

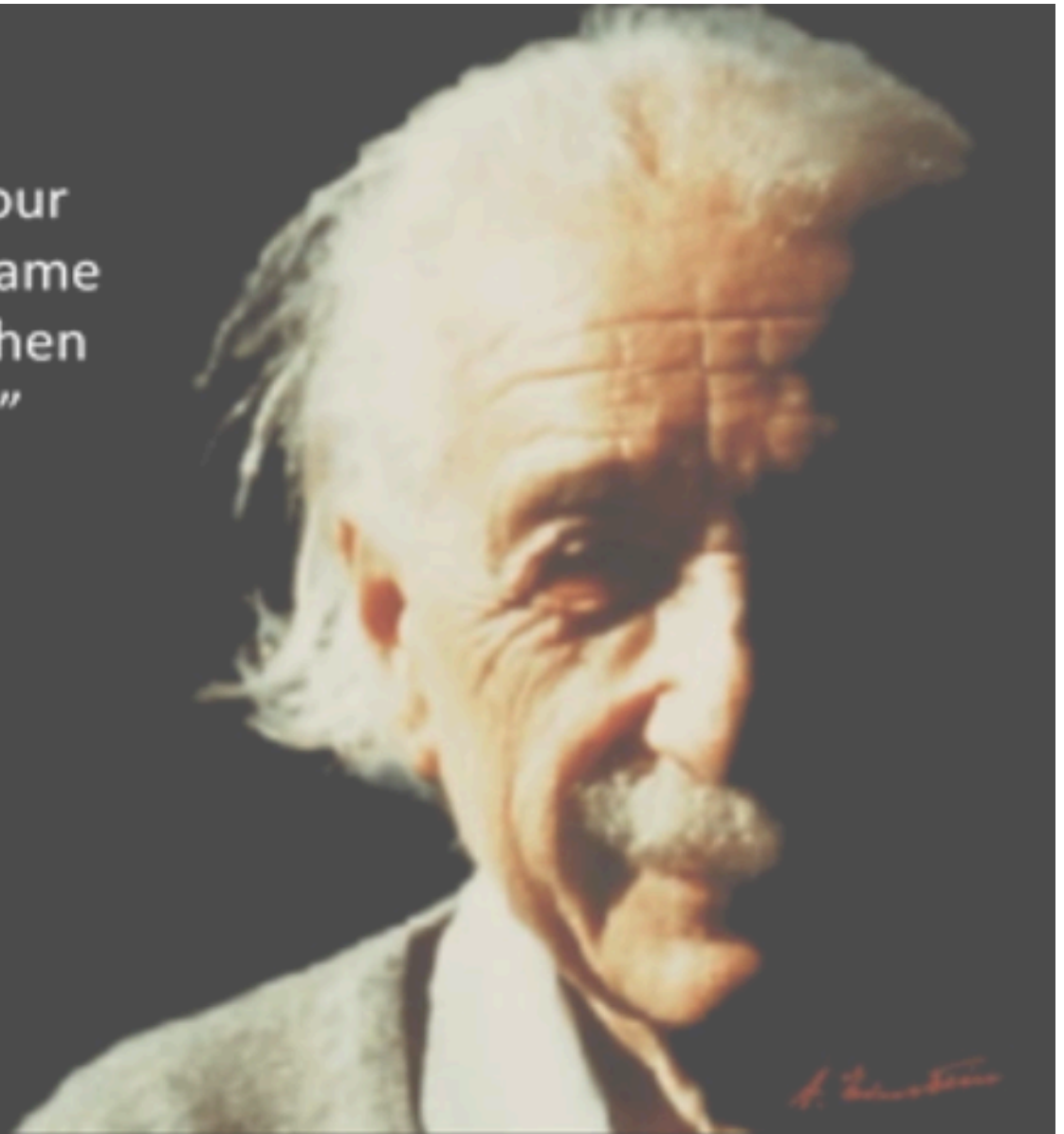
Improving efficacy, potential, and sustainability of innovation, for women (and men)

