

# Curriculum Vitae

---

Name: Bent Wilhelm Schoultz  
Born: April 10<sup>th</sup>, 1967, Oslo  
Civil status: Married, two children (18 and 20 years)  
Contact details: Mobile phone: +47 480 689 24  
E-mail: bent.wilhelm.schoultz@syklotronsenteret.no

## **Main fields of research**

Pharmaceutical radiochemistry, molecular imaging, nuclear chemistry, organic synthesis and analytical chemistry, radioisotope production, process automation.

## **Interests and experiences**

My key scientific interests are drug development and manufacturing, in particular within nuclear medicine. Major scientific work experiences are in general R&D related nuclear chemistry and physics with most experience from production of radionuclides, nuclear technology development, labelling chemistry, pharmaceutical production and preclinical evaluations.

I have extensive experience from different projects, with production of radionuclides by use of both nuclear reactors and cyclotrons. Methods and protocols were developed and optimized for production of different radionuclides used in pre-clinical and clinical studies, e.g. the therapeutic radionuclides Astatine-211 and Thorium-227, in addition to the approved radiopharmaceutical drug based on Radium-223.

Work on production of radionuclides by cyclotron led to several patents of a new technology platform for high performance production of radionuclides. The projects involved a new strategy for synthetic solid targets for production of Gallium-68 but also with a potential for a wide range of other radionuclides. Related work included development of separation chemistry adaptable for remotely processing of cyclotron targets and isolation of products by automation.

Projects on automation of chemical processing (PhD projects and in own company) involved different new interfaces from capillary reactors, self-developed dynamic syringe reactors and classical reactor vials. The automated systems comprised full processing from radiolabeling to isolation and formulation of several PET-traces.

## **Awards**

**“Ideprisen 2016”** Awarded by Inven2 AS (tech transfer office) after disclosure of the invention of a “high performance astatine production cyclotron target”.

**“Folkets pris 2016”** Awarded by Inven2 AS for the “high performance astatine production cyclotron target” after a public vote for the best innovation.

## **Academic Education**

**2012** **Dr. Philos.** in Nuclear Chemistry, Department of Chemistry, University of Oslo. Thesis “Automated Radio synthesis of Tracers for Use in Positron Emission Tomography”

**1995** **MSc** (Cand. Scient.) in Nuclear Chemistry, Department of Chemistry, University of Oslo. Master thesis: “ $^{125}\text{I}$  and  $^{211}\text{At}$ -labelled methylene blue and thionine derivatives; preparation, analysis, stability and bio-distribution”. The major objective was to develop a construct for targeted radiotherapy of malignant melanomas. In depth courses and education in radio- and nuclear chemistry. Other; advanced analytical chemistry, extraction and ion exchange, organic chemistry, radiation biology, health physics and detector technology.

**1993** **BSc** (Cand. Mag.) in Chemistry, Faculty of Mathematics and Natural Sciences, University of Oslo

## Continuing education

- 2014**                    **“Entering Leadership in Research”**. Personal development program for postdoctorals at the Faculty of Mathematics and Natural Sciences, University of Oslo
- 2002**                    **“FELACE category C scientist”**. Course in laboratory animal science. Norwegian School of veterinary science, Oslo
- 1999**                    **“Physics of medical X-ray imaging”**, ERPET course, Malmö, Sweden
- 1999**                    **“Establishment of Reference Levels in Diagnostic Radiology”**, ERPET course, Passau, Germany

## Professional affiliations

- 2023-current**            **Norsk Medisinsk Syklotronsenter AS**  
Rikshospitalet, Oslo, Section for R&D,  
acting research director.
- 2022-2023**              **Norsk Medisinsk Syklotronsenter AS**  
Rikshospitalet, Oslo, Section for R&D, senior  
research scientist, part time.

