

LECTURE 17



Dr. Benoit Perthame

- **Laboratoire J.-L.Lions, Sorbonne-Universite, Paris, France**
- **Professor (exceptional class) of the University of Pierre and Marie Curie (Paris 6), France**
- **French Academy of Sciences (2017)**
- **Academia Europaea (2016)**
- **European Academy of Sciences (2013)**

Date: November 19, 2019



淡江大學熊貓講座
TAMKANG CLEMENT AND CARRIE CHAIR

Title: Turing and Patterns in Nature

Professor Benoit Perthame
University of Pierre and Marie Curie (Paris 6)

Professor Benoit Perthame, a member of the French Academy of Sciences (2017), the Academia Europaea (2016) and the European Academy of Sciences (2014), is a University Professor (exceptional class) of the University of Pierre and Marie Curie (Paris 6), France. He is the Head of Division of Mathematics, European Academy of Sciences, since 2015, and is also the Head of Laboratoire Jacques-Louis Lions since 2013. He is one of world leading experts on the mathematical modeling in biology and medicine (including tissue growth and cancer therapy). He has published more than 260 research papers in SCI journals with very high number of citations. He has also received many distinguished awards: Grand Prix INRIA – French Academy of Sciences (2015), Blaise Pascal Medal (2013), etc. He was invited as a plenary speaker to ICM (International Congress of Mathematicians) in Seoul, 2014. He has served as an editor in many international journals and is now the Editor-in-Chief of Acta Applicandae Mathematica.

Time: 11/19/2019 (Tue), 14:00-16:00

Place: Hsu Shou-Chlien International Conference Center 守謙國際會議中心有蓮廳

Mathematics Department, Tamkang University

INTRODUCTION

- Professor Benoit Perthame is a University Professor (exceptional class) of the University of Pierre and Marie Curie (Paris 6), France. He is the Head of Division of Mathematics, European Academy of Sciences, since 2015. He is also the Head of Laboratoire Jacques-Louis Lions since 2013. He is one of world leading experts on the mathematical modeling in biology and medicine (including tissue growth and cancer therapy). He has published more than 260 research papers in SCI journals with very high number of citations.
- He was elected as a member in the French Academy of Sciences in 2017. He is also members of Academia Europaea (2016), European Academy of Sciences (2013), and Institut Universitaire de France (2007-16, 1994-99). He has also received many distinguished awards: Grand Prix INRIA – Academy of Sciences, Paris, in 2015, Blaise Pascal Award (2013), Prize R. Sacchi Landriani de l'Accademia Lombarda (1997), Silver Medal of CNRS (1994), Blaise Pascal Prize (1992), C.I.S.I. Prize (1992), and Pecot Prize, Collège de France (1989), etc.
- He was invited to ICM (International Congress of Mathematicians) as a plenary speaker (Seoul, 2014) and an invited speaker in PDEs (Zurich, 1994). He has served as an editor in many international journals: Comm. P.D.E., Calcolo, DCDS(B), Methods and Appl. of Anal., M3AS, Milan J. Math., Kinetic and Related Models, Bol. SeMA, NoDEA, Comm. Math. Sc., IMA J. Biology and Medicine, SIAM J. Math. Anal. He was the Editor-in-Chief of Model. Math. Anal. Num. during 1997-2005 and now the Editor-in-Chief of Acta Applicandae Mathematica (Springer) since 2017.

Topic : Turing and Patterns in Nature

ABSTRACT

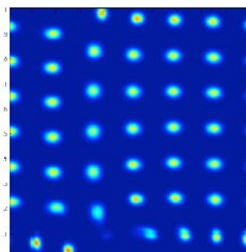
Alan Turing is most known for inventing cryptology and the decoding of the Enigma machine during the Second World War, thus founding the modern computer science.

However, in 1952, two years before he committed suicide, he published a remarkable mathematical paper in which he describes a surprising mechanism which explains how patterns are formed during morphogenesis and early development of organisms. He introduces the concept of morphogen, a notion which was unknown at that time, and his theory will be reproduced experimentally only decades later. Turing structures are now observed in a number of natural phenomenon.



Alan Turing and Patterns in Nature

Benoît Perthame



Alan Turing and foundations of informatics



1912–1954

Mathematics for biology



Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, Vol. 237, No. 641. (Aug. 14, 1952), pp. 37-72.

THE CHEMICAL BASIS OF MORPHOGENESIS

By A. M. TURING, F.R.S. *University of Manchester*

(Received 9 November 1951—Revised 15 March 1952)

It is suggested that a system of chemical substances, called morphogens, reacting together and diffusing through a tissue, is adequate to account for the main phenomena of morphogenesis. Such a system, although it may originally be quite homogeneous, may later develop a pattern or structure due to an instability of the homogeneous equilibrium, which is triggered off by random disturbances. Such reaction-diffusion systems are considered in some detail in the case of an isolated ring of cells, a mathematically convenient, though biologically unusual system.

Mathematics for biology



- Are there fundamental principles in biology ?
- "Science is a differential equation" (Alan Turing)
- Turing instability and Turing patterns are one of them

Conclusion



- Mathematics occur in life sciences
- Numerical simulations use mathematical models
- There are concrete applications
- There are theoretical questions



MINUTE



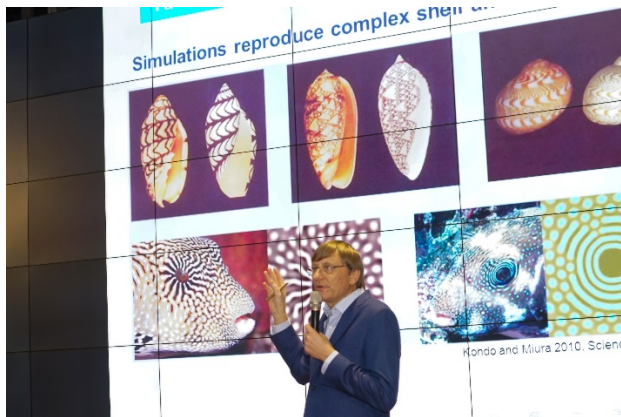
Meet with the Chairperson of the Board, Dr. Flora Chia-I Chang



Meet with Vice the President for Academic Affairs, Chii-Dong Ho, and TKU colleagues

- Prof. Benoit Perthame visited Tamkang University during November 14-19, 2019. Prof. Jong-Sheng Guo at the Department of Mathematics of TKU made receptions and accompanied him during his stay at Hwei-wen Hall. His visit was honored by Tamkang Clement and Carrie Chair Lecture Fund in Taiwan.
- Before the Chair Lecture at TKU, Prof. Benoit Perthame visited the Vice President for Academic Affairs, Dr. Chii-Dong Ho, and the Chairperson of the board, Dr. Flora Chia-I Chang. Warmest welcomes were presented to the first Chair Lecture. Prof. Benoit Perthame also visited the Tamsui Campus of TKU and had a very impressive impression of the beautiful campus.

*Tamkang University 70th Anniversary
Tamkang Clement and Carrie Chair*



Delivering The Tamkang Clement and Carrie Chair Lecture at The International Convention Centre

- Prof. Benoit Perthame delivered a two-hour Chair Lecture on Turing and Patterns in Nature at the international conference center on November 19, 2019. There were many faculty and hundreds of students from the Department of Mathematics attending the lecture. When delivering his speech, Prof. Benoit Perthame received great attentions from the audience and interacting with the audience during the Q&A session successfully.



Photos with Dean of Science College, Dr. Tzenge-Lien Shih and Mathematics Faculty