BIOGRAPHICAL SKETCH

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NAME: Gryczynski, Zygmunt

eRA COMMONS USER NAME (credential, e.g., agency login): GRYCZYNSKI

POSITION TITLE: Professor and “Tex” Moncrief Jr. Chair

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Gdansk, Poland	M.S.	05/82	Experimental Physics
University of Gdansk, Poland	Ph.D.	06/87	Spectroscopy and Fluorescence
University of Maryland, Baltimore, USA	Postdoctoral	03/89	Protein Chemistry

A. Personal Statement

The objective of the proposal is to develop new technology to monitor surface binding of biological markers with high speed and precision. Nanophotonic approach and signal enhancement allows for incredible signal enhancement and reduction of unwanted background.

I have the expertise, leadership, training and motivation necessary to successfully carry out the proposed research project. I have a broad background in physics, chemical physics, and protein chemistry along with highly advanced training in spectroscopy, fluorescence, and biomedical diagnostics, and imaging. For a long time, I have been working on applications of advanced fluorescence spectroscopy to the biophysics of macromolecular interactions, probe development, as well as highly sensitive fluorescence-based detection, imaging, and sensing. This includes TIRF, FRET, SPCE ultrafast time-resolved fluorescence spectroscopy, fluorescence lifetime imaging (FLIM), fluorescence correlation spectroscopy (FCS), single molecule imaging, fluorescence-based immunoassays and high throughput screening (HTS) with applications of fluorescence to microscopy-based molecular and cellular imaging. For last 10 years I have been co-organizing and co-chairing “Single Molecule Spectroscopy and Superresolution Imaging” conference at SPIE Photonic West Meeting. Over my career I have designed and built multiple devices and instruments for spectroscopic and imaging applications. In the last 10 years my interests have expanded to new, emerging phenomena at the interface of nanotechnology and optics. I have been pioneering applications of metallic nanoparticles and metallic nanolayers to enhance the fluorescence signal and fluorescence-based imaging. For over 20 years I have successfully administered multiple projects from Center grants (P41) and R01 to R33 and R21 grants (e.g. staffing, research planning and designing, research protections and budget). Most importantly over my career I have collaborated with a large number (over 100) established NIH/NSF researchers including 3 Nobel Prize laureates and produced many peer-reviewed publications (over 350), book chapters, and edited 14 books. This current application builds logically on my long experience working with fluorescence-based imaging, single molecule spectroscopy, super-resolution imaging and my recent work on probe development.

1. Ponomarchuk, O., F. Boudreault, I. Gryczynski, B. Lee, S. V. Dzyuba, R. Fudala, **Z. Gryczynski**, J. W. Hanrahan, and R. Grygorczyk. Nano-scale viscometry reveals an inherent mucus defect in cystic fibrosis. *ACS Nano* 2025, https://doi.org/10.1021/acsnano.4c14927.

2. Ceresa, L., J. Chavez, M. Bus, B. Budowle, E. Kitchner, J. Kimball, I. Gryczynski, **Z. Gryczynski.** Förster Resonance Energy Transfer-Enhanced Detection of Minute Amounts of DNA. *Anal. Chem.* 2022. https://doi.org/10.1021/acs.analchem.1c05275.
3. Olejniczak, A., R. M. Rich, **Z. Gryczynski**, B. Cichy. Non-excitonic defect-assisted radiative transitions are responsible for new D-type blinking in ternary quantum dots. *Nanoscale Horizons*, 7 (1), 63-76, 2022.
4. Rice, Q., S. Raut, R. Chib, **Z. Gryczynski**, I. Gryczynski, A. Wang, Y Y. Willliam, B. Tabibi, F. Jaetae Seo. Time-resolved and Temperature-dependent Broadband Emission of Plasmon-coupled Quantum Dots. *J. of Materials and Applications.* Vol. 9, 99-106, 2020.
5. Red blood cells do not attenuate the SPCE fluorescence in surface assays. Matveeva, E.G., Gryczynski, I. Barnett, A., Calander, N., **Gryczynski, Z**. *Ana. Bioanal. Chem*. 2007, **388**, 1127-1135.

B. Positions and Honors

Positions and Employment:

1982-1984 Teaching Assistant, Institute of Physics, Pedagogical University of Slupsk
1984-1986 Research Assistant, Institute of Experimental Physics, University of Gdansk
1987-1989 Assistant Professor, Institute of Physics, Pedagogical University of Slupsk
1989-1991 Research Associate, Department of Biological Chemistry, University of Maryland at Baltimore
1991-1999 Research Assistant Professor, Department of Biological Chemistry and Molecular Biology, University of Maryland at Baltimore
2000-2005 Associate Professor, Department of Biological Chemistry and Molecular Biology, University of Maryland at Baltimore
2005-2020 Professor, Department of Molecular Biology and Immunology, University of North Texas, Health Science Center, Fort Worth, Texas.
2007- Adjunct Professor, University of Shimane, Matsue, Japan.
2009-2010 Adjunct Professor, Texas Christian University, Fort Worth, Texas.
2010- Professor and Moncrief Jr. Chair in Physics, Texas Christian University, Fort Worth, Texas.
2014- Visiting Professor, Department of Physics, University of Strathclyde, Glasgow, UK.

