

## NIMS Award 2022 Winner

### Prof. Teruo Okano

Emeritus Professor and Specially Appointed Consultant  
Tokyo Women's Medical University, Tokyo, JAPAN



Distinguished Adjunct Professor, Department of Pharmaceutics and Pharmaceutical Chemistry, Director, Cell Sheet Tissue Engineering Center, School of Medicine and College of Pharmacy, University of Utah, UT, USA

#### Research Field

Micro-nanodomain Structured Surface, Stimuli-Responsive Polymers, Hydrogels, Modulated Control of Drug Release, Artificial Organs, Tissue Engineering, Regenerative Medicine

#### History

2022-present	Specially Appointed Consultant, Tokyo Women's Medical University (TWMU)
2020 to 2022	Director and Specially Appointed Professor, Center for Advanced Biomedical Science, TWMU
2016 to present	Distinguished Adjunct Professor, Department of Pharmaceutics and Pharmaceutical Chemistry and Director, Cell Sheet Tissue Engineering Center, School of Medicine and College of Pharmacy, University of Utah
2014 to present	Emeritus Professor, TWMU
2012 to 2014 (Mar.)	Vice President, TWMU
2011 to 2013 (Feb.)	Acting Secretary General, Office of Medical Innovation, Cabinet Secretariat, Government of Japan
2011 to 2013	Adjunct Professor, Wake Forest Institute for Regenerative Medicine, Wake Forest University School of Medicine, North Carolina, USA
2011 to 2018 (Mar.)	Invited Professor, Center for Advanced Medical Engineering and Informatics, Osaka University
2004 to 2016 (Mar.)	Visiting Professor, Consolidate Research Institute for Advanced Science and Medical Care, Waseda University
2001 to 2014 (Mar.)	Director and Professor, Institute of Advanced Biomedical Engineering and Science, TWMU
2000 to 2001	Director and Professor, Institute of Biomedical Engineering, TWMU
1994 to 2014	Professor, TWMU
1994 to 2016	Adjunct Professor, University of Utah
1979 to 1994	Assistant Professor, Associate Professor, Institute of Biomedical Engineering, TWMU
1984 to 1988	Visiting Assistant Professor, Research Associate Professor, Department of Pharmaceutics and Center for Controlled Chemical Delivery, University of Utah
1974 to 1979	Graduate Student and Research Assistant, Department of Polymer Chemistry, Waseda University

#### Major Awards

- The JSRM Achievement Awards, Japanese Society for Regenerative Medicine (2021)
- Excellence Achievement Awards, Tissue Eng. and Regenerative Med. Inter. Soc.-Asia Pacific (2018)
- Honorary Professorship, Harbin Medical University, China (2016)
- Outstanding Achievement in Biomaterials Science, Japanese Society for Biomaterials (2014)

**Fellow, The Royal Society of Chemistry (2014)**

Fellow, Science Council of Japan (2014-2019)

Outstanding Achievement in Polymer Science and Technology from Society of Polymer Science Japan (2013)

Fellow, Tissue Engineering and Regenerative Medicine International Society (2012)

Honorary Professorship, Sichuan University, China (2012)

**Fellow, Controlled Release Society (2010)**

**Emperor's Medal with Purple Ribbon (National Meritorious Achievement Award) (2009)**

The Commendation for Sci. and Tech. by the Minister of Education, Culture, Sports, Sci. and Tech. (2009)

The Yamazaki-Teiichi Prize (2009)

The Awards for Excellent New Technologies and Products of Small and Medium Enterprises (2009)

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Nagai Innovation Award, Controlled Release Society (2006)

Leona Esaki Prize (2005)

The Award of the Official Journal of Japanese Society for Artificial Organs (2002)

**Fellow, Federation of Biomaterials Science & Engineering (2000)**

Founders Award, Controlled Release Society (2000)

The Award of the Official Journal of Japanese Society for Artificial Organs (2000)

The Award of the Official Journal of Japanese Society for Artificial Organs (1999)

The Award of the Society of Polymer Science, Japan (1998)

**Clemson Award for Basic Research, Society for Biomaterials (1997)**

**Fellow, American Institute of Medical and Biological Engineering (1997)**

Outstanding Pharmaceutical Paper Award, Controlled Release Society (1997)

Outstanding Paper Award, Controlled Release Society (1996)

Outstanding Paper Award, Controlled Release Society (1995)

The Award of the Japanese Society for Biomedicals (1992)

Outstanding Paper Award, Controlled Release Society (1990)

The 49th Noteworthy Inventions, Science and Technology Agency (1990)

The 48th Noteworthy Inventions, Science and Technology Agency (1989)

Science News Award, Japan Society for Medical Electronics and Medical Engineering (1983)

**Major Publications/Books (Listed from 1990 publications)**

1. **T Okano**, YH Bae, H Jacobs, SW Kim, Thermally on-off switching polymers for drug permeation and release, **J of Controlled Release**, 1990, **11 (1-3)**, 255-265
2. **T. Okano** , N. Yamada, H. Sakai , Y. Sakurai . A novel recovery system for cultured cells using plasma-treated polystyrene dishes grafted with poly(N-isopropylacrylamide). **J of Biomedical Materials Research** 1993;27(10):1243-1251.
3. **T. Okano** , N. Yamada , M. Okuhara , H. Sakai , Y. Sakurai . Mechanism of cell detachment from temperature-modulated, hydrophilic-hydrophobic polymer surfaces. **Biomaterials** 1995;16(4):297-303.
4. R Yoshida, K Uchida, Y Kaneko, K Sakai, A Kikuchi, Y Sakurai, **T Okano**, Comb-type grafted hydrogels with rapid deswelling response to temperature changes, **Nature** 1995, 374 (6519), 240-242
5. J Kobayashi, A Kikuchi, T Aoyagi, **T Okano**, Cell sheet tissue engineering: cell sheet preparation, harvesting/manipulation, and transplantation **J of Biomedical Materials Research**, 2019 Part A 107 (5), 955-967



## **Research Achievement Title**

Development of cell sheet engineering using temperature-responsive polymers and its application to regenerative medicine

## **Research Summary**

Inventing smart cell culture dishes coated with nano-leveled thickness of temperature-responsive polymers, Prof. Okano has developed a world-leading technology that allows for easy harvesting of cells as sheets simply by lowering the temperature and without cell-damaging enzymatic treatment. The technology has been applied to regenerative medicine, achieving the innovative therapy where transplanting the cell sheets to diseased tissue and organs. In particular, the heart of a patient with severe heart failure enables the patient to recover enough by cell sheets to walk without an artificial heart.

## **Impact on the Academic and Industrial Sectors**

The cell sheet technology, which started as materials science research, now leads innovation in the field of regenerative medicine. Clinical trials are being conducted not only for the treatment of heart failure, but also for the regeneration of corneal and periodontal tissues, prevention of stenosis after esophageal cancer resection, among others. Further development is expected as the world's first, cutting-edge medical technology originating from Japan.