Key projects: Development and testing of technology for cyclotron nuclide production, e.g. proton energy moderators, target materials and target holders in addition to automation of post processing of cyclotron target for radionuclide production. Concept studies for development of Technesium-99m generators based on accelerator produced Molybden-99. Establishment of labeling protocols for custom production to OITL customers. Facilitating and contribution to strengthen NMS role in the width of radiopharmaceutical science by creating in house IP on production and manufacturing technology and potential concepts for future applied nuclear medicine.

- 2013-2023**              **Nuclear Chemistry**, Department of Chemistry,  
and **Nuclear and Energy Physics**, Department of  
Physics, University of Oslo, senior research  
scientist.

Key projects: In joint venture with NMS, development of technology platforms for production of PET, SPECT and therapeutic radionuclides. Supervision and collaborations with students and post doctor on nuclear technology. Taken initiative and being an entrepreneur in upgrading and establishing modern laboratories for radiochemistry at the Oslo Cyclotron Laboratory, Department of Physics, UiO.

**2010-2014**                      **Scintomics Up North AS** Ås, Norway, CEO

Co funder of company for customizing and sale of equipment for automated synthesis and manufacturing of radiopharmaceuticals. R&D activities led to patent application and filing of production technology.

**2005-2013**                      **Nuclear Chemistry** Department of Chemistry, University of Oslo, senior engineer

Key projects: Establishing radiochemistry for new labelling technology on  $^{18}\text{F}$ -tracers and  $^{64}\text{Cu}$ -chelates with emphasis on automated radiochemistry suitable for production under GMP condition and supervision of students. Active part in renovation and modernization of the department's old laboratories to facilitate modern research laboratories in addition to GMP laboratory for PET radiochemistry. Engagement also included consultants for building of preclinical PET laboratories at IMB at the Medical faculty. Doctoral thesis work performed partly in Oslo and at the Department of Nuclear Medicine, Technische Universität München, Germany.

**2000-2005**                      **Algeta ASA** Oslo, Norway, senior research scientist

Key projects: First fixed employed. Production and use of alpha-particle emitting radionuclides for targeted radiotherapy of cancer, including  $^{212}\text{Pb}/^{212}\text{Bi}$ ,  $^{223}\text{Ra}$ ,  $^{224}\text{Ra}$ ,  $^{227}\text{Ac}$  and  $^{227}\text{Th}$ . The key projects comprised development of radionuclide production systems and targeting vehicles. The process development for Radium-223 manufacturing was essential for clinical trials and the final commercial product, Alpharadin.

**1999-2000**                      **Norwegian Radiation Protection Authority**  
Østerås, Norway, research scientist in medical physics, in the field of ionizing radiation applied for diagnostic and radiation therapy.

Key projects: Biological effects of ionizing radiation in diagnostic imaging and radiation therapy. Development of methods for surveillance and supervision of radiation workers in the Norwegian Health Care System, and dosimetry for patients receiving radiation for therapy and diagnosis.

**1996-1998**

**Duke University Medical Center** Department of Radiology, North Carolina, USA, research scientist.

Key projects: At the laboratory of Professor M. Zalutsky the focus of the work was twofold: 1) Establishing production of the alpha-particle emitter  $^{211}\text{At}$  in a quantity and quality for clinical studies. 2) Preparation of  $^{18}\text{F}$ -labeled tracers for molecular imaging by means of PET.

### **Project management experience**

**2019-2022**

**SPARK.** Life Science's innovation program for health-related topics in the life science domain

**2019-2020**

**Innovation grant.** University of Oslo/Norwegian Research Council

**2019-2021**

**FORNY2020.** Cyclotron targets for production of radiogallium. Co-investigator. Norwegian Research Council

**2010-2015**

**Scintomics Up North AS** Automation of radiosynthesis. CEO, owner

**2005-2012**

**Grant from University of Oslo.** Automation of radio synthesis/work for doctoral thesis

### **Supervision of graduate students and research fellows**

**2005-**

Co-supervision of > 10 Master's students/ Ph.D./Postdocs at Nuclear Chemistry, Department of Chemistry, and Nuclear Physics and Biophysics and medical physics at the Department of Physics, University of Oslo, Norway

