first-degree diploma students that are Arab, benefit from the boycott? Why boycott the only institutions that consistently employ between four and eight Arab professors each year (about 1.2% of all academia members; Al-Haj, 2002)? Only recently, Professor Majid Al-Haj was appointed Vice President and Dean of Research at Haifa University. During 2005, the Israeli Open University granted first-level university degrees to about 100 Palestinian prisoners, who are in Israeli prisons. Unlike in South Africa, Arab and Israeli students share the same dormitories, classrooms and hospital beds; Israeli academic institutions are considered to be the biggest 'melting-pot' in Israel.

Cases where Palestinian students and professors were denied entry into Israeli territory are constantly used as facts to justify a boycott against Israel. However, we need to bear in mind that in the face of the threat of terrorism, it is necessary to ensure the security of Israeli citizens from suicide bombers, who come in all sizes and shapes—from women to children and even students (Israel Security Agency, 2009). Nonetheless, Palestinian students who have begun to study at Israeli universities have been permitted to complete their studies in these institutes (Traubmann, 2006).

We need to look at the situation from a different angle without spiralling into a full-scale political debate. The boycotters try to convince the reader that their view leads to only one conclusion. However, observations are prone to different interpretations. One interpretation of the recent war in Gaza is that only Israel violated human rights; however, Colonel Richard Kemp, a decorated former Commander in the British Forces, provides a different interpretation (Kemp, 2009). In his article, Kemp claims that Hamas fighters discarded their uniform once the fighting began and used women and children as suicide attackers, which is clearly a violation of human rights. This example already undermines the boycotters' certainty in their conclusion. Another example of wrongful interpretation is seen by simply reading the title of Steven Rose's column that mentions a country (Palestine) that ceased to exist on 14 May 1948.

The 'so-called' academic boycott claims to target Israeli academia in order to change Israeli policies, yet it targets the wrong body and intentionally targets Israel alone. Boycotts seem to fall short of their initial aim (Jacobs, 2009). Enticing call-outs only feed the extremists. Boycott

promotes alienation and impedes communication, which is the opposite of what academia stands for. Scientists and scholars are primarily teachers, who should teach and not preach. We should leave the political campaigns to politicians, while they leave the teaching to us.

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Response by Steven Rose

Neither Shai Berlin nor Ari Elson attempt to refute the facts in my Opinion column, nor show any concern for the routinely abrogated academic freedom of their colleagues in the Palestinian universities in Gaza or the West Bank. Instead, they argue that issues of human rights and politics should not intrude within the walls of academia. Yet, politics intrude inevitably into their letters. Berlin suggests that the boycott campaign is an anti-Israel conspiracy—even though the boycott would apply to Israeli academic institutions but not to Israeli citizens working elsewhere. Nor, despite Berlin's claim, is the boycott call timed to relate to Israel's Gaza massacres or the Goldstone report; rather, it is part of a growing global movement, from civil society, churches and academia, for Boycott, Divestment and Sanctions.

Elson justifies roadblocks as a measure to prevent suicide bombing of civilians, acts of terror that I join him in condemning. But he implies that these roadblocks are within Israel itself, that is, behind the 1967 borders. In fact, hundreds of such blockades straddle roads within the West Bank, closing Palestinian cities, preventing farmers reaching their lands, the sick from health care, and staff and students access to their schools and universities. The West Bank is also criss-crossed with 'Jews only' settler roads on which Palestinians may not travel. The illegal Jewish settlers—400,000 of them—drain the aquifers for their swimming pools and leave hundreds of thousands of Palestinians without access to running water, as documented by Amnesty International. It may take two to tango, as Berlin states, but the tango involves two

evenly matched partners. Israelis should not be surprised to discover that the asymmetry of illegal military occupation, expropriation and poverty breeds resistance.

Berlin writes from Tel Aviv University (TAU), which has participated in 55 joint technological projects with the Israeli army over recent years, mainly in electro-optics (Keller, 2009). TAU's campus occupies the site of a demolished Palestinian village, Sheikh Muwanis, whose inhabitants were forcibly evicted in 1948. His staff club, the Green House, was once that of a Palestinian village elder. Berlin claims, in flat contradiction to the United Nations and international opinion, that since 1948, Palestine as a country "does not exist". Is this denial a neutral scientific claim, or an endorsement of a political agenda?

