

The University of Toronto's Innovation Ecosystem and Some Emerging Therapeutic Technologies

Rohan Alvares, *PhD*
Technology Analyst – Life Sciences

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Welcome to U of T!

1. **Global Excellence**
2. **An Innovation Powerhouse**
3. **A Leader in Entrepreneurship**



U of T's innovation network owes a lot to the city in which it's located.

One of the world's most livable cities

North America's 4th largest city

Considered the world's most diverse city, with more than 170 languages spoken

One World-Class University – Three Distinctive Campuses



- 15,000 faculty (incl Hospital Researchers)
- 10,000 staff (incl Librarians)
- 97,000+ students (incl 27,000+ Int'ntl)
- Partner with >300 companies at any given time (> 600 over past 10 years)
- 19 Faculties and Schools
- 174 Research Centres across all three campuses
- 300 graduate programs, 20,700 Graduate Students
- Created > 600 start-ups, raising > \$2.5B in venture funding over past 10 years

U of T's position in World University Rankings

	2022	2021	2020	2019	2018
National Taiwan University Ranking	6	3	3	4	4
Times Higher Education World University Rankings	18	18	18	18	21
U.S. News Best Global Universities	18	16	17	18	20
Academic Ranking of World Universities	22	22	23	24	23
QS World University Rankings	34	26	25	29	28

Note: The year on the table reflects the year of publication, not the year that the rankings publisher uses.

#1

in the world for industry,
innovation & infrastructure

TIMES HIGHER EDUCATION IMPACT RANKINGS, 2020

#3

in the world for performance
of scientific papers

NATIONAL TAIWAN UNIVERSITY RANKING, 2020

#2 & #3

in the world for
research output – publications & citations

INCITES™, CLARIVATE ANALYTICS (2014-2018), INCLUDING WEB OF
SCIENCE CONTENT INDEXED THROUGH 2019-11-29.



#3

**in the world
for clinical medicine
and healthcare**

Clinical Medicine Rankings

A petri dish containing several circular bacterial cultures on a light blue agar surface, held by a gloved hand. The background is a soft-focus image of a white lab coat.

1	Harvard
2	Johns Hopkins
3	University of Toronto
4	University College, London
5	UC San Francisco

- 
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Largest Research Entity in Canada



A Legacy of Discovery and Innovation

At the University of Toronto we celebrate a long history of breakthroughs and discoveries that have saved countless lives and improved societies all over the world.

1921

Insulin

Nobel Prize 1923 –
Banting (Best) and
Macleod (Collip)



1941

**Anti-Blackout
Flight Suit**

Franks – precursor to
modern Space-suit



1961

Stem Cells

Till and McCulloch
(Princess Margaret
Cancer Centre &
U of T)



1988

1st Nerve Transplant

Hudson and Mackinnon
(St. Michael's Hospital &
U of T)



1930s

Electron Microscope

Burton.



1951

**Cardiac
Pacemaker**

Bigelow and
Callaghan (Toronto
General Hospital &
U of T)



1980s

Chemical Laser

Nobel Prize 1986
Polanyi



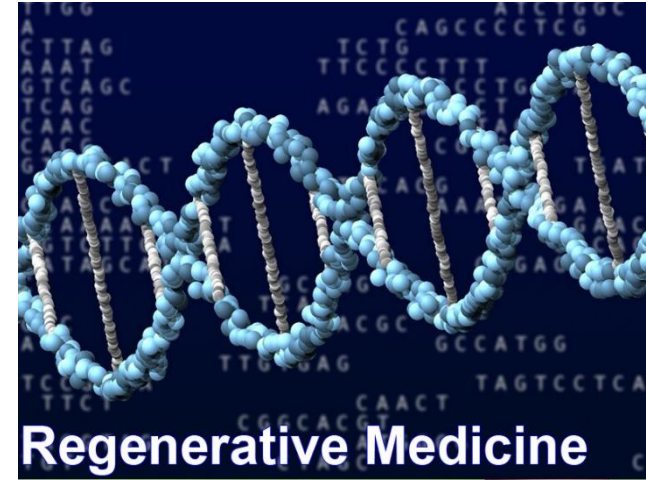
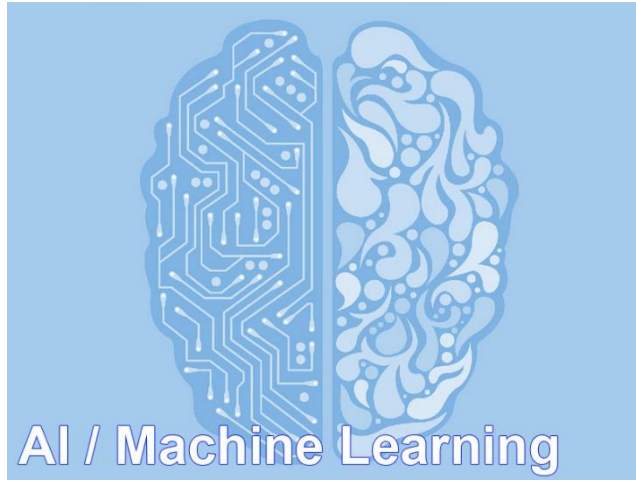
2010s