### **Teaching activities**

**2014-2016**

**Radio and Nuclear Chemistry,** University of Oslo, Norway. Responsible

**2006-2008**

**Radiochemistry Fundamentals.** University of Oslo, Norway. Co-lecturing

## List of publications

- 1 C. F. Foulon, **B. W. Schoultz**, M. R. Zalutsky. Preparation and Biological Evaluation of an Astatine-211 Labeled Biotine Conjugate: Biotinyl-3-[<sup>211</sup>At]astatoanilide. Nucl. Med. Biol. 1997, 24, 135-143.
- 2 **B. W. Schoultz**, B. W. Wieland, R. H. Larsen, M. R. Zalutsky. Production of Astatine-211 via the <sup>209</sup>Bi( $\alpha$ ,2n)<sup>211</sup>At reaction with curved natural Bismuth internal target, J. Labld. Compds. Radiopharm. 1997, 40, pp. 283.
- 3 **B. W. Schoultz**, R. H. Larsen, M. R. Zalutsky. Preparation of  $\alpha$ -particle emitting radiopharmaceuticals for radiotherapy: Radiolytic degradation of an <sup>211</sup>At-labeled acylation agent and its stannyl precursor. J. Labld. Compds. Radiopharm. 1997, 40, pp. 363.
- 4 G. Vaidynathan, D. J. Affleck, P. Welsh, J. Li, **B. W. Schoultz**, M. R. Zalutsky. Preparation of 5-[<sup>131</sup>I]Iodo- ([<sup>131</sup>I]FIAU) and 5-[<sup>211</sup>At]astato-1-(2-deoxy-2-Fluoro-b-D-Arabinofuranosyl)Uracil ([<sup>211</sup>At]FAAU) by halodestannylation reaction. J. Labeld. Compds. Radiopharm. 1997, 40, pp. 91.
- 5 P. Grøn, H. M. Olerud, G. Einarsson, W. Leitz, A. Servomaa, **B. W. Schoultz**, O. Hjordemaal. A Nordic survey of patient doses in diagnostic radiology. Eur. Radiol. 2000, 10, 1988-1992.
- 6 R. H. Larsen, G. Salberg, K. W. Borch, G. Henriksen, **B. W. Schoultz**, B. Farstad, M. Aas, E. Traasdahl, L. Balteskard, S. Hess, S. F. Nilsson, S. D. Fossaa, O. B. Bruland. Treatment of skeletal metastases with alpha emitting Ra-223: Blood clearance pattern in patients with advanced breast and prostate cancer. J. Nucl. Med., 2002, 43, 580.
- 7 R. H. Larsen, K. W. Borch, M. Aas, G. S. D. Fossaa, L. Balteskard, E. Traasdahl, S. Hess, Salberg, G. Henriksen, **B. W. Schoultz**, S. F. Nilsson, O. B. Bruland. Phase I clinical trial exploring the alpha emitting radium-223 against skeletal metastases: blood clearance in patients with breast and prostate cancer. Int. J. Cancer, 2002, 13, 285
- 8 G. Henriksen, **B. W. Schoultz**, P. Hoff, R. H. Larsen, Potential in vivo generator for alpha-particle therapy with <sup>212</sup>Pb: Presentation of a system to minimize escape of daughter nuclide after decay of <sup>212</sup>Pb to <sup>212</sup>Bi. Radiochimica Acta, 2003, 91, 109-114.
- 9 G. Henriksen, **B. W. Schoultz**, T. A. Michaelsen, O. S. Bruland, R. H. Larsen. Sterically stabilized liposomes as a carrier for alpha-emitting radium and actinium radionuclides. Nucl. Med. Biol. 2004, 31, 441-449.
- 10 G. Henriksen, **B. W. Schoultz**, C. Hultsch, H. J. Wester. Fast and repetitive in-capillary production of Radiopharmaceuticals (ICPR): 1. [<sup>18</sup>F]FDG. Eur J Nucl Med Mol Imaging. 2008 Nov 27. [Epub ahead of print] PMID: 19037638.
- 11 **B. W. Schoultz**, E. Arstad, J. Marton, H. J. Wester, G. Henriksen. A New Method for Radiosynthesis of <sup>11</sup>C-Carbamate groups and its application for a highly efficient synthesis of the Kappa-Opioid Receptor Tracer [<sup>11</sup>C]GR103545. The Open Medicinal Chemistry Journal. 2008, 2, 72-74.
- 12 J. Marton, **B. W. Schoultz**, T. Hjørnevik, A. Drzezga, B. H. Yousefi, H. J. Wester, F. Willoch, G. Henriksen. 2009. Synthesis and Evaluation of a Full-Agonist Orvinol for PET-Imaging of Opioid Receptors: [<sup>11</sup>C]PEO. Journal of Medicinal Chemistry, 52, 5586-5589.
13. H. J. Wester, **B. W. Schoultz**, C. Hultsch, G. Henriksen. 2009. Fast and repetitive in-capillary production of Radiopharmaceuticals (ICPR): 1. [<sup>18</sup>F]FDG. European Journal of Nuclear Medicine and Molecular Imaging, 36, 653-658.
- 14 **B. W. Schoultz**, T. Hjørnevik, F. Willoch, J. Marton, A. Noda, Y. Murakami, S. Miyoshi, S. Nishimura, E. Arstad, A. Drzezga, I. Matsunari, G. Henriksen. 2010. Evaluation of the kappa-opioid receptor-selective tracer [<sup>11</sup>C]GR103545 in awake rhesus macaques. Eur J Nucl Med Mol Imaging. 37, 1174-1180.
- 15 T. Hjørnevik, **B. W. Schoultz**, J. Marton, J. Gjerstad, A. Drzezga, G. Henriksen, F. Willoch. 2010. Spinal long-term potentiation is associated with reduced opioid neurotransmission in the rat brain. Clinical Physiology and Functional Imaging. 30, 285-293