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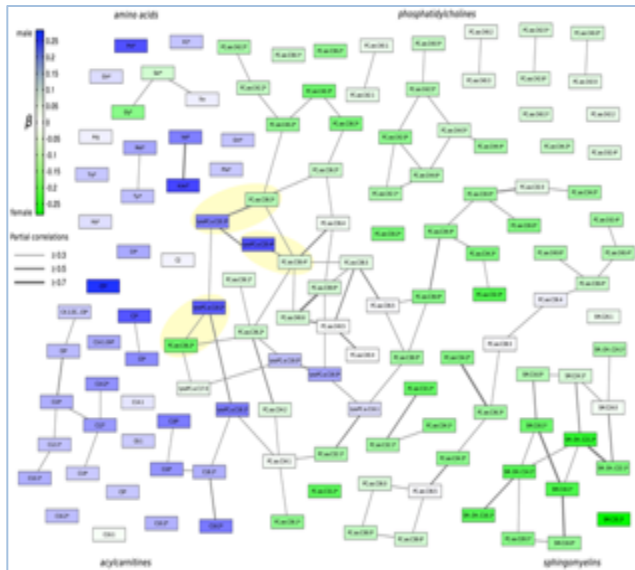
“We cannot solve our
problems with the same
thinking we used when
we created them”



Improving efficacy, potential, and sustainability of innovation

EFFICACY: the ability to produce a desired or intended result

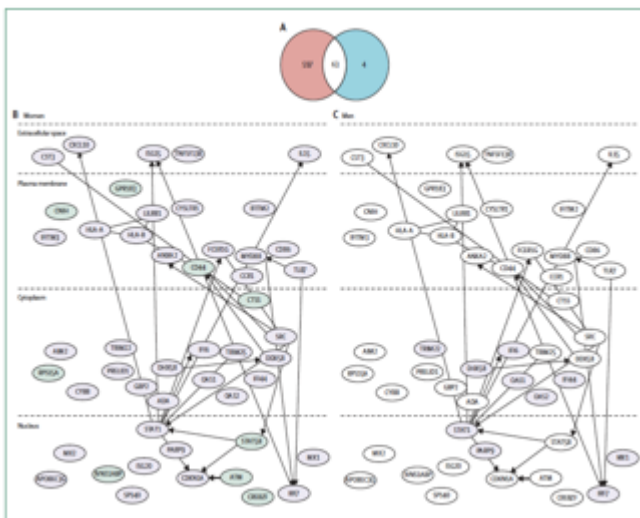
Improving efficacy for women in predicting course of disease, immune response, and toxic effects of drugs



Metabolic profiles of women and men are different



Sex differences in biochemical mechanisms might explain observed differences in susceptibility and time course of the development of common diseases in males and females and lead to more accurate predictive biomarkers



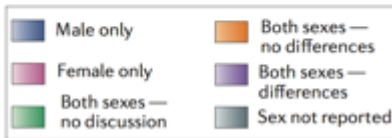
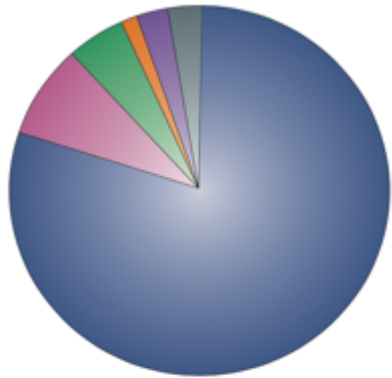
There are sex differences in signaling pathways in response to vaccines



Sex affects the frequency and severity of adverse effects of vaccination, including fever, pain, and inflammation. Pregnancy can also substantially alter immune responses to vaccines. The public health and vaccination strategies need to be revised

Improving efficacy for women in management and treatment of pain

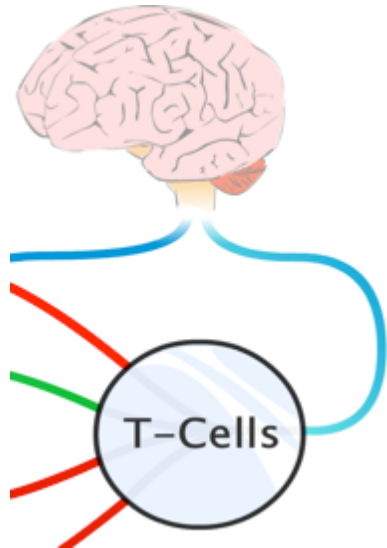
Past non-human pain studies



Male bias in the knowledge of pain

Gender bias in the efficacy of analgesic intervention

Clinical pain, both acute and chronic, and experimental pain models all show sex differences between women and men. The traditional paradigm, based on data for males, explains pain in terms of transmission from the site of injury or inflammation through the nervous system using an immune system cell called **microglia**.



