

## **CSIRO submission to the McKeon Review into Health and Medical Research**

### **EXECUTIVE SUMMARY**

The major health challenge for Australia is to reduce the impact of chronic disease by increasing the healthy life expectancy (or disability-free life expectancy) so that people are healthy longer and by having effective management systems for people already with a chronic disease. The emphasis therefore should be on primary and secondary prevention.

There should be greater emphasis on translational research to balance Australia's investment in basic research. As a nation we are at risk of falling behind in the area of translational research, which we define broadly to include products (such as health technologies and new foods), improved medical procedures, a variety of services provided by governments and industry, public education and support for policy development.

Greater health impact through enhanced performance in translation requires the integration of a range of activities and approaches that fall outside the traditional health research focus area, and include areas such as ICT, health systems research, food production, health technologies, biosecurity, etc. It also requires close collaboration with industry and other delivery partners.

The integration of traditional health and medical research with a translational approach requires high level priority setting and co-ordination and a whole of systems and whole of government approach. This implies a fundamental change to the way in which health and medical research is funded and managed.

Indigenous and global health are major challenge areas which require special focus, attention, co-ordination and funding.

CSIRO is a major investor in health research (approx. \$145m pa) with activities in a range of non-traditional health and medical research areas and can be used as one example of a successful translational approach. CSIRO's research in human health is goal-directed where a broad range of scientific, technical, management and partnering expertise is focused on achieving specific health outcomes.

## **CSIRO submission to the McKeon Review into Health and Medical Research**

### **Overarching comments**

CSIRO strongly supports the strategic review and appreciates the opportunity to formally respond. Our response acknowledges that the current system has served Australia well, however, to position Australia well for the future, changes are needed and our comments should be viewed in that context. You will note from our responses that CSIRO has similarly focused on the four main questions that your Review team has extracted as core. In that approach we have aligned our activities to the Commonwealth Government's objectives as they relate to human health.

We would also like to emphasize the importance we place on human health research and its translation to society. We currently expend approximately \$145m pa comprised principally (~65%) of Commonwealth Government appropriation dollars together with investment from a variety of other public and private sources. CSIRO's research in human health is goal-directed and structured around translation where a broad range of scientific, technical, management and partnering expertise can be focused on achieving specific health outcomes. As we will describe below we see this as a powerful model for funding, managing and translating research into health benefits for Australian society.

"Translation" has historically been used in a variety of ways and to avoid confusion we use the term inclusively to cover a broad range of activities:

- Products, such as health technologies and new foods
- Services provided by governments and industry
- Improved medical procedures
- Evidenced-based science underpinning policy decision making
- Public education to improve health literacy
- Any other activity that results in an impact on prevention and treatment based on an integration of research and an understanding of unmet need

### ***SPECIFIC QUESTIONS:***

1. **Why is it in Australia's interest to have a viable, internationally competitive health and medical research sector? (Terms of Reference 1 and 6)**

#### **General Comment**

There have been historically well developed arguments that have underpinned the concept of a viable internationally competitive health and medical research sector. Much of what we have summarized briefly below can be viewed as self-evident and will be reiterated by others:

**Societal** – from an individual Australian's perspective the principal issue associated with health is the availability and quality of delivery. Research at a highly competent level influences both of those expectations. Firstly the nature and quality of training of health professionals in its broader context is best performed in institutions that are at the leading edge of both knowledge generation

and knowledge understanding. Secondly, the application of research particularly in the area of delivery (simulation, data integration etc.) is in many ways in its infancy but will be a major contributor to curtailing costs while at the same time attempting to maintain expectations. This influence will only occur with the encouragement of the development of medical researchers particularly in the area of information and communication technologies and, most importantly, researchers that are operating at an internationally competitive level.

**Industry** – developed countries such as Australia face the ongoing challenge of shifting research focus to the value added end of the spectrum. This principle applies as much to health as it does to other aspects of business and industry. There are existing examples of this value add, for example, the exports of pharmaceuticals from Australia are currently of the order of \$3.7b. While it is beyond the scope of this response to define additional areas nonetheless it is a topic that should be examined rigorously to identify opportunities for added value industries in traditional health areas and in areas that have not been historically associated with health, for example, data, information and communications technology associated with remote sensing, telemedicine, etc. That analysis should also include industries associated with wellbeing and lifestyle. CSIRO has made a major impact in this area, particularly through its efforts with the Total Wellbeing Diet platform and related areas.