- 16 D. Ø. Eriksen, B. Rynningen, **B. W. Schoultz**, G. Salberg, R. H. Larsen, 2012. Liquid Scintillation Spectroscopy of  $^{227}\text{Ac}$  and Daughters. *Journal of Analytical Sciences, Methods and Instrumentation*, 2, 33-36
- 17 **B. W. Schoultz**, B. J. Reed, J. Marton, F. Willoch, G. Henriksen. 2013. A Fully Automated Radiosynthesis of [ $^{18}\text{F}$ ]Fluoroethyl-Diprenorphine on a Single Module by Use of SPE Cartridges for Preparation of High Quality 2-[ $^{18}\text{F}$ ]Fluoroethyl Tosylate. *Molecules*, 18, 7271-7278
- 18 E. Galante, **B. W. Schoultz**, M. Koepp, E. Arstad, 2013. Chelator-Accelerated One-Pot 'Click' Labeling of Small Molecule Tracers with 2-[ $^{18}\text{F}$ ]Fluoroethyl Azide. *Molecules*. 18, 5335- 5347.
- 19 A. Kristian, P. Riss, H. Qu, M. Milde, **B. W. Schoultz**, O. Engebråten, G. Mælandsmo, E. Malinen, 2014. Positron emission tomography and pharmacokinetics of 2-[ $^{18}\text{F}$ ]fluoroethyl choline for metabolic studies in breast cancer xenografts. *Acta Oncologica*. 53, 1086- 1092
- 20 **B. W. Schoultz**, T. Hjørnevik, B. J. Reed, J. Marton, C. S. Coello, F. Willoch, G. Henriksen. 2014. Synthesis and Evaluation of Three Structurally Related  $^{18}\text{F}$ -Labeled Orvinols of Different Intrinsic Activities: 6-O-[ $^{18}\text{F}$ ]Fluoroethyl-diprenorphine ([ $^{18}\text{F}$ ]FDPN), 6-O-[ $^{18}\text{F}$ ]Fluoroethyl-buprenorphine ([ $^{18}\text{F}$ ]FBPN), and 6-O-[ $^{18}\text{F}$ ]Fluoroethyl-phenethyl-orvinol ([ $^{18}\text{F}$ ]FPEO). *Journal of Medicinal Chemistry*, 57, 5464-5469
- 21 Görgen, Andreas; Guttormsen, Magne Sveen; Larsen, Ann-Cecilie; Siem, Sunniva; Adli, Erik; Edin, Nina Frederike J; Gjersdal, Håvard; Henriksen, Gjermund; Malinen, Eirik; Modamio, Victor; Schoultz, **Bent W. Schoultz**; Sobas, Pawel Andrzej; Theodossiou, Theodossis & Wikne, Jon Christopher, 2021. The Oslo Cyclotron Laboratory. *The European Physical Journal Plus*. ISSN 2190-5444. 136, s. 1–13.