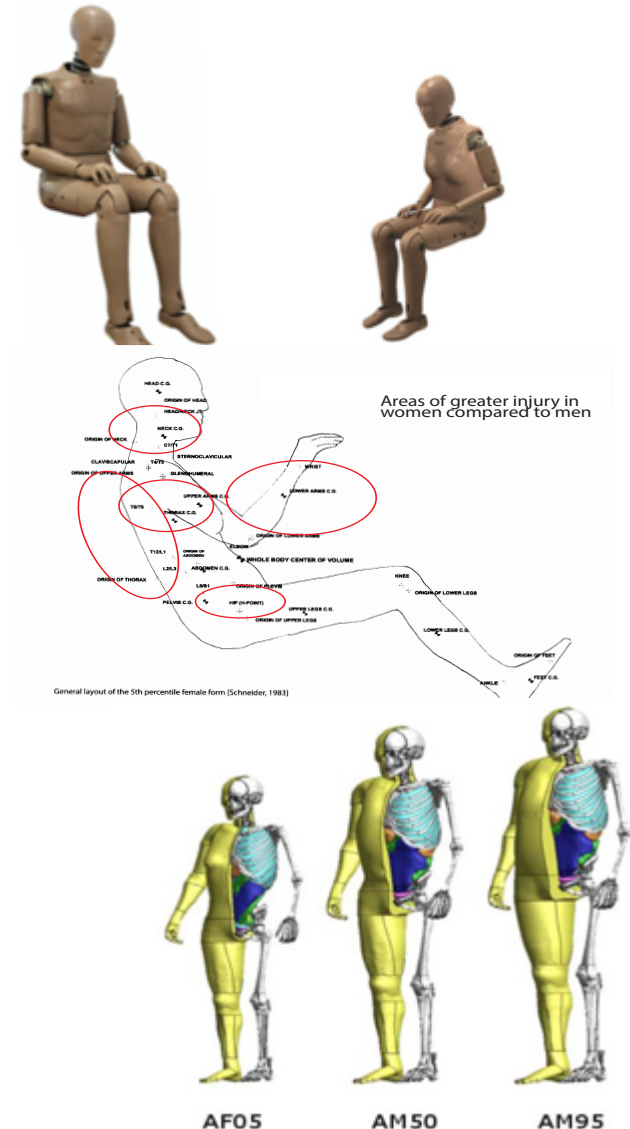
New data comparing male and female mice

A completely different type of immune cell, called **T cells**, appears to be responsible for sounding the pain alarm in female mice.

This opens up a new biological paradigm, which may (at last) help explain the observed differences, and provide women with better analgesic protection.

Improving efficacy of vehicle safety systems for women

- Women have 47% higher risk of serious injury in a car crash than men
- Most injuries for women occur at speeds 20-65km/h
- Most injuries for men occur at speeds over 65km/h
- There are important differences in types of injury for women and men in both accident data and in crash test data
- The accident data and crash test data show different injury profiles for women
- Current crash test dummies do not account for important differences between women and men in anthropomorphic and morphological characteristics, and biomechanical responses during a crash
- The 'female' crash test dummy is basically a scaled down version of the male crash test dummy
- Current vehicle safety systems (seat belt, head rest, air bag) are less effective for women



Improving efficacy of innovation value chains by engaging women more fully at each stage

Analysis of the **Innocentive** 166 science challenges involving over 12,000 scientists revealed that technical and social marginality, being a source of different perspectives and heuristics, plays an important role in explaining individual success in problem solving. **Female solvers – known to be in the “outer circle” of the scientific establishment - performed significantly better than men in developing successful solutions.**

Foldit is a multiplayer online biochemistry game that presents players with computationally difficult protein folding problems in the form of puzzles, allowing ordinary players to help solve these problems. It brings a wide variety of individual and collective problem solving skills of non-experts into the scientific discovery process. In this way a problem scientists could not solve for 10 years was solved (by 57,000 players) in a matter of few weeks. **30% of the gamers are women.**



