % |
| 2006 | 182 | 59 | 32.4 | 85 | 46.7 | 28 | 15.4 | 9 | 4.9 | 1 | 0.5 |
| 2007 | 213 | 72 | 33.8 | 101 | 47.4 | 27 | 12.7 | 12 | 5.6 | 1 | 0.5 |
| 2008 | 211 | 80 | 37.9 | 80 | 37.9 | 31 | 14.7 | 19 | 9.0 | 1 | 0.5 |
| 2009 | 302 | 142 | 47.0 | 109 | 36.1 | 51 | 16.9 | 0 | 0.0 | 0 | 0.0 |
| 2010 | 250 | 128 | 51.2 | 122 | 48.8 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

Many of the students who fail to complete will have been excluded. In 2012 the Science Faculty excluded 23 first time entering undergraduate students after the November/ February exams. This represents nine percent of this group of students. The exclusion rate for African students in all faculties is three to four times higher than for white students (data from 2012 Statistical Digest).

Most departments track changes in pass rates and a single example is presented here. Botany 102 is a single semester first year course taken in the second semester. Pass rates in both theory and practical exams have declined since 2005 (Figure 11). The benefits of this type of analysis of long term trends are clear. While there have been cycles of improvement and decline in performance, the trend is downwards. As a Faculty, we need to establish how widespread this downward trend is and then how it can be reversed without lowering exit standards.



Figure 11. Exam results for Botany 102 showing a decline in mean annual marks for both theory and prac exams.

*Strategies to address changes in and differences in pass rates*

The data presented above paint a mixed picture. While some of the indicators have remained static, others have declined. At third year and second year level there has been little change in student performance but there are several trends at first year that should concern us. These include the recent decline in the number of students passing 6 or more credits and the decrease in the mean number of credits per student. These are reflected in the decline in the number of students completing the degree in the minimum of three years and the high dropout rate. The Faculty has a teaching and learning sub-committee and a new informal teaching discussion group lead by Professor Büttner, and these and other issues have been discussed during 2013 and will continue to be discussed in 2014.

In 2013 we were able to introduce augmented first year courses in biology and geography, and pass rates in June indicated that they were successful. We plan to continue to offer these augmented courses but in a better structured way in 2014. During 2013 discussions started around the possibility of a flexible, 4-year first degree. In fact, the Faculty has a 4 year degree on the books and in the past we have channelled one or two students into the 4-year degree at the start of first year. Now that we have staff in place to offer augmented courses in biology, geography and hopefully soon, chemistry, we will be able to offer a properly structured 3 04 4-year, **flexible** curriculum to selected students in 2014. The key feature is a reduced content load of three courses in the first semester. If these are passed the load can be increased to four in the second semester and the degree completed in three years. If one or more exam is failed, the load will remain at three or be further reduced and the degree spread over four years.

*Undergraduate success by race.*

Several years ago, the DMU provided data on exams written, passed and failed for Indian, African, Coloured and White students (all nationalities pooled) in academic years 1, 2 & 3, for the years 2006-2010. The numbers of Coloured and Indian students are small and the data are not very meaningful. To allow comparison, the data were converted into the proportion of exams written that were passed and the general trend was for White students to do better in all academic years than Indian, African and Coloured students (Figure 12). If the comparison is done for African and White students, the difference in the percentage of exams passed is between 10 and 15% (Figure 13). For each academic year, the pass rate of African students was significantly lower than that of white students (post hoc Tukey test; P<0.05 for all pairs).



Figure 12. The mean proportion of exams passed (2006-2010) by Indian, African, Coloured and White students. (Data from the DMU; all nationalities pooled.)



Figure 13. Data as in Figure 12 but showing African and White students only.

In a further analysis, the data for African students were categorized by nationality (South African or International African) and there was no statistically significant difference between the proportions of exams passed (Figure 14).



Figure 14. A comparison of the data for all international African students with those of South African African students.

To begin to explore the possible influence of home language on success, a two way ANOVA was used with home language and academic year as categorical predictor variables and exams passed as the dependent variable. There was a significant effect of home language (Figure 15), and English speaking student passed a significantly greater proportion of their exams than those who speak another language (F1,30 = 108.6; P<0.005). There was a significant effect of year, and the proportion of exams passed increased with increasing academic year (F2,30 = 18.7; P<0.005). There was no significant interaction between year and home language (F 2,30 = 1.8; P>0.05).



Figure 15. The relationship between home language and success.

Figures 13 and 15 are, not surprisingly, strikingly similar and it is very likely that home language and demographic group are not independent factors. Further analyses that look at the influence of home language within demographic groups are required and will be a focus of attention in 2014. The intention will be to work with colleagues across the university who undertaking these sorts of analyses.

