Translational Neuroscience

In this age of neuroscience, as we keep marching forwards, there is an unmet need to directly impact the day-to-day lives of people, given the burden of neurological diseases. This is where translational science comes in, to apply strides made in basic sciences to the clinical needs of the populace, which is widely referred to as the 'bench-to-bedside model'. NIH National Center for Advancing Translational Sciences (NCATS) defines translation as "the process of turning observations in the laboratory, clinic and community into interventions that improve the health of individuals and the public — from diagnostics and therapeutics to medical procedures and behavioural changes."

The existing healthcare is in dire need of newer tools (diagnostic and therapeutic), a paradigm shift towards efficient clinical approaches. Modern medicine has come a long way, yet there are many diseases where the existing treatment isn't satisfactory, while some diseases have no cure. This requires translational research in both wet labs and dry labs. We would also require significant input from industry partners, policymakers, and the public. Davies C et al. (2020) have beautifully illustrated this as a neuronal flowchart (Figure 1).

-Harsh Srivastava

The translational research pipeline, also known as the translational science spectrum, as depicted by Davies C et al. (2020), is a multi-phase process consisting of five phases, T0 to T4.

T0 refers to basic biomedical research to discover fundamental mechanisms in biology, diseases, or the behaviour of organisms.

T1 is the translation of the findings from basic biomedical research to humans, i.e., pre-clinical research. This includes proof of concept studies (small-scale studies that are designed to detect if a drug is active on a pathophysiologically relevant mechanism), phase 1 clinical trials, and the focus is to develop new or more effective methods of diagnosis, treatment, and prevention in highly-controlled settings. Experiments are carried out in cell or animal models; or through computer-assisted simulations of the drug or devices within living systems.

T2 stage is the translation of the findings in T1 stage to patients. This includes Phase 2 and 3 clinical trials, and controlled studies leading to clinical application and evidence-based guidelines. The goal is to test the safety and efficacy of interventions based on the findings in the T1 stage.

T3 stage is the translation to clinical practice. This involves adopting interventions into routine clinical care for the general population. This includes comparative effectiveness research, post-marketing studies, and clinical outcomes research. T3 stage is essentially the core of clinical research. While this is the first stage where discoveries from the lab reach the public, it also helps identify gaps in the existing clinical care which can guide the research at T0 stage.

T4 stage or, the final stage is, the translation to the target communities. Here, the benefit of extensive research reaches the whole community as compared to a limited group of people in T3, which is the goal of biomedical research, helping the society. This stage includes population-level outcomes research, monitoring of morbidity, mortality, benefits and risks, and health policy changes.

Movement along the scale between T0 and T4 is not one-way. Results from a T4 population outcome study might inform a future T1 pilot study, for instance, or a T3 trial might reveal the need for more studies at the T2 level. Results at any point on the spectrum might indicate new pathways for research at the T0 stage. This can be well visualized through this infographic by NCATS depicting translational spectrum as an iterative cycle (Figure 2).

We have shortlisted a few resources where you can check out the opportunities in Translational Research.

1. Programs offered by NINDS Division of Translational Research
https://www.ninds.nih.gov/Current-Research/Research-Funded-NINDS/Translational-Research

2. Programs offered by UAMS Translational Research Institute
https://tri.uams.edu/funding-opportunities/

3. Four Year PhD Programme in Translational Neuroscience by the University of Edinburgh
https://www.ed.ac.uk/studying/postgraduate/degrees/index.php

4. MSc Translational Neuroscience one year course by Imperial College, London
https://www.imperial.ac.uk/study/pg/medicine/translational-neuroscience/

5. Wu Tsai Neurosciences Institute, Stanford University: Translate grant program
https://neuroscience.stanford.edu/research/programs/neuroscience-translate