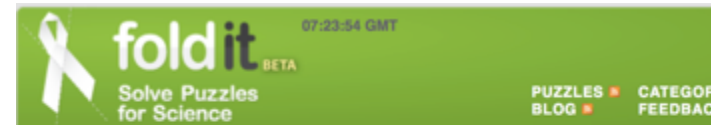
REQUEST
A DEMO



SOLVE A
CHALLENGE



RESOURCE
LIBRARY

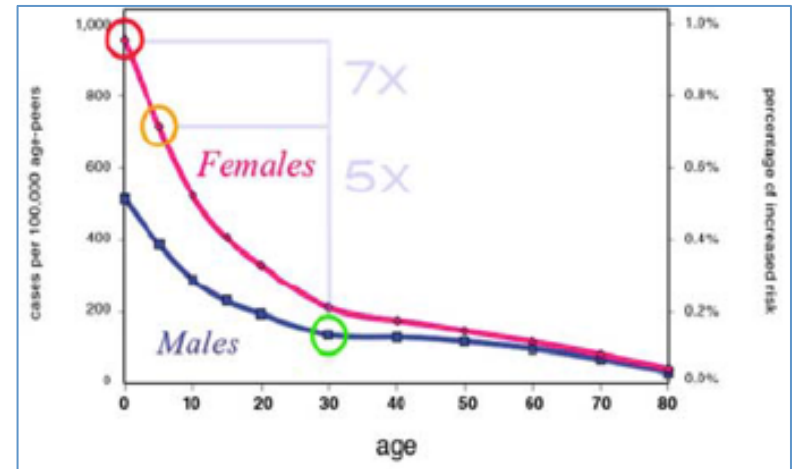


Improving efficacy, potential, and sustainability of innovation

POTENTIAL: capable of being but
not yet in existence

Improving the potential for diagnostic radiology, and radiotherapy to be safer for women

- The vast majority of spontaneous cancers have higher incidence rates in males than in female
- The incidence of cancer following irradiation is greater in women, for all cancers
- In 2006, Americans were exposed to more than seven times as much ionizing radiation from medical procedures as was the case in the early 1980s
- However, radiation standards are based on a male body (the Reference Man). Most were developed in 1950's-60's before the growth in medical uses of radiology
- Young children are at greatest risk from radiation exposure
- 93% of doctors underestimate the actual ionizing radiation dose patients are exposed to during diagnostic procedures and may be administering too high doses
- Dosimetry models have to be revised



Improving the potential of non-ionizing methods for more accurate cancer screening in women

Breast cancer screening using an **innovative radar system with 60 antennas, developed from land mine detection system, captures in just eight seconds, high-resolution, 3D image of breast.** It measures and compares dielectric constant of the tissues and skin.

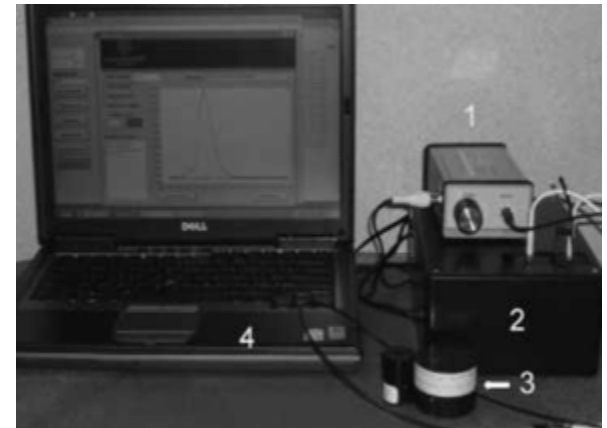
Using harmless radio waves instead of X-rays

This will make screening more accessible and economically viable.



Colorectal cancer (CRC) remains the third leading cause of death in both women and men. **Flexible sigmoidoscopy is routinely used for diagnosis but its performance is markedly inferior for women.** Using a novel light scattering approach to detect increase in blood supply in the distal colonic mucosa as a marker of proximal neoplasia greatly improves accuracy of the method for women.