### Conference proceedings and oral presentations

- 1 R. H. Larsen, K. W. Borch, M. Aas, S. D. Fosså, L. Balteskard, E. Traasdahl, S. Hess, G. Salberg, G. Henriksen, **B. W. Schoultz**, S. Nilsson, Ø. S. Bruland, 2002. Phase I clinical trial exploring the alpha emitting radium-223 against skeletal metastases: Blood clearance in patients with breast and prostate cancer, 18<sup>th</sup> UICC International Cancer Congress, Oslo, Norway, 2002
- 2 R. H. Larsen, G. Salberg, K. W. Broch, G. Henriksen, **B. W. Schoultz**, B. Farstad, M. Aas, E. Traasdahl, L. Balteskard, S. Hess, S. F. Nilsson, S.D. Fossaa, Ø.S. Bruland 2002. Treatment of skeletal metastases with alpha emitting  $^{223}\text{Ra}$ : Blood clearance pattern in patients with advanced breast and prostate cancer. American Society of Nuclear Medicine Annual Meeting, Los Angeles, USA, 2002
- 3 D. Ø. Eriksen, B. Rynningen, **B. W. Schoultz**, G. Salberg, R. Larsen, Liquid Scintillation Spectroscopy of  $^{227}\text{Ac}$  and daughters. 1<sup>st</sup> International Nuclear Chemistry Congress. Kusadasi, Turkey 2005
- 4 **B.W. Schoultz**, E. Årstad, J. Marton, F. Willoch, K. H. Jansen, H.J. Wester, G. Henriksen. New Radiosynthesis of [ $^{11}\text{C}$ ]GR103545 Opens for First Selective PET-Investigations of Kappa-Opioid Receptors in Humans. The XIVth Scandinavian Congress of Clinical Physiology and Nuclear Medicine, Lillehammer, Norway, 2008 (oral presentation)
- 5 **B.W. Schoultz**, E. Årstad, J. Marton, F. Willoch, H.J. Wester, G. Henriksen. A new method for radiosynthesis of  $^{11}\text{C}$ -carbamate groups and its application for a highly efficient synthesis of the kappa-opioid receptor tracer [ $^{11}\text{C}$ ]GR103545. 55<sup>th</sup> SNM Annual