*Strategies to address differential pass rates.*

Further work needs to be done to better understand the possible causes of the different pass rates. Do the differences in pass rates reflect quality of schooling? Does the Rhodes system continue to favour White English speaking students through all academic years? How important is home language, parents’ education and so on?

In 2010 we began to collect and collate all test results for first year students and have used these to identify students in trouble. We meet with these students and discuss their results, problems and experiences and where necessary reduce the work load by dropping a subject. While tracking test marks is a useful tool for identifying at risk students, the real problem is how to deal with these students. Few departments are in a position to offer additional support over and above their other commitments.

In late 2012, the University received teaching development funds from the DoHET and some of this was made available to fund two staff members to provide augmentation in EAR 101, CEL 101, GOG 102 and ZOO 101 during 2013. Because of the very late stage at which this money was made available, the augmentation in 2013 was somewhat *ad hoc.* Nevertheless, the evidence points to some success and all students who attended augmented sessions for EAR 101 passed the June exam. In 2014 we will be able to offer a much better structured programme of augmentation in biology, geography and chemistry and this will be made available to BScF2 students and BSc students who are identified as likely to benefit from a reduced content load and extra support in at least the first semester. It should also be possible to move students across to the augmented courses based on performance in the first or second tests.

The Departments of Botany and Zoology & Entomology, in conjunction with the African Languages Department have initiated a study that is looking at if and how the language used in practical manuals and tests affects students from different backgrounds and with different linguistic abilities. We hope that the results from this study will enable us to better cope with linguistic diversity.

**4.3 The Science extended studies programme (BScF) - Successes and failures**

The Science extended studies programme (BScF) has as its goal to increase access to Rhodes University and increase the likelihood of success for students who might otherwise not gain access or who might be unlikely to succeed. The number of students in the foundation programme has varied and these students have experienced varied success. (Tables 15 & 16).

Table 15. The number and percentage of students excluded at the end of the foundation year of the BScF year and continuing studying in subsequent years.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year started | Students in BScF | | % continuing with BSc | | | | | | |
| Number at start | Excluded at end year 1 (%) | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
| 2005 | 27 | 6 (22%) | 21 (67) | 14 (52) | 12 (44) | 8 (30) | 0 | 0 | 0 |
| 2006 | 31 | 3 (10) |  | 28 (90) | 21 (68) | 20 (65) | 10 (32) | 4 (13) | 1 (3) |
| 2007 | 43 | 20 (47) |  |  | 21 (49) | 19 (44) | 15 (35) | 7 (16) | 1 (2) |
| 2008 | 46 | 12 (26) |  |  |  | 34 (74) | 28 (61) | 23 (50) | 14 (30 |
| 2009 | 36 | 15 (42) |  |  |  |  | 21 (58) | 20 (56) | 18 (50) |
| 2010 | 32 | 9 (28) |  |  |  |  |  | 22 (69) | 20 (63) |
| 2011 | 29 | 2 (7) |  |  |  |  |  |  | 27 (93) |
| 2012 | 47 | 10 (22%) |  |  |  |  |  |  |  |

\*If the % exclusions and % studying in their second year of study do not add to 100%, it is because students have withdrawn for reasons other than academic exclusion

Table 16: Cohort analysis showing the number and percentage of students graduating with a BSc or BSc (Hons).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year started | Number students | Number graduating in: | | | Total BSc graduates (%) | Honours graduates (%) |
| 4 years (%) | 5 years (%) | 6 years |
| 2005 | 27 | 4 (15) | 6 (22) | 1 (4) | 11 (41) | 4 (15) |
| 2006 | 31 | 7 (23) | 6 (19) | 1 (3) | 14 (45) | 3 (10) |
| 2007 | 43 | 8 (19) | 6 (14) | 0 (0) | 14 (33) | 2 (5) |
| 2008 | 46 | 8 (17) | 8(17) | / | / | / |
| 2009 | 36 | 12 (33%) | / | / | / | / |

For the cohorts that started in 2005 and 2006, less than half completed a first degree although four students (15% of those who started in 2005) and three students (10% of those who started in 2006) have completed an Honours degree. For the cohort who started in 2009, 33% have completed a degree in the minimum time of four years (Table 16) and this is substantially higher than in the previous years.

These success rates may seem low but if the number completing a degree is expressed as a percentage of those entering BScF year 2 the success rates are improved to just above 50% (Table 17).