**Global Profile and Access** – it is often stated that Australia contributes approximately 2% to total global new knowledge generation. With the rise of China and India this figure may reduce to 1%. Without a highly trained and internationally connected and competitive research community, Australia would not be able to access the other 98% and as a nation we would be deprived of major health advances that occur elsewhere. Being internationally competitive has been critical to having access to international developments. We believe we are now at a stage where the paradigm should be “collaborating with the best internationally” rather than “competing with the best” because the scale and complexity of the problems in achieving health and wellbeing require major international collaborations based on scientific excellence. Without a viable research community Australia will not be included in those international collaborations.

## **2. How might health and medical research be best managed and funded in Australia? (Terms of Reference 2, 3 and 7)**

Funding processes must support and follow strategy. It is beyond question that funding models and management processes help define the culture that underpins effective delivery in health and medical research. Compared to our achievements in basic research, Australia is falling behind in translational research and to redress this will require not just a management change but also a cultural change. Accordingly, there is a need to take a whole of government view of translation of health and medical research into better health and wellbeing.

A funding model and management model must be one that promotes research but also delivers to better health and wellbeing and this will require skills broader than in the traditional health area. Our specific comments under these headings are as follows:

### **Management and cross-discipline input**

We would argue strongly that to position Australia well for the future, a health and medical research sector that is going to deliver impact in the area of better health and wellbeing must be one in which the contributions to research come from areas not only within the easily recognizable traditional areas of funding for medical research but well beyond. This is best illustrated by example. Obesity research to be effective must be able to incorporate traditional basic and indeed

clinical research with allied activities associated for example with the food industry, with consumer sciences and with the built environment to name but a few. Taking a whole of systems approach is essential and it is very unlikely that any single proposed solution in isolation will have a major impact, be it at the level of the individual or of society. Rather it is the co-ordinated and mutually reinforcing actions of multiple approaches that will result in positive health impacts.

This implies there must be a framework for managing such an approach. The oversight of the health and medical research sector should be one which incorporates effective governance with domain knowledge from fundamental research, clinically applied research, social and behavioural research, policy research and the relevant industries. Such a governance approach would also incorporate skills in managing the path to impact (project management).

### **Funding**

Throughout the world a significant component of health research funding has historically been based on the principle of excellence and no one would doubt the appropriateness of that endeavour. However, if the intent is to translate medical research into better health and wellbeing then funding must be organised to maintain excellence (for all the reasons outlined above, Terms of Reference 1 and 6) but equally to support and provide for a translational agenda which may rely more on effective project management and adoption as well as traditional measures of scientific excellence. We therefore hold firmly to the position that there needs to be both a balance and an integration of curiosity driven research with scientific merit as the sole metric and goal-directed research where science excellence is a metric alongside other translational metrics of health impact.

Additionally, the bulk of funding for health and medical research in Australia is based on competitive processes. In an environment where total funding is not large, such processes over time have created a competitive culture. Invariably, translation to be effective, involves many disciplines and by its nature must be goal driven and collaborative. The challenge and opportunity relates to developing funding mechanisms that support this.

A specific example of a funding approach that encourages collaboration is CSIRO's Collaboration Fund model around the National Flagships Programme. Universities and similar publically funded institutions are funded to promote collaboration because they align their activities with the goals of the CSIRO National Flagships as well as those of other institutions and universities. The National Flagships have high homology with the National Research Priorities and operate with a high translational agenda.