Berlin points to the presence of 'Arab Israeli' students in Israeli universities. Twenty per cent of Israeli citizens are Palestinian, but only 1% of Israeli academic staff is Palestinian. Berlin fails to mention the discriminatory legislation that gives special benefits and credits to students from the Israeli Defence Force, which excludes Palestinian citizens of Israel. He says nothing of the many well-documented examples of racist harassment by professors and Jewish students of Palestinian students on the campuses of Haifa and the Hebrew University in Jerusalem, or of Haifa University's endorsement of a conference—from which Palestinian Israelis were excluded—focusing on the 'demographic problem' of the high birth rate of Palestinian Israelis and the problems this would present for the Jewish State. Think about how this would sound if a

conference in New York on the demographic problem of the Jews excluded Jews.

Israeli universities and research institutions are thus not independent of the Israeli State and its political agendas and acts. Rather, they, and many of the academics within them, are active creators and endorsers. As I emphasised in my Opinion column, a boycott is a tactic, not an end in itself. It

is an effort to persuade those boycotted to change their policies. Berlin claims that it is ineffective. If so, and the policies do not change, so much the worse not just for Palestinians, but for Israel itself and the wider world outside the Middle East.

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Comment on 'Big science, little science'

In his recent Opinion article, Gregory Petsko raised concerns about the hegemony of 'big science' over 'little science' (Petsko, 2009). He argued that the scale of the resources sequestered to expensive, large research projects is "outrageous" and may be missing for small, investigator-driven research. As a result, he argues that big science might be detrimental to research in general. However, a consideration of the apparent anxiety and potential tensions between investigator-driven research and big science—that is, organized multidisciplinary collaborations—should not be based on budget allocations alone. Instead, the benefits of big science should be examined carefully in terms of discovery and value to little science, economic spillovers to industry and national innovation systems, and interactions with society. These realities should be used as guidelines to funding structures and big science may turn out to be the saviour of little science.

During the past decade or so, the breadth and goals of some scientific research have grown to a new dimension that warrants the term big science. This scaling-up has taken place mostly during the late twentieth century, which, according to Hughes (2002), saw the most remarkable growth in the scale, scope and cost of scientific research. In this sense, big science is a natural evolution of scientific research and its increasing interaction with a knowledge-based economy and the ever more connected modern world.

In the post-genomic era of biology, little science can benefit immensely from big science centres that perform high-throughput analyses. According to Wiley (2008), big science centres provide valuable resources

to the scientific community and thereby generate new research opportunities and directions for many areas in the life sciences. One important example is the rapid increase of genomic information, which is being made available directly to most research groups across the globe. However, it has also been stressed that big science, such as large-scale genomic analyses, cannot replace the traditional approach of little science but should rather complement it (Editorial, 2001).

The benefits of big science for economic growth and national innovation systems become more pertinent if we look at how it contributes to the knowledge-based economy and current changes in market capitalism towards so-called "technocapitalism" (Suarez-Villa, 2003). At the heart of technocapitalism are private and public enterprises that rely heavily on research and innovation—in contrast to industrial capitalism, which is production-driven (Suarez-Villa, 2000). It is therefore misleading to think that the only role of big science is the production of knowledge, because in reality it creates many non-epistemic benefits (Autio *et al*, 1996). The potential of spillover effects from big science to the economy via industrial knowledge transfers have been documented extensively: one of the most well known is the profound work that was carried out at CERN during the 1980s and 1990s to develop a Web Data Management system, which led to the establishment of the World Wide Web and the consequent economic and societal revolution (Byckling *et al*, 2000). In addition, big science centres can also serve potentially as an important source of knowledge spillovers in national and regional innovation systems (Autio *et al*, 2004).

Furthermore, the importance of big science to society may be evident in the interactions with non-scientific groups and actors. First, science itself has become a subject of study and debate outside the scientific community. Second, big science reaches beyond its boundaries as it attracts public and media interest and helps scientists to communicate with the public. These interactions will promote more awareness about science among the general public and decision-makers, which, in turn, benefits the scientific community.

In conclusion, big science has a major impact on national economies, societies and the advancement of little science. However, for little science to utilize the benefits of big science, the funding agencies should implement policies that guarantee the growth of little science along with big science.

CONFLICT OF INTEREST:

The author declares that he has no competing interests.

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