Table 17. Success rates of BScF students.

|  |  |  |  |
| --- | --- | --- | --- |
| Year started | Number of students in  BScF year 1 | Number of students  entering BScF year 2 | Total graduates as a  % of those entering year 2 |
| 2005 | 27 | 21 | 11 (52%) |
| 2006 | 31 | 28 | 14 (50) |
| 2007 | 43 | 21 | 14 (67) |
| 2008 | 46 | 34 | n/a |

The identification of students for the extended studies programme is far from straightforward and there is no doubt that a few of the students who have been admitted did not have the ability to cope at Rhodes. The magnitude of this problem is expected to decrease as those responsible for making these decisions become ever more capable of interpreting the needs and abilities of our applicants based on the application form.

There is evidence that at least in some subjects, students who have been through BScF year 1 and are now in BScF year 2 do slightly better than their counterparts who were accepted directly into BSc year 1 (Table 18; Figures 16 & 17).



Figure 16 & 17. Comparative success rates of students in cell biology 101 and earth science 101.

Table 18. Comparison of success rates for earth science 101 and cell biology 101. Data are totals for 2005-2010 from the DMU.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Cell Biology 101 | | | | Earth Science 101 | | | |
| BScF2 | | BSc1 | | BScF2 | | BSc1 | |
| wrote | passed | wrote | passed | wrote | passed | wrote | passed |
| **South African** | | | | | | | | |
| African | 43 | 29 (67.4%) | 151 | 87 (57.6%) | 39 | 22 (56.4%) | 112 | 56 (50%) |
| Coloured | 1 | 1 (100%) | 12 | 8 (66.7%) | 0 | / | 5 | 2  (40%) |
| Indian | 0 | / | 14 | 9 (64.3%) | 0 | / | 10 | 7  (70%) |
| White | 0 | / | 395 | 343 (86.8%) | 0 | / | 31 | 277 (87.7%) |
| **International** | | | | | | | | |
| African | / | / | 43 | 38 (88.4%) | / | / | 27 | 21 (77.8%) |
| Coloured | / | / | 5 | 4 (80%) | / | / | 5 | 4  (80%) |
| Indian | / | / | 6 | 6 (100%) | / | / | 2 | 2 (100%) |
| White | / | / | 38 | 37 (97.4%) | / | / | 26 | 25 (96.2%) |

The results indicate (further analyses are necessary) that International students perform better than South African students; that South African African BScF2 students perform slightly better than South African African BSc1 students; that White SA students are performing far better than their African SA class mates and that International White students outperform the other students. It is pleasing to see that the students in BScF2 outperform those students who did not have the benefit of the first foundation year however the differential success rates remain a concern and have been discussed earlier.

The attrition of students in the Science Extended Studies Programme is not just at the end of BScF year 1 but occurs through the remaining three years of the degree, as is the case for students who are accepted into the mainstream. The benefits that will accrue from providing support in second year for the BScF students has been discussed earlier and I expect to see an increase in success rates once we have introduced the augmented courses in cell biology and earth sciences. These courses will provide support only for the group of students interested in earth and biological sciences and we will need to explore the possibility of adding similar support for students whose interests are in the more mathematical subjects.

1. **Research and Postgraduate education**

In this section, research and postgraduate education are combined as the two are very closely intertwined in the Science Faculty.

* 1. **Research Activity: Present Levels and History**

Here research activity is reflected in research outputs as recorded in the Statistical Digest. Data for 2011 and 2013 are taken from other sources such as graduation programmes. The increase in total weighted outputs from 2003 – 2012 is 96% reflecting strong increases in publication and graduation of PhD and MSc students (Table 19; Figures 18 & 19). There has been a 108% increase in the number of postgraduates (MSc & PhD) graduating between 2003 and 2013 and an 88% increase in papers (2003-2012)(Table 19).

Table 19. Changes in research outputs from 2003-2013. Increase (bottom row) is the percentage change from 2003-2012. (Data for 2003-2012 from Statistical Digest; data for 2013 from graduation programme.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | Papers | MSc | PhD | Weighted total |
| 2003 | 93.7 | 42.5 | 14 | 178.2 |
| 2004 | 121.66 | 35 | 22 | 222.66 |
| 2005 | 116.94 | 40 | 13 | 191.18 |
| 2006 | 139.31 | 39.5 | 23 | 248.81 |
| 2007 | 159.8 | 61.5 | 32 | 317.2 |
| 2008 | 151.5 | 54 | 15 | 250.5 |
| 2009 | 185.5 | 51.5 | 15 | 282.1 |
| 2010 | 174.01 | 59 | 26 | 311.01 |
| 2011 | 187.12 | 66.5 | 31 | 346.62 |
| 2012 | 176.16 | 71 | 34 | 349.16 |
| 2013 | / | 83 | 35 | / |
| Increase (%) | 88.0 | 95.3 | 150.0 | 96.0 |

19

18



B

A

Figures 18 & 19. Changes in research outputs between 2003 and 2013. Only the graduating postgrads are shown in B so that trends are clear. (Data from the Statistical Digest and Graduation programme for 2013.)

