Editorial: The Future of Our Basic Science and Scientists

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In our scientific society, the activities of our members are often designated as being in clinical, translational, or basic disciplines. Many of our research grant funding schemes and our journal publications are "labeled" in the same way. In 2015, it has become a familiar conundrum as to how we maintain a balance of these 3 categories, yet integrate the same into collaborative research efforts. A previous editorial, in 2014, reflected on the vulnerability of the physician-scientist in the current and continuing academic climate (1). Now, more than ever, it appears that "basic scientists" are a vanishing species!

"The challenge is to tailor our needs so that a vertical integration of science is maintained; that the bank of knowledge that we have in the basic sciences is not lost forever and can be transferred from one generation to the next resulting in tranformative discoveries and their (unknown) applications."

What is basic about this craft? I really do not know. It seems an inept description of the intent to conduct scientific discovery. Almost 60 years ago, basic research was defined as that research "performed without thought of practical ends" and "the scientist doing basic research may not be at all interested in the practical applications of his work" (2). We are all aware of the obvious fact that basic science feeds translation and clinical application, but the balance is not being supported by funding bodies and the institutions upon which we rely, because research funds have declined. New knowledge and ideas provide scientific capital and this "creates the fund from which the practical applications of knowledge" can be drawn. Today, and as it was 60 years ago, basic research is the pacemaker of technological advance. Proven over time, "many of the most important discoveries have come as a result of experiments undertaken with very different purposes in mind" (2). For example, in 1962, John Gurdon discovered that mature cells can be reprogrammed to become pluripotent and he successfully cloned frogs. Forty years later, Yamanaka overturned a textbook dogma in basic developmental biology and showed that adult, fully specialized mouse cells could be reprogrammed to become cells that behave like embryonic stem cells, known as induced pluripotent stem cells. Induced pluripotent stem cells have the capacity to develop into any type of cell, and this collective knowledge was used to achieve cardiac reprogramming and develop a novel method to regenerate damaged myocardium (3). This example of how discoveries and knowledge progressed from frog to a significant advance in regenerative medicine, and from generation to generation (earning Gurdon and Yamanaka a Nobel Prize), is a point to which I return at the end of this editorial.

Thus, basic science is an investment in long term future without obvious short term gain (4). Similarly, we invest in human capital and workforce capacity by training basic scientists, usually awarding them a PhD. Once trained, what are their career paths? Industry is one option, but many aspire to a career in academia, where they seek to establish themselves with research grants to make advances in the conduct of "investigator driven research." Despite this, research funding in many countries has fallen, and the success rate for grant funding is about 10%. A particular imperative

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for obvious translation is mandated, so the success of basic research grants has fallen even further. The monetary investment by our governments for early career training is also reduced, so basic scientists lose their jobs or leave the field, because there is no obvious sustainable career path. Unlike physicians, they cannot rely on a salary from delivering clinical care or service.

In the circumstance when a basic scientist has an untenured teaching position, he or she may increase their teaching load. Whether the teaching load is light or heavy, teaching requires dedication and is an intensive and demanding pursuit. New teaching methods, such as blended learning, place additional demands on teaching academics because of the time required to prepare course material that is available online. Our students have become "clients," who regard their education as a "fee-for-service"; they expect and demand the very best service. This has led to a vicious cycle, such that excellent teachers, providing the highest quality teaching, cannot dedicate the necessary time to research, research performance falls, and competiveness for grant funding is lost. The consequence is that these early-career academic scientists fail to obtain grant support lacking the credentials required for a tenured academic position. Women become particularly vulnerable! Despite numerous mechanisms to entice women back into research after maternity leave, the figures show that throughout their career, women on average do not advance as far as men. In Australia, the success of women in early career fellowships, career development grants, and project grants remains disappointingly lower than their male counterparts, and there is a continuing failure of women to be taken into the upper ranks (5).

Whether man or woman, many institutional promotion committees present more unnecessary barriers. How often have we seen promotion committees insist that scientists demonstrate "independence" to achieve their academic advancement? How does this align with the fact that greater success is achieved in multidisciplinary and multiinstitutional teams? The day of single investigator laboratories has virtually gone; researchers use core facilities, access expertise and collaborate across departments and campuses, in a local or global context. Independent thought is quite different to being independent with a stand-alone research group. Until we can better measure and assess research performance, and recognize independence in an environment requiring team effort, this will remain yet another barrier to basic research (see also a previous Editorial on the importance of the asterisk in publications) (6).

So what is the solution to the impasse for the basic scientists and are they a species in danger of extinction? It would seem so, but take heart in the fact that the wheel will turn eventually and basic scientists will return to fashion. Timing is of the essence, however. When a tap that has been turned off for a long time is turned back on, water usually flows at the normal rate. If the tap for basic research remains off for too much longer, the source of the water may be cut off! In other words, if we curtail efforts to sustain basic science, the feeders for translational and clinical science will dry up. One cannot translate anything if there is a failure to put a focus back on basic research because there is no material to "translate"! Basic scientists are fragile creatures, requiring recognition of the contributions of their craft and investment in it. Like clinicians the disciplines of basic researchers are many and varied, ranging from bioinformatics/statistics to cell/molecular biologists to bioengineers to physical chemists. "Creativeness in science is of a cloth with that of the poet or painter" and one size does not fit all. The challenge is to tailor our needs so that a vertical integration of science is maintained; that the bank of knowledge that we have in the basic sciences is not lost forever and can be transferred from one generation to the next resulting in transformative discoveries and their (unknown) applications.

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