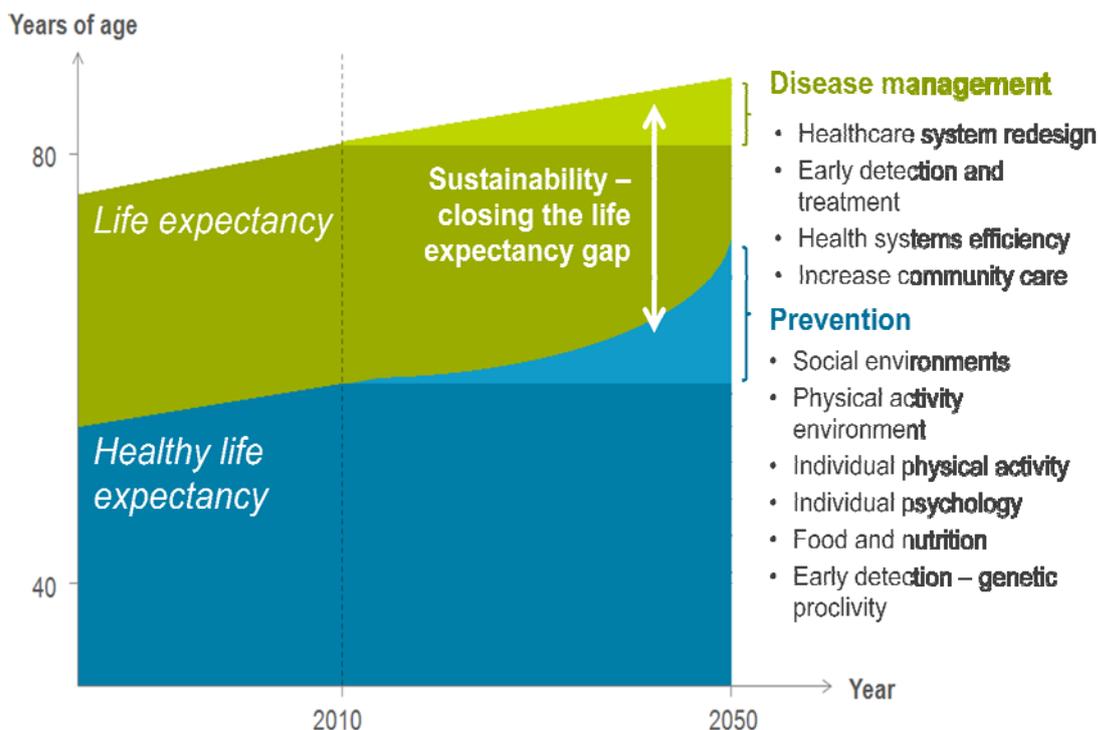
In a traditionally narrow sense, undertaking translational research means working with a clinician in a hospital. With the above comments we hope to have demonstrated that translational health and medical research is a far broader concept requiring higher level co-ordination, management and funding approaches.

To give a more specific example, a significant population health measure involves the development of primary products and manufactured foods that provide substantiated health benefits. However, while the RDCs such as the Grains RDC focus on on-farm issues there is a lack of a mechanism for taking a whole of chain investment perspective to support initiatives to develop a healthier food supply.

### 3. What are the health and medical research strategic directions and priorities and how might we meet them? (Terms of Reference 5, 12 and 13)

#### General Comment

The medical research strategic directions for Australia in the forthcoming period must flow from the national need. At the highest level the focus should be on increasing healthy life years (also referred to as disability free life expectancy) and closing the gap between healthy life years and life expectancy (see diagram). In achieving this not only is the quality of life of individuals improved but the nation benefits from increased productivity and contained health costs.



The major burden of disease challenge for Australia, indeed it is a global challenge, is chronic non-communicable disease.

In meeting Australia's major health challenges we support the principles enunciated by COAG, viz.

"Australia's health systems should

- be shaped around the health needs of individual patients, their families and communities;
- focus on the prevention of disease and injury and the maintenance of health, not simply the treatment of illness;
- support an integrated approach to the promotion of healthy lifestyles, prevention of illness and injury, and diagnosis and treatment of illness across the continuum of care; and

- provide all Australians with timely access to quality health services based on their needs, not ability to pay, regardless of where they live in the country.”

In summary, the major priorities are prevention, integration, user-centric health solutions and equity.

### **A Whole of Systems Approach and enhanced collaboration**

An implication of a whole of systems approach is that multiple initiatives are required in combination to have real impact. As we have described above, this means that sectors outside the traditional health sector have a significant role to play in providing a critical part of the solution (e.g. transport, urban design, communications, education, employment, housing, agriculture, food, tax, etc.).