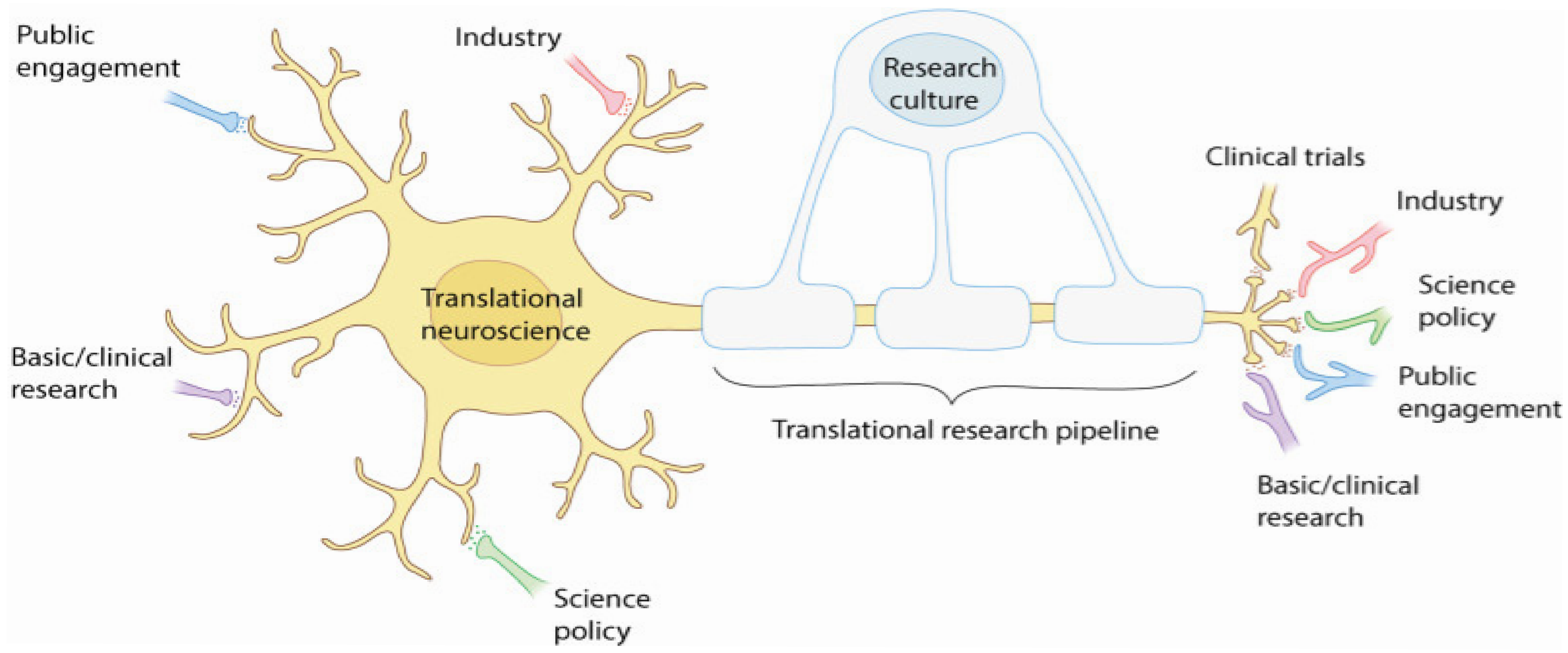

Figure 1: Davies C, Hamilton OKL, Hooley M, Ritakari TE, Stevenson AJ, Wheater ENW. Translational neuroscience: the state of the nation (a PhD student perspective). Brain Commun. 2020;2(1):fcaa038. doi: 10.1093/braincomms/fcaa038. Epub 2020 Apr 6. PMID: 32671338; PMCID: PMC7331125.

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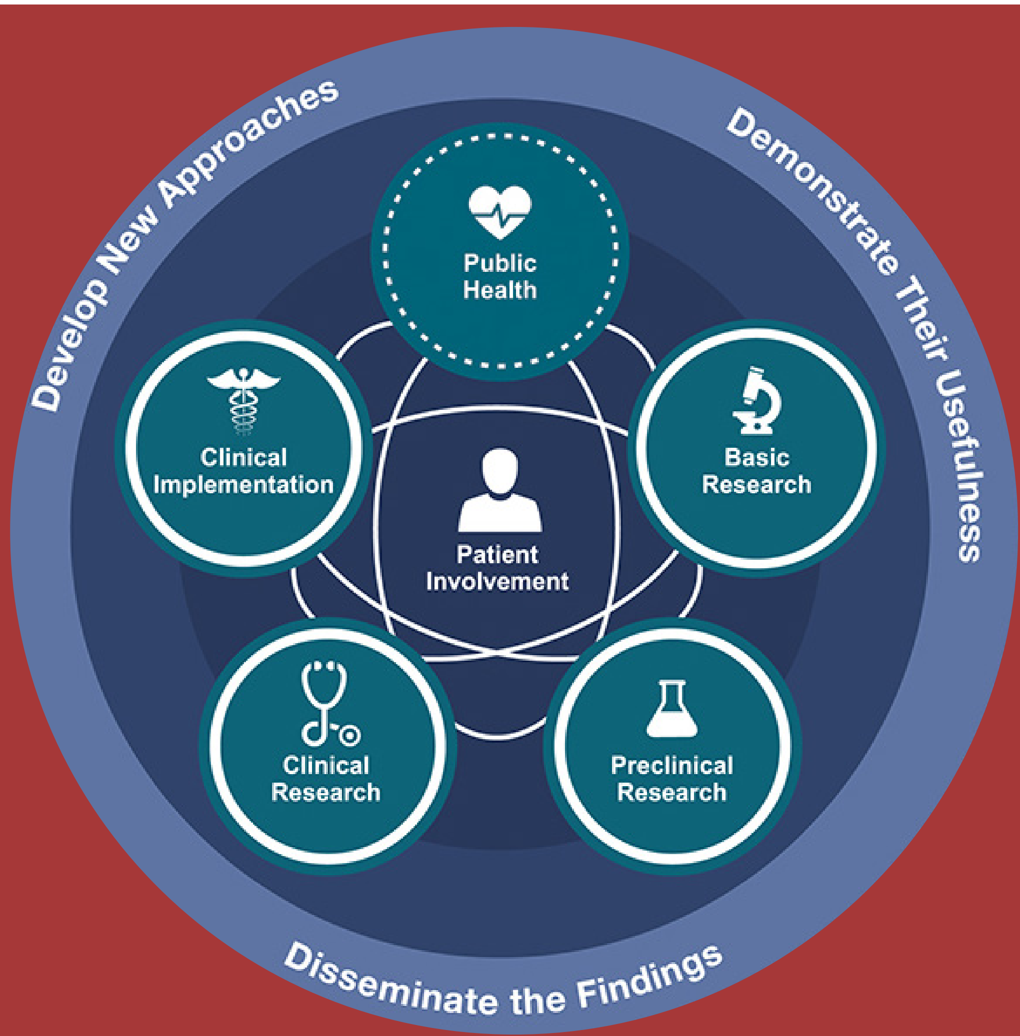

Figure 2: https://ncats.nih.gov/translation/spectrum