Research productivity is not evenly spread through the Science Faculty with considerable variation between (Table 20) and within departments. In the period under analysis, three departments performed below the DoHET norm and three at more than four times the norm (Table 20). A goal for the next three years must be to work with the departments that do not meet the DoHET norm to find ways to facilitate research.

At an individual Staff level, 55% of staff produce less than the DoHET norm of 1.4 units per year. Eleven Staff produce just less than half of all Science Faculty research outputs and one third produce three quarters (Table 21, Figures 20 & 21). Of the 11 Staff, three will retire in the next five years and three occupy SARChI Research Chairs.

Table 20. Research outputs (papers and graduating postgraduate students) by department for 2009-2011 (Data from the Research Office.) Data for 2011 and 2012 from the 2012 Statistical Digest. *Note: Maths, Stats and Geography have all shown very pleasing increases in research outputs in 2011 and* *2012*.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Department | Research outputs (2009-2011) | | | |  |  |
| Total | Annual average | Annual average/  Staff member | % DoHET norm | 2011 | 2012 |
| Chemistry | 231.5 | 77.2 | 9.6 | 7.7 | 107 | 80 |
| Zoo & Ento | 175.2 | 58.4 | 7.3 | 5.8 | 58 | 74 |
| BMB | 130.2 | 43.4 | 3.9 | 3.2 | 39 | 41 |
| Ichthyology | 77.4 | 25.8 | 5.2 | 4.1 | 43 | 39 |
| Computer Science | 52.6 | 17.5 | 1.5 | 1.2 | 16 | 8 |
| Env Sci | 48.7 | 16.2 | 4.1 | 3.2 | 18 | 28 |
| Botany | 47.6 | 15.9 | 3.2 | 2.5 | 15 | 9 |
| Physics | 47.0 | 15.7 | 2.2 | 1.8 | 23 | 9 |
| IWR | 40.0 | 13.3 | 13.3 | 10.7 | 16 | 18 |
| Geology | 30.2 | 10.1 | 2.0 | 1.6 | 7 | 17 |
| HKE | 29.1 | 9.7 | 1.9 | 1.6 | 6 | 11 |
| Statistics | 18.1 | 6.0 | 0.8 | 0.6 | 3 | 10 |
| Geography | 15.6 | 5.2 | 0.9 | 0.7 | 7 | 10 |
| Mathematics | 9.5 | 3.2 | 0.5 | 0.4 | 2 | 13 |
|  | 952.7 | 317.6 |  |  |  |  |

Table 21. Research outputs as a 3 year total and percentage of all outputs for the Science Faculty (2009-2011; data from the Research Office).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number  of staff | Outputs per  staff member |  | Total number  of staff | Cumulative total  number  of outputs | % of total |
| 1 | 105.5 |  | 1 | 105.5 | 19.6 |
| 10 | 20.3 |  | 11 | 308.9 | 48.1 |
| 10 | 10.7 |  | 21 | 416.0 | 64.8 |
| 10 | 7.0 |  | 31 | 485.7 | 75.7 |
| 10 | 5.4 |  | 41 | 539.7 | 84.1 |
| 10 | 3.9 |  | 51 | 578.8 | 90.2 |
| 49 | 1.3 |  | 100 | 642.8 | 100 |



Figure 20**.** Average research outputs per year (2009-2011) for staff in the Science Faculty. Each point is an individual staff member. Solid circular symbols are Staff who will retire in the next 10 years. The horizontal line is the DHET norm of 1.4 units per year.



Figure 21. Accumulation curve for research outputs over three years for Staff in the Science Faculty.

The analyses so far have focused on quantity but the need to balance quantity with quality and to report both is a very real one. It is acknowledged that measures of quality can be contentious and that no single measure is likely to be equally appropriate across the Science Faculty however, here we use some of the measures that are readily available.

The Science Faculty now hosts six SARChi Research Chairs. By comparison, NMMU has four and UJ three in their Science Faculties.

The number of NRF rated researchers in the Science faculty is 47 and there has been a pleasing increase during 2013 (Table 22, Figure 22). It is important to note that of the 47 rated staff members, eight are either attached to research groups or are Emeritus Professors. It is not been easy to find comparable data but UJ has 46 rated scientists in a much larger Science Faculty. It is accepted that an NRF rating may not be appropriate for all staff but it should be expected that most Staff in a science faculty that places emphasis on research would have a rating.