In this context, an exciting challenge for the Australian government is to introduce a whole-of-government approach to planning and program implementation based on evidence based research. Research in prevention and treatment of disease should be not just highly multidisciplinary but also multi-sector. Hence, the priorities for health and medical research should reflect this whole of systems approach and funding programmes should be designed and incentives put in place to encourage boundary crossing, novel alliances and a focus on impact. Although this is a challenge for any government, it is also a great opportunity for Australia to be in the vanguard in taking such an approach.

The other consequences and benefits of a whole of systems approach are:

- Researchers must work with delivery partners. We support encouraging more clinician researchers, but clinicians are only one part of the implementation system. Other key partners could be health insurance companies, allied health professionals, nurses, aged care institutions, and service companies. As emerging trends in the US demonstrate, increasingly insurance companies will play a much more active role in the health system including R&D, clinical trials, and direct communication with patients about clinical options.
- The need to integrate biomedical concepts with population health and the social sciences. There is a vast literature on the social determinants of health being equally if not more important than biological-behavioural factors.
- Taking a systems approach opens the way to introducing modelling and simulation into investment decision making, especially for prevention. Modelling of a subsystem allows priorities to be set despite a variety of complex inputs and provides the opportunity for health economists to determine the relative efficiency of various approaches to prevention or treatment. Modelling is a core skill at CSIRO and we plan to apply these skills to health problems in partnership with research and delivery partners to build a much needed modelling capability for the nation.
- There is the opportunity to improve the collection, sharing and analysis of structured electronic health and clinical data for improved decision making and for secondary uses such as clinical outcomes and performance and identifying trends in disease prevalence. CSIRO expertise in these data technologies would complement others in Australia in extracting the most information from the data.

### **Primary and Secondary Prevention**

A greater focus is required on prevention, both primary and secondary. Health and medical research strategic directions and priorities should be aligned with:

- Optimal growth and development of the young
- Opportunities to maximize the productivity for those in mid-life
- Autonomy and independence for those in the latter stages of life

The nature of the health and medical research and strategic directions are obviously directed at the unmet needs in each of those three areas. By way of example, in the young, integrated effective programs that are broad based and address the issues of obesity are needed. For mid-life, programs are needed that are based both upon lifestyle and early detection of chronic disorders and that meld with social environment initiatives. With the elderly, appropriate sensing in the built environment designed to provide both safety and autonomy could be a priority.

To illustrate further the way in which sectors outside the traditional health area can significantly contribute to achieving health goals, we provide the following examples:

i. Information and communication technology (ICT)

- ICT has been broadly recognised as a powerful tool to use in developing solutions, through:
  - Enabling patients with chronic disease to better manage their condition
  - Enabling new models of care between patients and clinicians
  - Enabling patients to maintain independence and reduce their burden on the health system through remote monitoring
  - Motivating and managing lifestyle changes to reduce the risk and impact of these diseases
- Timely and equitable access to quality health services, regardless of location, is a second priority that has already been laid out by COAG. The National Broadband Network is providing Australia with the necessary physical infrastructure to address this challenge through telehealth. Indeed, comments on the value of the NBN have focused on Health as a major beneficiary. There is critical multidisciplinary research required around how to make it a viable system for delivering quality health care within economic, clinical, operational, technological and workflow constraints. In conjunction with ophthalmology clinics, CSIRO is implementing a tele-ophthalmology service to some of the remote places in Australia.
- Australia has made the decision to invest in electronic health records, through a Personally Controlled Electronic Health Record (PCEHR). Like the NBN, this is a large taxpayer-funded investment in infrastructure where the potential value goes well beyond the infrastructure. Research is needed into the new systems, tools and services that will realise this value, through bringing together an overall view of patient data, over time. However, unlike the NBN, which is using well-understood, mature technology, the PCEHR is at the cutting edge of global thinking.
- Health services research is needed to address efficiency and costs. There is a recognition that innovation is required across health service delivery, to respond to three drivers; change in population health needs, increased demand, and rising costs of new treatments. Health Services research is needed to determine appropriate, effective and efficient health

operational strategies through this change. As examples, CSIRO has recently deployed the Patient Admission Prediction Tool across QLD, which is reducing ambulance bypass at Emergency Departments by ensuring the hospital is prepared for the number and type of patients it is likely to receive each day. CSIRO has also recently successfully completed a randomised clinical trial of a mobile phone and internet based cardiac rehabilitation program.