Adding bio-photonics technology greatly improves diagnostic accuracy in women



Improving the potential of environmental sensors to monitor water and food safety

- Dirty water kills more women than AIDS and breast cancer
- Climate change and higher temperatures will increase health risks for women and children because it will magnify risk of waterborne diseases
- 50% of the 64 million people travelling from developed to developing countries experience diarrheal diseases, which can have long term health effects
- The US medical costs, productivity losses, and costs of premature deaths caused by food-borne diseases are approximately \$6.9 billion per year
- Many cases of food borne diseases are caused by contaminated water
- According to WHO, 1.8 million deaths related to contaminated food or water occur every year (bacteria, viruses, parasites, biotoxins).
- 77% of homes use dish sponge that contains faecal bacteria. A 10cm² sponge may contain 320 million bacteria

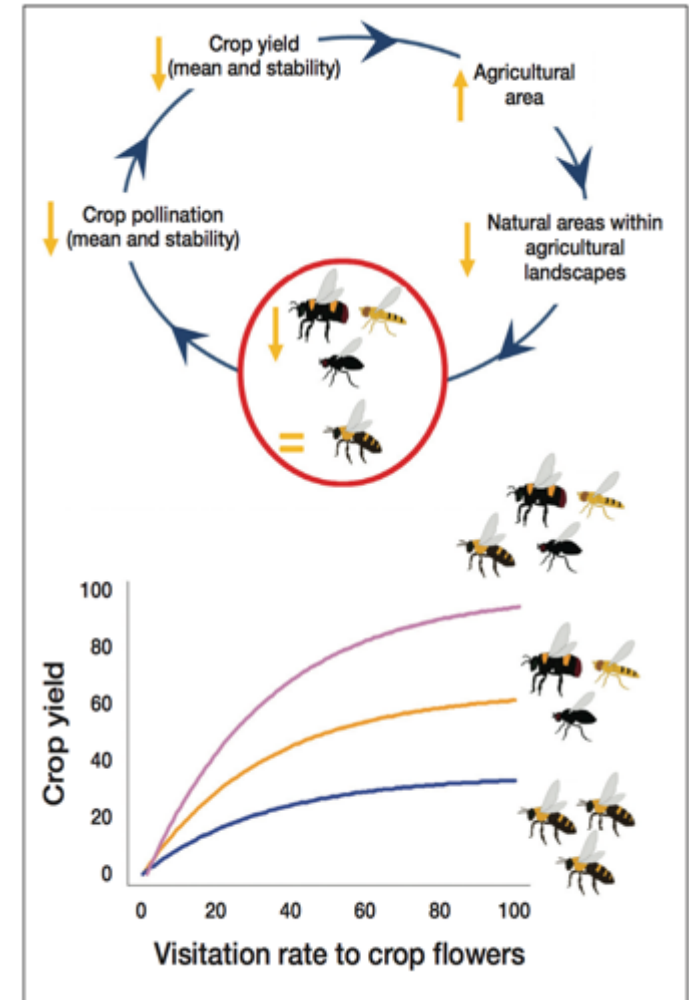


Improving efficacy, potential, and sustainability of innovation

SUSTAINABILITY: capable of enduring; a biological systems that remain diverse and productive

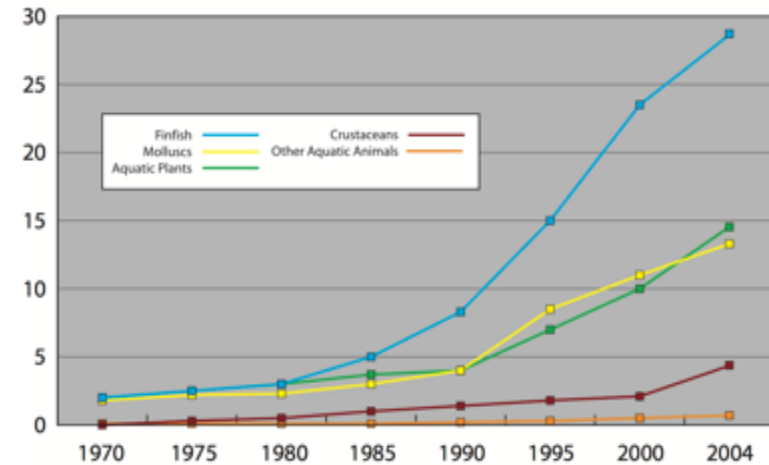
Improving the conditions needed for sustainable crop food production by increasing availability and success of pollinators