**Deep
Learning**

Hinton



U of T has World – Leading Expertise



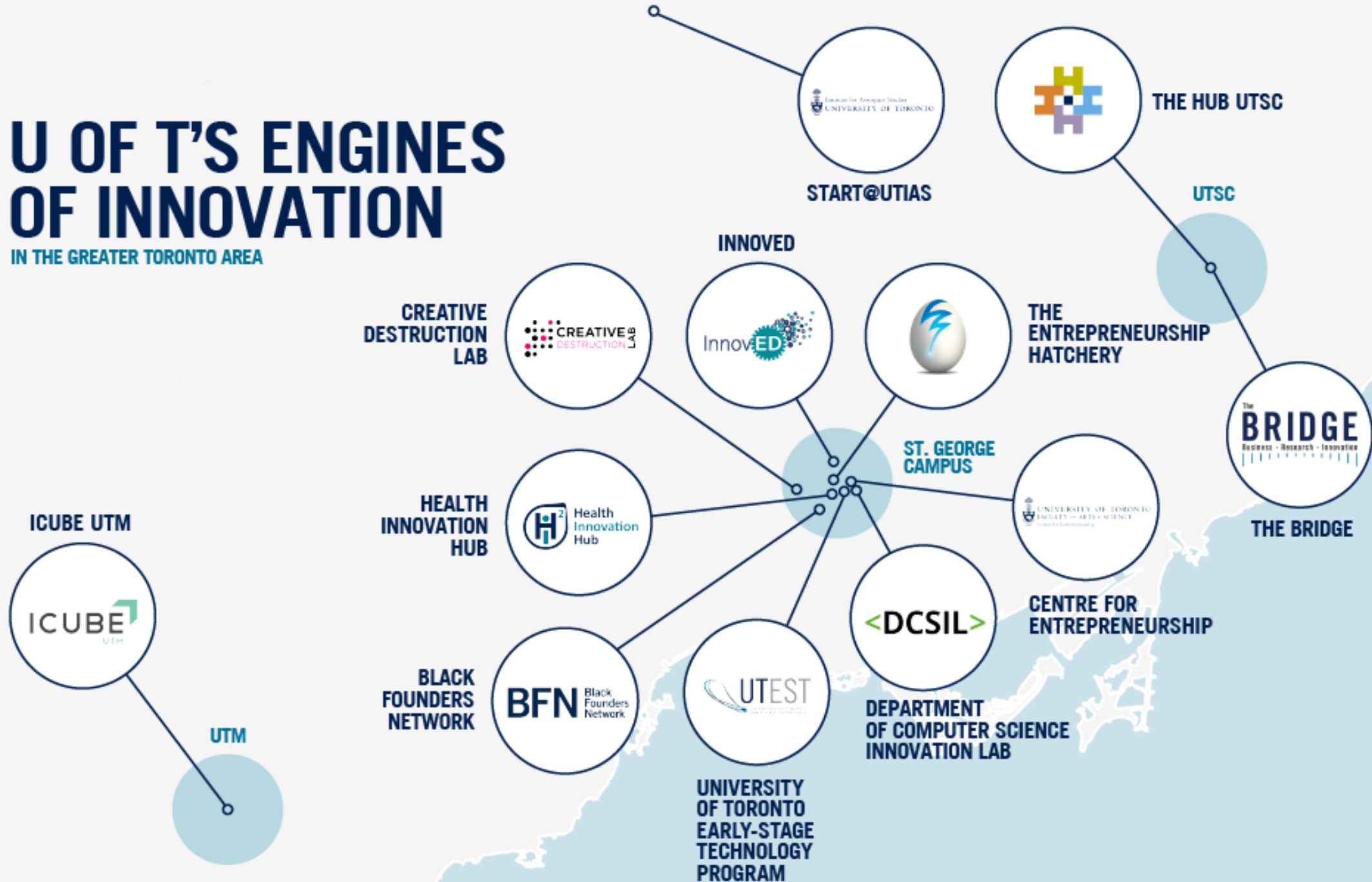


1,000+ patent applications filed
over the last 10 years

- 
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U OF T'S ENGINES OF INNOVATION

IN THE GREATER TORONTO AREA



A Powerhouse of Innovation & Entrepreneurship

U of T is Canada's leading engine for research-based startups and a global leader in transforming ideas into products and services that impact the world.