Table 22 & Figure 22. Changes in the number of staff with an NRF rating. (Data are from the Research Office and exclude retired staff, staff in research institutes and staff on soft money.)



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Year | | |  |
| NRF Rating | 2010 | 2011 | 2012 | Dec  2013 |
| A1 | 0 | 0 | 0 | 0 |
| A2 | 0 | 0 | 1 | 2 |
| B1 | 2 | 2 | 1 | 0 |
| B2 | 3 | 2 | 2 | 3 |
| B3 | 7 | 7 | 5 | 7 |
| C1 | 3 | 2 | 2 | 7 |
| C2 | 11 | 12 | 13 | 14 |
| C3 | 2 | 2 | 2 | 6 |
| Y1 | 1 | 1 | 2 | 4 |
| Y2 | 4 | 4 | 4 | 4 |
| total | 33 | 32 | 32 | 47 |
| % of all staff | 36 | 34 | 34 | 46 |

Another possible measure of recognition is the *h*-index and while it certainly favours some disciplines over others, it is an easily accessible measure. For the Staff in the Science Faculty, the *h*-index (without self-citations) ranges from 1 to 30 using the full Scopus record (Figure 23).



Figure 23. *h*-indices for all Staff in the Science Faculty. (Scopus full record excluding self-citations; each point is an individual staff member. Solid circular symbols indicate Staff who will retire in the next 10 years.)

*Strategies to broaden the base of active researchers in the Science Faculty*

The uneven distribution of research activity through the faculty and the fact that many of the very productive researchers are senior academics, 5-10 years from formal retirement, could be seen as a threat to sustained research output. It is important to counter these threats by ensuring that there is a group of mid-career researchers to replace the top researchers when they retire, that we attempt to broaden the base of active researchers by facilitating research, that we ensure that all new staff with a PhD are given the support needed (start-up costs and postgraduate bursaries) to ensure that their research does not lose momentum, and that we create opportunities for staff without a PhD to complete this degree.

Figures 20 and 23 indicate that while we will lose some of our most productive researchers in the next 5-10 years, there is a cohort of mid-career academics who will take their places. The recent award of three more SARChi Research Chairs in the Science Faculty has further strengthened our research productivity. In addition to the Research Chairs, there is a group of about seven mid-career academic staff members each with more than 100 papers and a further group of about five with very high *h-indices* but fewer papers.

We now do what we can to provide all new staff with at least one MSc or PhD bursary and in some cases we are able to assist with start-up funds to set up a basic research laboratory. The Faculty does not have the funds to support either of these strategies and they require collaboration with the Research Office.

In discussion with all new staff and all Heads of Department, the need to support research and to broaden the research base is made very clear and Heads and Staff are encouraged to speak to the Dean or Deputy Dean if they are not able to undertake research. The Dean’s Discretionary research Grant is a very small amount of money available to the Dean and faculty and is used to facilitate research by clearing small bottlenecks.

**5.2 Postgraduate numbers and throughput**

Postgraduate numbers have increased by 100% between 2002 and 2013 (Table 23; Figure 24) while staff numbers have increased by 12%. The increases in numbers of postgraduate students and the average number of postgraduates per Staff member are both impressive and concerning. Firstly, it is important to appreciate that the average number of students per Staff member will be less than shown in Figure 24 as this is based on 102 academic Staff and excludes researchers, research officers, Postdoctoral Fellows and Staff at associated Institutes such as SAIAB, SAEON and the Albany Museum. Nevertheless, the increase in student numbers has been sharp and it is very unlikely that this rate of increase can be sustained. Indeed, in the very recent enrolment planning exercise (2014-2019) all departments have predicted that postgraduate numbers will plateau, some sooner than others.

Table 23 and Figure 24. Summary of the changes in numbers of postgraduate students from 2002 - 2013. Figure 24 shows the change in numbers of postgrads per staff member. (Data from the statistical digest for 2002 – 2012 and Faculty web site for 2013.)



|  |  |  |
| --- | --- | --- |
| Year | Postgrads | Staff  members |
| 2002 | 341 | / |
| 2003 | 341 | 91 |
| 2004 | 357 | 87 |
| 2005 | 350 | 88 |
| 2006 | 387 | 87 |
| 2007 | 395 | 89 |
| 2008 | 405 | 89 |
| 2009 | 463 | 89 |
| 2010 | 518 | 92 |
| 2011 | 484 | 94 |
| 2012 | 621 | 97 |
| 2013 | 681 | 102 |