- 75% of leading food crops, or 35% of global food production, is dependent on animal pollinators (e.g. bees, wasps, ants, bats, birds...)
- Availability of pollinators improves yields of food crop production and quality of fruit, vegetables and seeds
- Insufficient pollinator availability means more land and more fertilizer is needed to produce the same yields
- Male and female flowers deploy specific biochemical signals to attract pollinator
- Pollinators visit male flowers in the morning and female flowers in the evening
- Plants fertility is highest in the morning
- Many plants can self-pollinate but cross-pollination improves quality
- There are opportunities to improve the livelihoods of smallholder farmers, and women as heads of households, through beekeeping

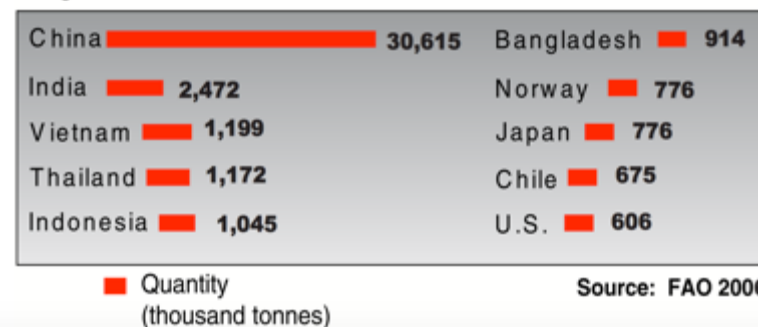


Improving conditions for sustainable fish farming through reproductive technologies

- Big diversity of sexual determination in fish: controlling the sex ratio is essential in finfish farming
- In many fish species one sex grows faster or matures earlier than the other and these differences may be accentuated under aquaculture conditions, e.g. in the turbot, females can be 50% larger than males, and are preferred.
- Tilapia is one of the fastest growing fish farming sector: sexual growth dimorphism favours males, and so males are preferred
- Female cod fish age better than males –the egg quality remains high: old mature high egg-productive females should be preferred, when managing cod fish stocks (current practice preserves young fish)
- Over 40% of meat consumed by humans worldwide comes from fish
- Women make up at least half of the inland fisheries' workforce, with 60% and 80% of seafood marketed by women in Asia and West Africa



**Aquaculture Production:
Major Producer Countries 2004**



Source: FAO 2006

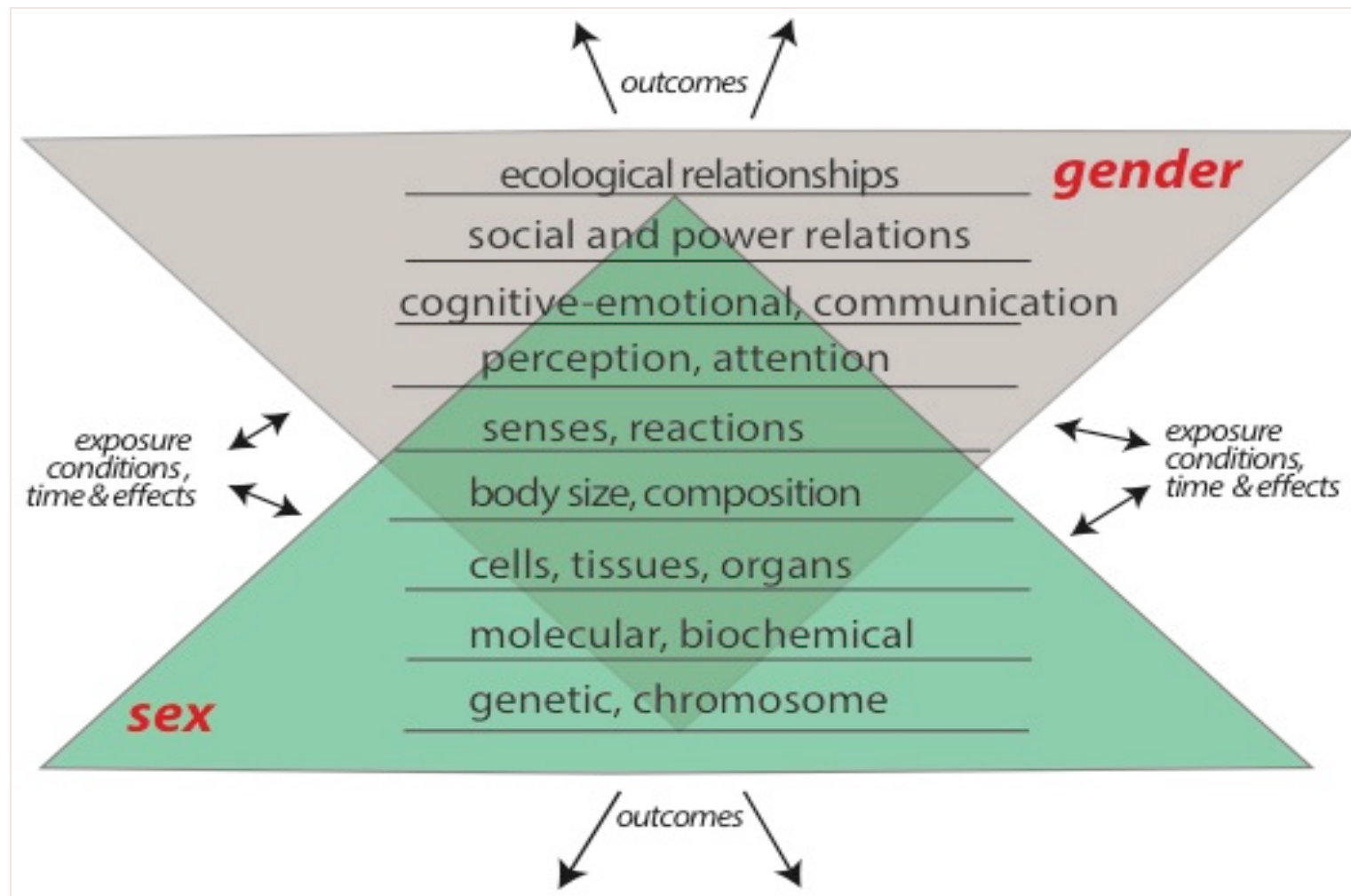
Other innovation opportunities and benefits