600

Startups created
in the past
decade

\$2.5B

In investment
generated

#1

In Canada for
research-based
startups

Top 5

In university-managed
incubators

9,000

Jobs created

U of T named the fastest-rising global institution in PitchBook's 2021 Top 50 rankings of best universities for startup founders.

Liliana Attisano

Professor
University of Toronto

Therapeutic Area:
Oncology

Modality: Small molecule

Disease Indications:
Cancer, Fibrosis

Intellectual Property:
AU, CA, CN, EU, JP, US

Stage of Development:
Lead optimization
Animal studies

Background

- Hippo signaling pathway regulates cell proliferation and cell death
- High cell density and stress activate pathway to stop cell proliferation and induce apoptosis
 - Phosphorylation events
- Hippo OFF → pro-oncogenic, pro-fibrotic outcomes
- Promotion of YAP/TAZ phosphorylation → cancer & fibrosis therapeutics

Hippo pathway linked to cancer and fibrosis

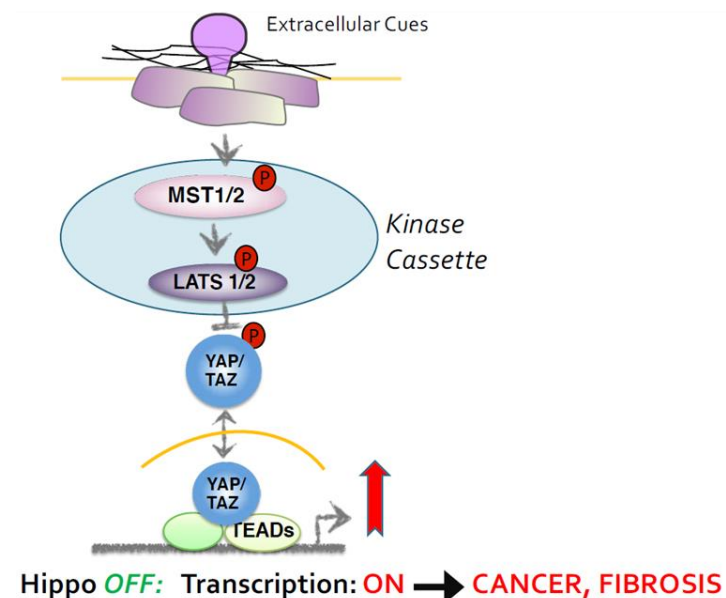


Fig. Hippo signalling pathway. Extracellular cues turn on the Hippo pathway which results in phosphorylation and cytoplasmic retention of YAP/TAZ; unphosphorylated YAP/TAZ localise to the nucleus where they exert pro-oncogenic, pro-fibrotic functions.



Technology

- NUA2 / NUA1 - promotes YAP and TAZ oncogenic and fibrotic activity
- Small molecule NUA inhibitors prevents tumorigenic and fibrotic properties in cells and in mice models
 - OICR Drug Discovery Program

Benefits

- Two classes of novel inhibitor compounds for NUAs: IC50 in the nM range
- NUA1 and NUA2 are elevated in broad disease indications based on Cancer and Fibrosis
- Drug screening capabilities: new opportunity to develop kinase inhibitors

Applications

- Cancer therapeutic - Multiple solid cancers: breast, colon, bladder, HNSCC, others
- Fibrosis therapeutic - Kidney, lung, liver, pancreas, others

Project Status

- Mice studies conducted

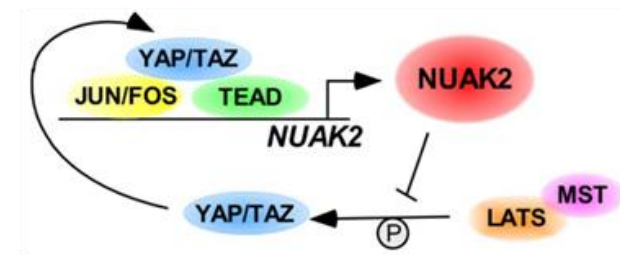


Fig. Negative regulation of the Hippo pathway by NUA2 promotes oncogenesis and fibrosis.