- Bio-informatics will become increasingly important to aid interpretation of the anticipated amount of clinical data (including genomic), and as part of the R&D effort to discover patterns of disease, and new diagnostic and screening tools.

## ii. Food and nutrition

A mechanism for improved public health is the generation of new consumer food products with substantiated health benefits. CSIRO has a concerted strategy of developing enhanced food products delivering health attributes, through either genetic enhancement of primary production or post-farm gate technologies. Of necessity, this is a whole-of-food chain approach from primary production through processing to consumer foods and health outcomes. CSIRO is uniquely placed to conduct such R&D by bringing together teams across crop and animal genetics, food science and nutrition science in partnership with industry. Examples of this strategy include cereal grains with increased dietary fibre and oilseeds containing long chain omega-3 fatty acids for cardiovascular health. In addition to providing the opportunity for a reduction in health costs through improved diet, this work also provides an opportunity for direct economic benefits to the agricultural and food sectors through value addition in domestic and export markets.

The CSIRO strategy includes:

- The socio-economic importance of the target conditions;
- The size of the opportunity to effect significant risk reduction and improvement in the quality of life;
- The return on research investment directly in lowering of health-related costs and in value addition for the Australian agri-food industry;
- A scientific rationale for the mechanisms of risk reduction.
- The capability of CSIRO and its research partners to effect the basic research to develop the new food crops and incorporate them into food products and monitor their consumer acceptability; and,
- On-going evaluation of improvements in health and well-being and industry profitability.

## iii. Building resilience in the face of global change

New emerging diseases pose large scale and potentially catastrophic threats to Australia's population. Many of these diseases jump from animals to humans (for example, the Hendra virus). Insect vectors also transmit disease between humans and there is an increase in the threat of insect-borne disease due to rapidly changing environment and patterns of human behaviour. These threats demand innovative research comprising a whole-of-system multi-disciplinary approach focused on translating science into preventative instead of reactionary solutions. The implications

of the changing vector-borne disease 'landscape' are far reaching. Beyond the direct public health and economic consequences of vector-borne pathogens, increased disease activity directly impacts tourism appeal and places additional demands on Australia's already limited blood supply.

The current approach of managing vector borne diseases is:

- Public health focused
- Disease focused
- Responsive/reactive
- Comprised of fragmented roles & responsibilities, where regulation and policy are being surpassed by the pace of global change.

The present state of knowledge indicates that our approach should evolve to:

- Ecological- integrated - whole of system
- Process focused -> pre-emptive with proactive solutions
- Multi-disciplinary, including biophysical and social elements
- Multi-institutional - public health, research, industry, regulatory, community
- Local, national and international integration
- Connects relevant science to regulation, policy and decision making.

There is a real opportunity to generate an over-arching national framework for emerging disease and vector ecology in human health that builds resilience and flexibility in the face of global change through integration across the science, regulatory and policy domains.

#### iv. Indigenous and global health

The health of Australian indigenous communities is a prime example of where a whole of systems, multi-sectoral approach is required. Indigenous health is a major Australian national challenge. Indigenous health should be a major and prominent component of any health and medical research strategy. CSIRO has many broad ranging capabilities (prevention modelling, nutrition, ICT, caring for country, etc) that can contribute to assisting in improving aboriginal health. However, the challenges are beyond the resources of any single institution so there needs to be national leadership for the integration of the efforts of many players.

In global health, the recent independent review into aid effectiveness recommended AusAid support more research in the medical area (Recommendation 23). We fully support this as an important part of Australia's engagement with the developing world which DFAT has declared is in Australia's national interest. Once again, a whole of systems and a whole of government approach is needed with AusAid taking leadership in defining the areas of priority.

#### v. New materials and devices

New materials are finding use in applications as diverse as efficient stem cell manufacturing, improved therapeutic delivery, tissue repair and improved diagnostics. Additionally devices

developed for non-medical applications such as gaming are now being developed as part of the tool-kit for non-invasive clinical diagnostics such as electroencephalography.