An obvious concern is the ability of or capacity for our Staff to provide appropriate supervision for these students and it is encouraging to see that graduation rates have not changed substantially (Table 24). Average completion rate for PhD students between 1991 and 2006 was 73% and for MSc students, it was 80% (Table 24). While the completion rates may seem acceptable, over the period of analysis, 102 PhD students and 157 MSc students failed to complete. There will be various reasons for these failures some of which will have been unavoidable. Nevertheless, this represents a substantial waste of funds and effort. The average number of years taken to complete a postgraduate degree over the same period (1991-2006) was 2.6±0.7 years for the MSc and 4.4±1.4 years for the PhD. These data are now dated and the number of postgraduate students has climbed by 300 since 2006. There is a need to repeat the above analyses to see if there has been a change in success.

Table 24. Numbers of MSc and PhD students starting and completing degrees between 1991 and 2006. (Data from Pat Terry.)

|  |  |  |  |
| --- | --- | --- | --- |
| Degree  and years | Students | | |
| Number  starting | Number  graduating | %  graduating |
| **PhD** |  |  |  |
| 1991-1998 | 164 | 128 | 78% |
| 1999-2006 | 218 | 152 | 70% |
| 1991-2006 | 382 | 280 | 73% |
| **MSc** |  |  |  |
| 1991-1998 | 337 | 260 | 77% |
| 1999-2006 | 467 | 387 | 83% |
| 1991-2006 | 804 | 647 | 80% |

Although not a proper substitute for the analysis mentioned above, it is possible to get a feel for changes in success rate by plotting postgrad numbers and postgrad graduation on the same graph. Changes in numbers of registered students should be followed three to four years later by a similar change in numbers of graduating students. This can be seen to some extent in Figure 25 where the increase in numbers of students from 2007 to 2012 was followed by an increase in the number graduating from 2010 to 2013 (Figure 25).



Figure 25. Changes in the number of registered MSc & PhD students and the number of these students graduating each year.

**5.3 Postgraduate demographics**

The majority of postgraduate students are White. The number and proportion of African students (all nationalities pooled) has increased by 150% from 2002 (111 and 32.6% of the total) to 2013 (278 and 40.4%) (Table 25; Figure 26). The number of Indian students has declined gradually and the number of Coloured students has always been low. Male postgraduates outnumber females and there is no indication of this changing (Table 25; Figure 27). While these numbers are for the Faculty, there are substantial differences between departments and between research groups within a single department.

Table 25. The demographics of postgraduate students in the Science Faculty. (Data are from the Statistical Digest; all nationalities pooled.)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Postgraduates | | | | | | | | | | | | | |
|  | Indian | | African | | Coloured | | White | | Male | | Female | | total |
|  | Total | % | Total | % | Total |  | Total | % | total | % | total | % |
| 2002 | 21 | 6.2 | 111 | 32.6 | 6 | 1.8 | 203 | 59.5 | 196 | 57.5 | 145 | 42.5 | 341 |
| 2003 | 18 | 5.3 | 106 | 31.1 | 6 | 1.8 | 211 | 61.9 | 199 | 58.4 | 142 | 41.6 | 341 |
| 2004 | 21 | 5.9 | 91 | 25.5 | 12 | 3.4 | 233 | 65.3 | 209 | 58.5 | 148 | 41.5 | 357 |
| 2005 | 14 | 4 | 98 | 28 | 5 | 1.4 | 233 | 66.6 | 220 | 62.9 | 130 | 37.1 | 350 |
| 2006 | 17 | 4.4 | 121 | 31.3 | 6 | 1.6 | 243 | 62.8 | 232 | 59.9 | 155 | 40.1 | 387 |
| 2007 | 17 | 4.3 | 126 | 31.9 | 6 | 1.5 | 246 | 62.3 | 246 | 62.3 | 149 | 37.7 | 395 |
| 2008 | 15 | 3.7 | 135 | 33.3 | 6 | 1.5 | 249 | 61.5 | 232 | 57.3 | 173 | 42.7 | 405 |
| 2009 | 13 | 2.8 | 180 | 38.9 | 7 | 1.5 | 263 | 56.8 | 271 | 58.5 | 192 | 41.5 | 463 |
| 2010 | 13 | 2.5 | 204 | 39.4 | 5 | 1 | 296 | 57.1 | 300 | 57.9 | 218 | 42.1 | 518 |
| 2011 | 21 | 3.8 | 220 | 39.8 | 2 | 0.4 | 310 | 56.1 | 310 | 56.1 | 243 | 43.9 | 553 |
| 2012 | 24 | 3.9 | 256 | 41.4 | 7 | 1.1 | 332 | 53.6 | 350 | 56.5 | 269 | 43.5 | 619 |
| 2013 | 18 | 2.6 | 278 | 40.4 | 14 | 2.0 | 378 | 54.9 | 389 | 56.5 | 299 | 43.5 | 688 |

27

26



A

B

Figures 26 & 27. Changes in the demography (26) and gender (27) of postgraduate students in the Science Faculty. (Data from the Statistical Digest; all nationalities pooled.)