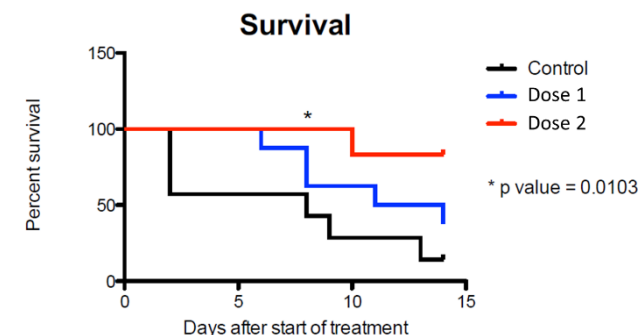


Fig. A small molecule compound (NUA inhibitor) inhibits tumor growth in a late-stage breast cancer model (orthotopic MDA-MB-231) in immunocompromised (NSG) mice leading to increased survival.



*Philip M. Kim, †Suneil Kalia, †Lorraine Kalia

Professors

*University of Toronto

†University Hospital

Network

Therapeutic

Area: Neurology

Modality: Gene Therapy

Disease Indications:

Parkinson's

Intellectual Property: PCT

(2022)

Stage of Development:

Animal studies

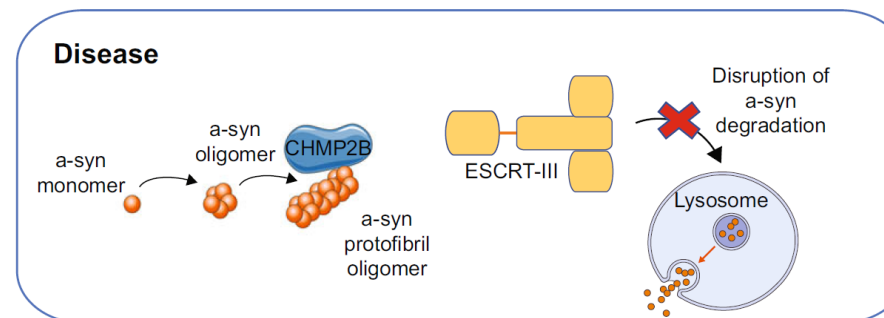
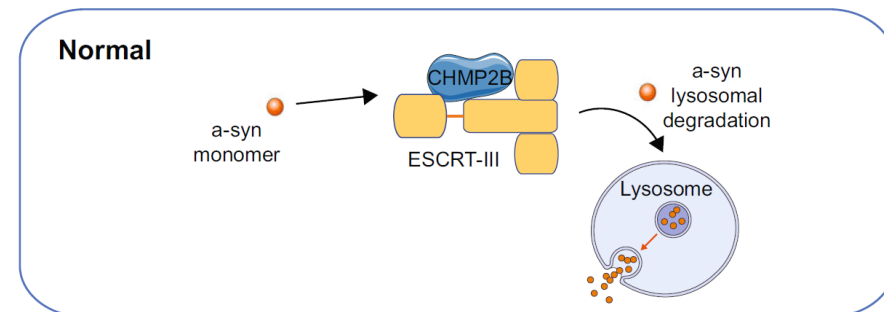


Background

- Parkinson's Disease
 - Results from degeneration of dopamine-producing neurons
- No disease-modifying therapies available

Technology

- Screening Platform to identify peptide-based protein-protein interaction inhibitors
- Applied to alpha-synuclein based models of Parkinson's disease
- Optimized a top peptide candidate (PDpep1.3)





Benefits

- Novel screening platform enabled discovery of protein-protein interaction hits
- Lead compound with nanomolar target engagement
- Fully novel target in an under-explored molecular pathway
- Proven *in vivo* efficacy

Project Status

- Rat, earthworm and human cell line studies conducted

Fig. In a commonly used rat preclinical model of Parkinson's disease, viral mediated expression of A53T alpha-synuclein causes degeneration of TH+ dopamine neurons in the substantia nigra compared to empty viral vector (EV). PDpep1.3 reduces degeneration of dopamine neurons in this model (left panel) and rescues dopamine levels in the striatum, which receives projections from the affected substantia nigra (right panel).