- meeting, New Orleans, USA, 2008. Radiopharmaceutical Young Investigator Award Session (oral presentation)
- 6 G. Henriksen, **B.W. Schoultz**, KH. Jansen, H. J. Wester. Automated and repetitive production of PET tracers with  $\mu$ -fluidics: A "faster lab". 55<sup>th</sup> SNM Annual meeting, New Orleans, USA, 2008. Radiopharmaceutical Young Investigator Award Session
  - 7 G. Henriksen, **B.W. Schoultz**, KH. Jansen, H. J. Wester. In-Capillary Chemistry for PET-Tracer Production. European Association of Nuclear Medicine Annual Meeting, München, Germany, 2008
  - 9 **B.W. Schoultz**, E. Arstad, J. Marton, F. Willoch, H. J. Wester, G. Henriksen. A Highly Efficient Method for <sup>11</sup>C-Carbamate Formation Increases the Potential of the Kappa-Opioid Receptor Selective Tracer [<sup>11</sup>C]GR103545. European Association of Nuclear Medicine Annual Meeting, München, Germany, 2008 (oral presentation)
  - 10 **B.W. Schoultz**, J. Marton, E. Årstad, A. Drzezga, F. Willoch, I. Matsunari, H.J. Wester, G. Henriksen. New route to [<sup>11</sup>C]GR103545 enables KOP-PET studies in humans. Deutsche Gesellschaft für Radiofarmazie Annual meeting, Münster, Germany, 2008
  - 11 G. Henriksen, **B. W. Schoultz**, K. H. Jansen, H. J. Wester. In-Capillary Chemistry for PET-Tracer Production. Deutsche Gesellschaft für Radiofarmazie Annual meeting, Münster, Germany, 2008
  - 12 T. Hjørnevik, **B.W. Schoultz**, J. Marton, J. Gjerstad, A. Drzezga, G. Henriksen, F. Willoch. Spinal LTP is associated with reduced opioid neurotransmission in the rat brain. IXth International Conference on Quantification of Brain Function with PET, Chicago, USA, 2009
  - 13 **B. W. Schoultz**, B. Reed, J. Marton, T. Hjørnevik, F. Willoch, G. Henriksen. Establishment of three structurally related 6-O-18F-Fluoroethylated opioid receptor tracers of different intrinsic activities: Automated production and evaluation of [<sup>18</sup>F]FPEO, [<sup>18</sup>F]FBPN and [<sup>18</sup>F]FDPN. Norwegian Society of nuclear medicine and molecular imaging Annual meeting, Tromsø, Norway, 2012
  - 14 B. Reed, C. Coello, I. Lindblom, T. Hjørnevik, **B. W. Schoultz**, G. Henriksen, F. Willoch. Mapping opioid receptor occupancy of varying concentrations of sustained-release naltrexone in serum by PET imaging. Norwegian Society of nuclear medicine and molecular imaging Annual meeting, Tromsø, Norway, 2012
  - 15 **B. W. Schoultz**, B. Reed, J. Marton, T. Hjørnevik, F. Willoch, G. Henriksen. Three structurally related <sup>18</sup>F-labeled opioid receptor tracers of different intrinsic activities: Synthesis and evaluation of [<sup>18</sup>F]FPEO, [<sup>18</sup>F]FBPN and [<sup>18</sup>F]FDPN. SNM Annual meeting, Miami, USA, 2012

#### Granted patents and patent applications:

- a. B.W. Schoultz, G. Henriksen. Apparat og fremgangsmåte for å utføre kjemiske reaksjoner og prosesser. NO20101757.
- b. G. Henriksen, J.C. Müller, S. Siem, A. Görge, B.W. Schoultz. Method of producing radionuclides and apparatus thereof. EP3482400. 2018
- c. B.W. Schoultz, G. Henriksen. Process for the production of gallium radionuclides. UK patent, September 3rd, 2019.
- d. B.W. Schoultz, G. Henriksen European patent number 3482400
- e. B.W. Schoultz. G. Henriksen. US patent application WO2018/007643
- f. B.W. Schoultz, G. Henriksen. PCT/EP2019/073463
- q. B.W. Schoultz. G. Henriksen United States Patent Application No. 16/315,268
- h. B.W. Schoultz, G. Henriksen. PCT/EP2021/080166