**5.4 Research Officers, Postdoctoral Fellows and Research Groups**

The research efforts of the Science Faculty are strengthened enormously through the activities of Staff who are not directly employed or paid from University funds. In this group I include the Postdoctoral Fellows, Researchers, Research Officers and Research Assistants and managers who are paid with funds raised by members of the academic Staff. In addition, allied Research Institutes such as the Albany Museum, SAIAB and SAEON, contribute to the research ethos, postgraduate supervision and research outputs, and bring numerous benefits to the Science Faculty. Maintaining our excellent working relationships with these institutions is a priority.

The Institute for Water Research (IWR) and The Institute for Environmental Biotechnology (EBRU) have elected to be part of the Science Faculty and their Staff are active within the Faculty. The IWR brings with it a focus on teaching & learning and research in various aspects of water that are both fundamental and in many cases strongly applied and shares a growing focus with colleagues from some other departments on transdisciplinary research. EBRU brings an applied focus on biotechnology and waste remediation and both institutes add to the range of areas in which our students can study.

The small size of Rhodes works against the formation of research groups. Our departments are all small and there is a need to ensure that the academic staff have the expertise to teach the required curriculum content. This reduces the likelihood of a department being able to appoint two staff with similar research interests. Thus groups form through the appointment of Postdoctoral Research Fellows, or research staff or through collaboration within and between departments and outside Rhodes. In the Science Faculty there has been no top down pressure to develop research groups or focus areas and the groups that exist have developed naturally around one or more active researchers. The approach to formalizing the group structure varies within the faculty with some Staff avoiding any formal structure or name for their group and others developing a more formal organization. Whatever the case, it is clear that most of the very productive researchers in the Science Faculty are active members of, or leaders of at least one and often more than one research group. Research groups bring with them a range of benefits including a critical mass of personnel, a range of skills and interests focussed on answering often complex questions, and increased supervisory capacity. These attributes work together to support large postgraduate schools and high levels of research productivity.

An important role for the Dean and Deputy Dean is to support and facilitate the development of research groups but not to drive the process. The organic growth and demise of research groups, which has characterized the Science Faculty up to now, is the desired route to follow.

**Research and postgraduate education: Future**

There is no doubt that research and postgraduate education in the Science Faculty is healthy. There is also no doubt that we can do things better. The strong upward trajectories in numbers of postgraduate students (100% increase between 2002 and 2013), graduating postgraduate students (108% increase between 2003 and 2012) and papers (88% increase between 2003 and 2012) begs the question of the extent to which such increases are sustainable. It is also the case that the research endeavour has not been equally spread through the faculty with one third of the staff producing three quarters of the outputs. However, with new appointments there are now signs of this changing.

Amongst the top researchers, there are a number who will retire in the next 5 – 10 years but there is a strong cohort at the Professor, Associate Professor and Senior Lecturer levels who will take their places. The development of three new SARChI research Chairs in the Science Faculty will provide a further boost to research.

It is not expected that all staff will either want or be able to increase their research outputs. However, to ensure that the Science Faculty is able to maintain or further increase its research outputs, we will need to find ways to assist those staff who are on an upwards trajectory, while neither neglecting the top researchers or those at the start of their careers. It is understood that not all staff have the same opportunities for research and while identifying staff to support we will consider performance relative to opportunity.

Direct research funding to the Science Faculty is limited and all strategies to further support research will need to be in collaboration with the Research Office.

During 2014 we will reanalyse postgraduate completion rates and years per degree. Depending on the outcome of this, strategies may have to be developed to improve completion rates.

There would be value in a regular (once per year or once every two years) meeting between the Dean, DVC Research & Development and individual Heads of Department along similar lines to those held with the Director HR.

The faculty will need to review the need and benefits of better and more aggressive marketing to attract prospective postgraduate students from other universities in South Africa and Africa at-large. Recent statistics from the Communications Division suggest that the bounce rate, a measure of how long visitors spend on a website, has decreased significantly for departmental websites that have been revised for clarity. The same set of numbers encouragingly shows that Rhodes University now ranks among the top three of highly searched-for South African institutions online. We need to exploit these developments by working with various departments to recognize marketing as opposed to reputation alone as a way of attracting and competing for good students who will add value to our research endeavours. The Science Faculty web site remains a work in progress and while what we have is a source of much very valuable information, it does little to show case our excellence.