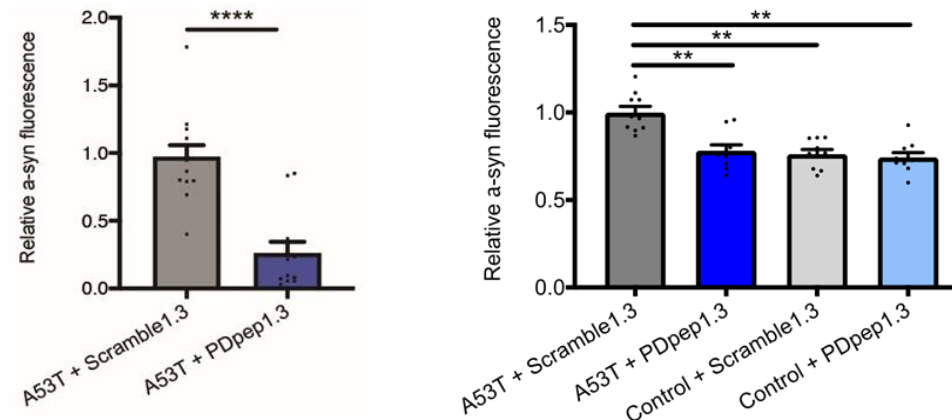
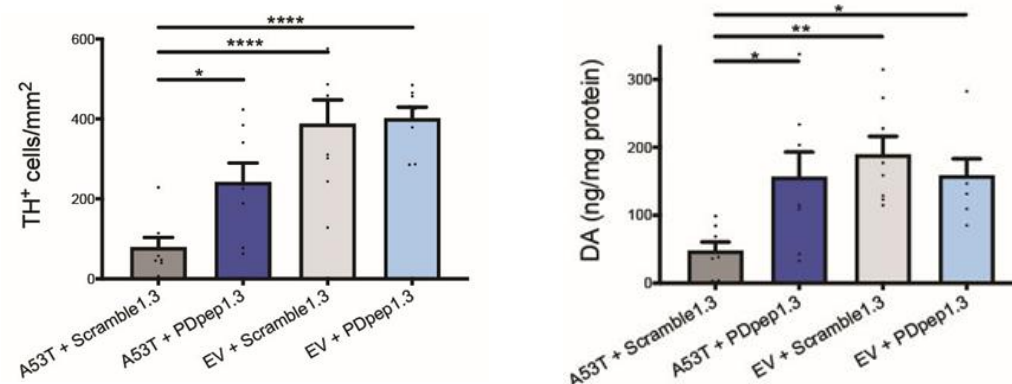


Fig. PDpep1.3 reduces alpha-synuclein protein levels in rat cortical neurons expressing the disease-causing A53T alpha-synuclein mutant (left panel) and normalizes A53T alpha-synuclein levels to those of isogenic controls in dopamine neurons derived from human iPSCs (right panel).



Why Partner With U of T?

Culture of Excellence:

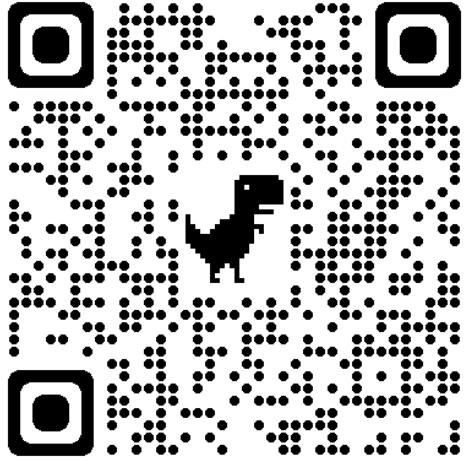
- History of Innovation and Discovery
- Large Well-equipped Researcher Base
- Global Respect (Independent Rankings)
- Global Reach (Partnerships)

Responsive to Industry Requirements:

- Industry Interface from SMEs to Multi-Nationals
- Expertise with Government Funding Support
- Flexible IP terms
- Exposure via Research and Internships to train tomorrow's thought leaders

U of T is Canada's innovation powerhouse where Canadian and international innovators and entrepreneurs can launch game-changing ventures that drive economic growth, social change, and entirely new industries.

Connect with us



Research and Innovation (IPO)

- Email industry.connects@utoronto.ca
rohan.alvares@utoronto.ca

← Visit research.utoronto.ca/connect-with-us to learn more.

Entrepreneurship (UTE)

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