Caltech

It is my first day at Caltech and I am handed a map of the campus. It easily fits onto a letter sized page and as drawn from above looks like any standard campus: a host of academic buildings crowded around the lunch and coffee quarters in the middle.

From the map alone it is certainly not clear what gives this university its ranking as the world's number one. (Although the scale suggests it might have something to do with its eliteness.)

TAPIR, the Theoretical Astrophysics Including Relativity group, sits on the third floor of the Cahill Centre - a burnt orange building on California Blvd, whose floors and windows were shaken out of place, before resting it on its foundations. Here it stands ready to brave real shocks from the San Andreas fault.

It takes me weeks to find my bearings on the inside amidst slanted walls and storeys angled relative to each other. In my third week I find that making an earlier left turn brings me to my office door much quicker.

Even on campus this is a strange building. The majority of it being built in the traditional Spanish mission architecture of Southern California. And although at first I find it odd that any consistent research could come from such a disorientating spaceship-like home, I would soon learn that the inhabitants of the third floor have a well-balanced physics diet and exercise routine in place.

The TAPIR colony is made up of several role players. At the top of the hierarchy stands prof. Kip Thorne, a legend in his field of expertise and an inspiring presence felt in something as simple as passing his name plaque and photo in the hallway. Thereafter follow the professors, the post docs and the graduate students – all in different phases of their careers as researchers.

It might seem like a very obvious structure to have, but without the right population and interactions between the different levels, the joint efforts would not be as successful as they clearly are.

What struck me as the most different from my university back home, was the culture of becoming, being and having post docs. (We have exactly three in the Stellenbosch Physics department, spread over different fields of physics).

Graduate students at Caltech seem to be working towards not only earning their PhD, but are at the same time hoping to become post docs and are actively considering the schools they would want to apply to. Graduates form a collective - peers who can support and encourage each other during the highs and lows of being a PhD candidate at a demanding and reputable school such as Caltech.

Being a post doc, means a more steady income for at least two years and the freedom of pursuing research perhaps more out of your own interest than your supervisor’s. On top of that you don't necessarily have the obligation to teach. And just like the graduates, post docs serve as inspiration.
and motivation to one another.

Typical examples of interactions within groups include something as simple as having a bite together. Once a week graduates have graduate lunch where, in the span of an hour, one graduate provides lunch (on the budget of the department - naturally) and another graduate presents any piece of research he or she has come across and thinks the others could benefit from.

Post doc lunch is a daily trip to the cafeteria. Forcing everyone to take a walk, get some fresh air and remind each other why doing the research they do is actually quite exciting. Gate crashing these lunch trips every now and again, I learned that talking about physics and physicists can apart from being insightful also be relaxing, lighthearted and funny.

So much for the healthy physics diet, what about the physics exercise routine? The idea of groups most certainly don't rise and fall with post docs conversing with post docs and graduates with graduates alone. Of course not. The aim of groups are to get researchers, be they professors, post docs or graduates to work together and produce concepts and research of significance. It is in this context that I think having post docs plays an important role. They bridge the gap between professors and graduate students, both in age and level of knowledge - causing all levels to interact more easily and freely.

A typical graduate student at Caltech, will not have a "project description" saved to the hard drive of his (or her) laptop. He will have a principal advisor and most likely also a primary project he works on or at least started out working on, but as time passes it's best for the student to try hook onto other projects in the group too. He searches for people he can collaborate with, so that he can learn more from them and have the chance to contribute to papers that will get published.

I really like this idea. I feel you will never learn as much or as fast from studying by yourself as you can from direct interactions with people who have much of the know-how readily available. Even if it means not answering your questions directly, but pointing you to previous valuable research done in a specific field, or other papers, texts and authors worth reading.

At first your contribution to the output may seem secondary, but as you get more involved and clued-up, you will be able to deliver more - making yourself unmissable to the project.

Writing papers with others, that have a background in publishing, has the added benefit of teaching you what a well written paper looks like and how to present research clearly and logically.

Group work, especially being connected to a group who pushes to get research done and published, can also add to the actuality of your experience as a physicist. Part of the run up to publishing, means to know what other groups at other universities are doing, and how it links or compares to what your group is working on and aiming to achieve.

In order to keep up with the physics, or at least general relativity research, the TAPIR’s have within their exercise plan, an archive work-out. Once a week they gather to discuss the articles that have
newly appeared that week on the gr-qc (the archive for General Relativity and Quantum Cosmology). Apart from informing you of current research, it also helps you to get to know other players in the field. And again the presence of fellow graduates and professors or post docs that have more exposure than yourself, speeds up your learning process on who is doing what, where and why. Handy information to have when, for instance, you start thinking of where to apply for a post doc position.

At Caltech, even strict theorists like most of the analytical and numerical relativists, can feel part of the experimental world with the LIGO project's management just across the road and NASA's Jet Propulsion Laboratories (JPL) a 20min shuttle ride away. It reminds us all just how much of intricate physics systems are constructible and can amount to incredible applications, encouraging theorists to let their imaginations take off.

It is my hope that if South Africa could host a scientific project, with the international stature like that of the Square Kilometer Array, it will bring an inspirational surge to the country's physicists, injecting them with a sense of boldness and creativity.

My visit to Caltech has shown me how attainable the goal of creating trend setting institutes in South Africa is. We have so much to be grateful and proud of here. I arrived at the world's number one university with only Stellenbosch's educational background to back me up. And even while walking into the field of general relativity, to which my exposure has at most been several months, I felt more than willing to take on the challenge of being one of them.

If we actively focus on creating specialised groups, where constant interactions between professors, post docs and graduate peers are a top priority we will be well away to competing and even surpassing the world's best ranked universities. South Africa, being in a phase of scientific development, has the advantage to create a healthy scientific research community than can reflect the diversity and inclusiveness of the country from the start.

Being new to the construction of research institutes we have the chance to do so in line with the state of the art communication technology. Younger generations are growing up with a strong focus on interaction and access: newspapers, books and hard copy journals have made way for the highly interactive internet, where you can simultaneously read, chat and follow links to further information or media like videos and simulations.

To have an academic experience in sync with this lifestyle means operating in a world where you and your research is well connected to both other research and researchers. An education system, be it primary, secondary or tertiary should always aim to keep its standards connected to and on par with other role players in the world. And with so much to offer I find it hard to imagine that other institutes would let the opportunity of being connected with and even visiting South Africa, slip them by.