It is widely acknowledged that during an academic life, one continually develops, acquires or learns certain skills that are necessary to improve performance. The Faculty of Science has one of the best research outputs in terms of graduates produced, published papers and research outputs. It follows then that the faculty also has some of the best informed or skilled researchers and academics. In an attempt to exploit this collective strength to improve the research capacity, the Office of the Dean established the transferable skills programme. This consists of a range of workshops and short-courses designed to address particular research related problems. Although the programme should benefit even the more seasoned researchers, it is envisaged that the primary target audience might be upcoming researchers, academics returning to research after many years’ break, others interested in picking up a new skill and of course postgraduate students. The first of these workshops, on academic writing in a scientific discipline, was run in 2012 and 2013 and was well attended. There is scope to extend this to include short courses and training in techniques and skills including GIS and statistics and this will be a priority for 2014.

1. **Community Engagement**

Community engagement is not infused equally across the Science Faculty but is a very important part of the lives of many of our Staff. It is seen in its various forms through the faculty and a few examples are highlighted below.

**6.1 Present activity**

*Engaged research*

There is increasing interest in the Science Faculty in engaged research, in which the research involves close co-operation with the community that will contribute to, and benefit from the research. Engaged research begins at the start of a research process, and the research questions, methods and process are co-created with the community. The researchers benefit from the deep contextual knowledge of community participants and this increases the likelihood that the research outputs and outcomes will be used by the community. In these instances “community” is a broad category, including residential-, user-, or management communities – or combination of these. This particular research practice could become characteristic of Rhodes, and has the potential to contribute strongly to the process of transformation.

*In Service Learning*

In service learning is not widespread through the faculty and is certainly more easily instituted in some departments rather than others. Good examples are seen in Entomology, Chemistry and Human Kinetics & Ergonomics.

*Interactions with Scholars*

1. Staff and students from many departments interact with scholars in an effort to broaden knowledge and better prepare the scholars for entry to university. An excellent example is the *Khanya Maths and Science Club,* the aims of which areto develop a passion for maths and science amongst learners most of who come from schools that are not equipped to teach these subjects properly. Staff and students from the Chemistry Department co-ordinate, run and teach at the *Khanya Maths and Science Club* andClasses are held every Saturday morning.
2. *Rhodes University Maths Experience:* The Rhodes University Mathematics Experience is an afternoon of competition, enlightenment and fun for High school learners of the Makana District of the Eastern Cape. It is held in February every year on the Rhodes University campus. The inaugural event was held in February 2012 and attracted around 270 learners from Grades 8 – 12 from schools surrounding Grahamstown. The following year, the event grew to close on 400 learners and indications suggest that this trend could continue. At this stage, schools are limited to five participants per grade. Three papers are set: one for Grade 7 and 8 learners, one for Grade 9 and 10 learners and one for Grade 11 and 12 learners. For ease of marking, the answers to all the questions are simple numerical ones. Prizes include calculators, books and money and Rhodes University bursary. In 2014, a new prize of a fully funded trip to either the SKA or the South African National Space Agency Observatory at Hermanus was awarded to the top learners from an under-resourced school.
3. *Internships*: A number of Staff and Departments invite learners from Grahamstown schools to spend time in research laboratories.
4. *Pollutant’s Tale:* This is an interactive display that illustrates some aspects of global warming and the effects of pollution and has been taken to schools in the Eastern Cape Province by Staff and students in the Chemistry Department.

*Popularisation of Science*

This takes many forms through the faculty, from the contribution of popular articles to newspapers and magazines, to the presentation of displays and workshops at SciFest, and popular talks to schools and the Grahamstown community.

**Community Engagement: Future Plans**

The Faculty will continue to support and encourage the full range of community engagement activities. The dean will continue to nominate staff and research groups for the Vice Chancellor’s Distinguished Community Engagement Award.

1. **Conclusion**

The Science Faculty is strong in research and postgraduate education, strong in undergraduate education although there are worrying trends that must be addressed, and has a developing strength and reputation in community engagement. We have got where we are without close supervision or top down steering, without an agreed on purpose or vision and without a strategic plan. While we may be satisfied with our current size and shape and proud of our strengths, it is questionable whether we can continue for the next 20 years without better planning. At the simplest of levels some of our undergraduate teaching laboratories are full every week day afternoon and we must either halt growth or think differently about how we educate the students and use the laboratories. This transformation report paints a picture of where the Science Faculty is at present; our next task is to produce the Faculty Development Plan which will guide us for the next 20 years.