There are expected to be considerable cost-savings and synergies for the health system envisaged from the use of new or improved materials and novel uses of devices. By encouraging multi-disciplinary research across traditional boundaries Australia will be well-placed to take a lead in this area.

#### **4. How can we optimise translation of health and medical research into better health and wellbeing? (Terms of Reference 4, 8, 9, 10 and 11)**

Australia is very privileged in as much as far-sighted individuals have historically promoted procedures or policies based on health and medical research which has led to the better health and wellbeing that we enjoy today. It is self-evident that this ranges from the implementation of vaccinations, societal programs around HIV awareness, to the wearing of seat belts, to population screening for chronic disorders. If you distil those successes to their core and more particularly look more broadly to similar successes, for example, urban hygiene and the development of antimicrobials, you see common themes:

- The ability to understand the unmet need
- Uptake and impact and, more particularly, the ability to project or program manage that process with adoption partners to ensure that impact will occur

We have addressed most of the issues around translational research in the sections above which we will not repeat here. There needs to be an ability to embrace disciplines and sciences often well outside the traditional biomedical health and research areas to achieve the outcome. Increasingly we see this in physics and imaging, social sciences and the uptake of evidence based programs, the importance of aiding and assisting industries such as the food industry and producing healthier products, the ability to influence farm production equally to provide not only high nutritional value but those with intrinsic health potential in their own right.

One goal of translational research is to exploit the insights obtained from basic research into approaches for treating or preventing disease. Another is to transform clinically relevant information into effective interventions in the reverse direction: identifying patient problems, designing laboratory solutions, and then working through clinical trials to deliver a solution to patients. Australia invests heavily in fundamental health research through NH&MRC and ARC programs, and through research institutes. Australia also has enviable clinical research capabilities but the iterative approach from the patient to the lab and back to the patient is weakened by the funding models for translational research. Issues in translating fundamental health discoveries into health and commercial outcomes have been noted in previous health reviews (the Grant review in 2004 and Cutler review in 2008). Key to achieving this are mechanisms to support stronger relationships between funding bodies such as the NH&MRC, research providers such as CSIRO and medical research institutes, industry and research clinics, which once again, argues for higher level co-ordination of health and medical research.

In the United States the NIH has recognised a similar set of issues concerning the link between fundamental research and its uptake and has taken a variety of steps to address the situation. For example, one initiative the NIH developed is the “Bridging Interventional Development Gaps” program, which enables investigators to apply for access to in-kind, government-funded, contract resources needed for the preclinical development of therapeutic agents.

While Australia is a relatively small research community it is in a wonderful position to be able to achieve this cross-cutting science but it will require a significant cultural change in our current approach to health and medical research to ensure this occurs. As an organisation, CSIRO has spent a considerable effort in many aspects of delivery to society and industry around translation and we have extended that to the area of human health and medical research.<sup>1</sup>

### **Final Comments**

This review provides an opportunity to stand back and consider in a big picture way the means by which research can contribute to achieving health and wellbeing in the Australian community. By necessity this requires a whole of systems approach and is dependent on Australia having a whole-of-government health and medical research strategy that also enlists the contributions of industry and non-government organisations.

Taking a whole of systems approach implies a fundamental change to the way in which health and medical research is funded and managed.

The major health challenge for Australia is to increase healthy life expectancy which requires greater emphasis on primary and secondary prevention.

Indigenous and global health are major challenge areas which require special focus, attention, co-ordination and funding.

As a nation we are at risk of falling behind in the area of translational research. Increased performance in translation requires the integration of a range of activities and approaches that fall outside the traditional health research focus area, and include areas such as ICT, health systems research, food production, health technologies, biosecurity, etc. It also requires close collaboration with industry and other delivery partners.

CSIRO is a major investor in health research (\$145m pa) with activities in a range of non-traditional health and medical research areas which are conducted in collaboration with a variety of government and industry partners. Our approach is one example of successful translational health research and could be leveraged and expanded as a national model.

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<sup>1</sup> This is encapsulated in a recent published analysis (O’Keefe, CM and Head, RJ (2011) “Application of logic models in a large scientific research program” Evaluation and Program Planning 34: 174-184.