- Improving accuracy of automatic speech recognition; acceptance of social robots; disaster resiliance; adaptation to climate change; infectious disease surveillance; healthy ageing; drug development; prospects for personalised and regenerative medicine; success of organ transplantation; human-computer interactions; soil management...
- Tapping into growing markets: e.g. by 2020 biometric market will be worth \$24.5 billion; biomarkers market will be worth \$45.55 billion; global environmental sensor and monitoring market will grow to 18 billion; global aquaculture will be worth \$100 billion, and crop pollination by insects will be worth \$15 billion in USA alone.

Improving efficacy, potential, and sustainability of innovation

CONCLUSION: creating gendered innovation ecosystems will improve outcomes for women, men, and society

Building foundations of when, why and how sex and gender influence innovation efficacy, potential and sustainability



Using STEM gender knowledge as a catalyst for advancing socioeconomic benefits of innovations

NEW BUSINESS MODELS/
POLICY STRATEGY

ARCHITECTURAL INNOVATION

Re-designing products, services and interventions using existing technologies to improve efficacy of outcomes for women and men

e.g. organ/tissue transplantation; vaccination programmes; nutrition regimes; social media, Internet of Things; public health interventions; building design; insurance; car seat design; parenting; cooking stoves; safe water...

DISRUPTIVE INNOVATION

Advancing technological innovations based on demonstrable biological differences between females and males

e.g. biomarkers (health, marine pollution, food safety); biosensors; biocontrols; lab-on-a-chip; infectious diseases surveillance; natural disaster resilience; fisheries management; food crop pollinator management...

EXISTING BUSINESS MODELS/
POLICY STRATEGY

ROUTINE INNOVATION

Improving performance, or usefulness, of existing products or services by incorporating new features recommended by gender knowledge

e.g. speech recognition; medical devices; administration of drugs; dosimetry of diagnostic ionizing radiation; assistive devices; child push-chair; car seat belt; skin care products; rehabilitation; mobility and road use...

RADICAL INNOVATION

Incorporating gender into innovation value chains (idea creation, development, and adoption) to improve socioeconomic benefits for women and men

e.g. urban growth; food security; cancer; vector borne diseases; Climate Change; demographics; biodiversity; zoonotic diseases; security; transport and mobility; migration; employment; research collaborations...

EXISTING GENDER & TECHNICAL COMPETENCES

NEW GENDER & TECHNICAL COMPETENCES

Thank You

Background research, and more, can be found at

www.gender-summit.com

www.genderinscience.org

www.portiaweb.org

www.genderportal.eu