



Organic chemistry in South Africa

Willem A. L. van Otterlo

Department of Chemistry and Polymer Science, Stellenbosch University, Stellenbosch, 7600, South Africa
E-mail: wvo@sun.ac.za

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It is an absolute honour to be able to preface a special issue on “Organic Chemistry in South Africa” in the 2020 volume of *Arkivoc*. Many South African organic chemistry practitioners have enthusiastically responded to my invitation to provide manuscripts for this issue, and it is my hope that the papers submitted will reflect the breadth and width of organic chemistry expertise across the country.

Reflecting on the “vital signs” of organic chemistry within South Africa, it quickly becomes apparent that there are many complex factors affecting the health of the discipline. I thus decided to undertake my analysis by way of a brief SWOT-type protocol, i.e., strengths, weaknesses, opportunities and threats pertaining to the subject, whilst keeping in mind the potential pitfalls and limitations of this approach. In South Africa, the descriptor “organic chemistry” covers a very broad field, encompassing synthetic methods development to natural product isolation and some arguably more applied fields such as medicinal chemistry, polymer chemistry, catalysis, organometallic and inorganic chemistry (the latter three specifically with respect to ligand design and synthesis). This aspect places the South African organic chemistry community in quite a unique space on the African continent since, apart from a few more northern African countries, the phrase “Organic Chemistry” essentially implies research focussed on natural products chemistry (i.e. isolation and structure elucidation).

One of the reasons for the strength of organic chemistry at the geographical tip of Africa is the infrastructure found at many universities there, encompassing equipment and expertise required for organic chemistry to thrive. This includes NMR, mass spectroscopy and X-ray crystallography facilities. It should be noted that these facilities are not equally distributed, with mainly the larger historically-advantaged universities being well equipped. In the last two decades, national equipment programs (through governmental funding agencies) have achieved greater equitability by the creation of regional equipment

facilities to be utilized by more researchers. In addition, many of the larger universities have small focussed cohorts of established organic chemists who perform their science within the wide arc of synthesis. It is also through these academics that the subject of organic chemistry maintains a high visibility in the curricula of many South African undergraduate programs. I would argue that a major reason for the current health of organic chemistry is the strong relationships between its practitioners. Firstly, on a local level, the enthusiastic support of the South African Chemical Institute's (SACI) organic chemistry-focussed, biennial Frank Warren conference¹ is a good indicator of the health of the discipline. This support is also depicted by the more sporadic, but also important, publication of synthetic organic-chemistry-focussed manuscripts in the South African Journal of Chemistry, an open-access journal with a more than a 100 year history.² Secondly, international interactions are another strength within the organic chemistry community – a world map showing links between South African and the rest of the globe would not leave many countries unlinked!

I will deal with perceived weaknesses and follow this with some thoughts on the “threats” to the discipline of organic chemistry in South Africa (whilst recognizing that the discussions often fall within both categories). The aging group of organic specialists in South African academia, the same frequently becoming more entrenched in senior administrative roles, is a definite concern. Furthermore, the relatively limited involvement of industry, particularly that of the pharmaceutical industry, with organic-minded specialists is also a significant weakness. The credible perception that organic chemistry and its related applied disciplines are very expensive to maintain within an academic environment represents a further significant challenge. This threat is currently exacerbated by a staggering and most unfortunate decrease in national research funding for more basic research, which includes organic chemistry. A complicated web-of-reasons, which amongst others, include a stagnant economy, decrease in tax revenues and other priorities seen as more urgent than higher education, has resulted in significantly less funding for more-longer-term research performed at tertiary institutions. Very few researchers within South Africa have not felt the adverse effect of decreasing budgets and the changing policies of our National Research Foundation (NRF), with fundamental organic chemistry often bearing the brunt. I would identify the paucity and insecurity of funding for synthetic chemistry practitioners as being the most significant threat to the discipline and predict that if this matter is not recognized and dealt with soon, it will lead to the decimation of academic groups able to afford to continue activities within the broader area of organic chemistry. At a minimum it will result in the contraction of the number of universities where this chemistry is pursued to a few “super groups”. A second cause for concern is that, amongst scholars and university students, it is anecdotally opined that organic chemistry is a very difficult subject, which at the end of the course provides a relatively undefined career path. To this end, I am convinced that the chemical industry could do much more to play a greater role within the school and university career-guidance sphere, as ultimately this industry has much to gain from more young people recognizing the rewards of being creative with carbon-based molecules. I would also argue that with government focussing on many more urgent, shorter-term national problems, the private sector should realize that investment in fundamental science, which includes organic chemistry, would provide significant benefits to all within the South African resource-based economy.

An honest appraisal of the state of organic chemistry within South Africa would include a reflection that within the discipline, academic practitioners are still under represented with respect to race and gender. Acknowledging this important issue, I would however like to visualize the solution by recognizing the many excellent young researchers, coming from a variety of backgrounds, now entering academia. The past 20 years have also brought to the forefront of our discipline a number of respected black, coloured and Indian researchers who have become important South African chemistry ambassadors and role-models.

I am also of the opinion that there are many more opportunities through South African industry, particularly with the aim of increasing the impact of chemistry within the economy as a whole. I would further suggest that there is much “low-hanging fruit” in terms of academic involvement in the local pharmaceutical industry – one just has to recognize that academia should get involved in terms of the goals of the new National Health Initiative,³ particularly with respect to the application of disruptive technologies involved in, amongst others, the synthesis of active pharmaceutical ingredients (APIs).⁴ Secondly, the general scientific goodwill from the international community that exists towards South Africa needs to be harnessed and extended to generate more knowledge-sharing opportunities. In addition, relationships with other African countries should be developed even more, specifically to address African challenges through neighbourly collaborations in order to provide organic chemistry solutions. Lastly, I would like to point out just one major competitive advantage within South Africa, which organic chemists should utilize to maximize their impact on the greater research environment. Geographically, South Africa has the benefit of being quite unique with respect to its natural product world – on land and sea – providing plenty of unexplored opportunities. When one adds to this a very rich indigenous cultural history, it means that the study, development and renewable utilization of the wealth of South Africa’s living systems will certainly increase the value of research by South African organic chemists to the economy and society as a whole. I trust that this special issue on “Organic Chemistry in South Africa”, published in the 2020 volume of ARKIVOC, will provide evidence of the value of organic chemists in pursuing the goals described above.

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