Leopoldina
Nationale Akademie
der Wissenschaften

Curriculum Vitae Prof. Dr. Thomas Bortfeld

Image: Massachusetts General Hospital

Name: **Thomas Bortfeld**
Born: **15 March 1962**

Research Priorities: Medical physics, intensity-modulated radiation therapy (IMRT), proton therapy, optimisation methods

Thomas Bortfeld is a German-American physicist who has made substantial contributions to developments in radiation therapy. When it comes to treating tumours, the main challenge relates to delivering a therapeutically effective dose to the tumour without exceeding the threshold that can be tolerated by the surrounding normal tissue. Together with his team, Thomas Bortfeld is developing models and algorithms for calculating the best-possible treatment strategy in each case as well as technologies for its clinical implementation. The intensity-modulated radiation therapy (IMRT) method – a development to which he has substantially contributed – has now been used in the treatment of 30 million patients worldwide.

Academic and Professional Career

since 2017	Honorary Professor, Faculty of Medicine, University of Freiburg, Freiburg, Germany
since 2008	Professor of Radiation Oncology, Harvard Medical School, Boston, USA
since 2008	Chief, Division of Radiation Biophysics, Department of Radiation Oncology, Massachusetts General Hospital, Boston, USA
2001 - 2008	Associate Professor of Radiation Oncology, Harvard Medical School, Boston, USA
2001 - 2008	Director of Physics Research, Department of Radiation Oncology, Massachusetts General Hospital, Boston, USA
1996 - 2001	Deputy Head, Division of Medical Physics in Radiation Oncology, German Cancer Research Center (DKFZ), Heidelberg, Germany

1995 - 2001	Independent Lecturer, Faculty of Physics and Astronomy, Heidelberg University, Heidelberg, Germany
1995	Habilitation and Venia Legendi (authorisation to teach) in Physics, Heidelberg University, Heidelberg, Germany
1994 - 2001	Head of the "Physical Models" Working Group, German Cancer Research Center, Heidelberg, Germany
1993 - 1994	Research Associate, Division of Medical Physics in Radiation Oncology, German Cancer Research Center, Heidelberg, Germany
1992 - 1993	Postdoc, Institute of Radiation Physics, MD Anderson Cancer Center, Houston, USA
1991 - 1992	Research Associate, Division of Biomedical Physics in Radiation Oncology, German Cancer Research Center, Heidelberg, Germany
1990	PhD in Physics, Heidelberg University, Heidelberg, Germany
1988	Diplom degree in Physics, Heidelberg University, Heidelberg, Germany

Functions in Scientific Societies and Committees

since 2021	Member, Scientific Advisory Board, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, (HZDR), Germany
2019	Co-Organiser, Think Tank Meeting "The most provocative questions for medical physicists in Radiation Oncology", European Society for Therapeutic Radiology and Oncology (ESTRO)
2019	Member, Scientific Committee, International Conference on the Use of Computers in Radiation Therapy (ICCR), Montreal, Canada
since 2018	Co-Founder and Co-Chair, International Consortium "Optimal Stopping in Radiation Therapy" (OSRT)
2017 - 2020	Secretary and Treasurer, Topical Group on Medical Physics (GMED), American Physical Society (APS), American Association of Physicists in Medicine (AAPM), USA
2014 - 2017	Member, Subcommittee of Professors, Harvard Medical School, Boston, USA
since 2014	Member, Steering Committee, Proton Program Project Grant (P01), Department of Radiation Oncology, Massachusetts General Hospital, Boston, USA
since 2013	Chair/Co-Chair, Medical Physics Residency Program Oversight Committee, Harvard Medical School, Boston, USA
since 2012	Chair, Proton Projects Oversight Committee, Department of Radiation Oncology, Massachusetts General Hospital, Boston, USA

2010 - 2017	Co-Chair, Working Group on Future Research and Academic Medical Physics (FUTURE), AAPM, USA
2009 - 2013	Member, Promotions, Reappointments, and Appointments Committee (P&R), Harvard Medical School, Boston, USA
2007 - 2008	Scientific Program Director, Therapy, AAPM 50th annual meeting, AAPM, USA
2004	Member, Scientific Committee, ICCR 2004, Seoul, South Korea
1999 - 2001	Member, Budget Committee, German Cancer Research Center, Heidelberg, Germany
1999	Member, Steering Council, IMRT School, Heidelberg University, Heidelberg, Germany

Honours and Awarded Memberships

since 2022	Honorary Member, ESTRO
since 2021	Member of the German National Academy of Sciences Leopoldina, Germany
2019	Australia-Harvard Fellowship, Harvard Club of Australia Foundation, Harvard Club of Australia, Bondi Junction, Australia
2018	Glocker Medal, German Society for Medical Physics (DGMP), Germany
2016	Stifterverband Science Prize, Fraunhofer Society, Munich, Germany
2015	Alfred Breit Prize, German Society of Radiation Oncology (DEGRO), Germany
2009	Fellow, AAPM, USA
2008	Artium Magistrum honoris causa, Harvard University, Boston, USA
since 2004	Fellow, Institute of Physics, London, UK
2001	Nominated for the Deutscher Zukunftspreis (Finalist, Top 4), German Federal President's Award for Technology and Innovation, Germany
1995	Young Investigator Award (third place), AAPM, USA
1994	Helax Award, Helax AB, Uppsala, Sweden
1990	Richtzenhain Prize, German Cancer Research Center, Heidelberg, Germany

Research Priorities

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From a mathematical perspective, radiation therapy is an inverse problem in which the intensity and direction of the radiation fields used must be inferred from the desired dose in the target volume of the tumour. This problem is mathematically linked to the reconstruction of computed tomography (CT) images from measured X-ray projections. Unlike image reconstruction, there is no exact solution to be found when planning treatment; rather, the best possible compromise, taking into account objectives and side conditions, must be sought. This is known as multi-objective optimisation. Thomas Bortfeld and his team focus on formulating and solving this optimisation problem during the treatment planning process.

Another aspect is delivering intensity-modulated radiation fields with multileaf collimators that match the treatment volume irradiated to the object to be treated and to enable geometrically differentiated dosing. This work has led to inverse intensity-modulated radiation therapy (IMRT) planning in which the intensity of the radiation dose within the radiation field can be changed and adapted to the radiosensitivity of the tissue with pinpoint accuracy. This enables radiotherapy to be targeted very precisely at the tumour while protecting the healthy surrounding structures from radiation. In turn, this means that a higher radiation dose can be used, thus improving the chances of patient recovery. IMRT is now considered the state of the art in radiation therapy worldwide.

Current research priorities include developing optimal stopping methods for improving tailored therapies, systematically determining the clinical target volume (CTV), and developing methods for cutting proton therapy costs with a view to making this type of treatment accessible to more patients.