Other Experience and Professional Memberships:

1997-2004 Assistant Director, Center for Fluorescence Spectroscopy (CFS), Department of Biological Chemistry and Molecular Biology, University of Maryland at Baltimore.
2006-2013 Director, Center for Commercialization of Fluorescence Technologies (CCFT), Department of Molecular Biology and Immunology, University of North Texas, Health Science Center, Fort Worth, Texas.
2013- Director, Center for Fluorescence Technologies and Nanomedicine (CFTN), Department of Cell Biology and Immunology, University of North Texas, Health Science Center, Fort Worth, Texas.
2004- present SPIE BiOS - Executive Organizing Committee for Photonics West Meeting
2001-2004 Editorial Board, Journal of Fluorescence.
2008- Editorial Board, Journal of Experimental Biology and Medicine.
2012- Editorial Board, Methods in Applications in Fluorescence.
1990-present The International Society for Optical Engineering (SPIE).

Honors:

1991-1993 American Heart Association –Fellowship
1997-1998 University of Maryland, Special Research Initiative Support
2016 Professor Shugar Award, Polish Biophysical Society

Conference/Course Organizer/Instructor:

1997-2004 Short Course. *Principles and Applications of Time-Resolved Fluorescence Spectroscopy (Organizer/Instructor).* Baltimore, MD.
2003 BITC Workshop*. Fluorescence Spectroscopy of Ligand Binding*. Durham, NH. July 2003. (Instructor)
2003-2004 *Biohazard Detection Technologies Conference (Chair); SPIE (Photonics West)*

2003-present *Plasmonics in Biology and Medicine Conference (co-Chair); SPIE (Photonics West)*
2005-present *Ultrasensitive and Single-Molecule Detection Technologies (Chair); SPIE (Photonics West)*
2003-present European Course. *Principles and Applications of Time-Resolved Fluorescence Spectroscopy (Organizer/Instructor)*. Berlin, Germany.
2006 *FRET Microscopy Workshop*, Keck Center for Cellular Imaging, University of Virginia, March 2006, 2011.
2007-present *Short Course on Molecular and Cellular Fluorescence*. (*Organizer*), Fort Worth, TX.
2013 Fluorofest Workshop organized with Horiba Scientific. UNTHSC, Fort Worth, TX.
2019 Fluorofest Workshop organized with Horiba Scientific. TCU, Fort Worth, TX.

Grants review/study sections:
Permanent Member of NIH Medical Imaging (MEDI) Study Section 2005-2010.
Ad-hoc Review Panels:
NIH, DOE, NSF

C. Contributions to Science

My research expertise emerges from my advanced education in physics, optical spectroscopy, and fluorescence spectroscopy in cells and tissue, as well as my long training in protein chemistry, protein-ligand interactions and protein conformational thermodynamics. ***Over 400 peer-reviewed publications, h-index: 63, and over 15,000 citations.***

1. My early work was focused on the basics of fluorescence spectroscopy and advanced methods for transition moment determination of organic molecules. The results of this work were new methods for studying transition moments in oriented media and a mathematical description noted in literature as the Kawski-Gryczynski Model. Selected examples:
   a. On the Determination of Transition-Moment Directions from Emission Anisotropy Measurements. Kawski,A. and **Z. Gryczynski.** *Z. Naturforsch*., Vol. **41a**, (1986), 1195-1199.
   b. Molecular Orientation and Structure of the Transition Moments of Porphyrin Derivatives with Various Symmetries. **Gryczynski, Z**., R. Paolesse, K. Smith, and E. Bucci., *J. Phys. Chem.*, Vol. **98**, (1994), 8813-8816.
   c. Polarization and Symetry of Electronic Transitions in Long Fluorescence Lifetime Triangulenium Dyes. (2013) Thyrhaug, E., Sorensen, T.J., Gryczynski, I., **Gryczynski, Z**., Laursen, B.W. *J. Phys. Chem. A* 117, 2160-2168.
   d. Mechanothermally induced conformational switch of a porphyrin dimer in a polymer film. Doan, H., S. L. Raut, D. Yale, M. Balaz, S. V. Dzyuba and **Z. Gryczynski** *Chem. Comm.,* 2016, **52**, 9510-9513. *Selected for cover.*

2. In early 90s' my interest shifted to protein-ligand interactions and the allostering mechanism of oxygen binding to hemoglobin. My most important contributions to this field have been the global analysis method for binding isotherms and time-resolved studies of tryptophan fluorescence in hemoglobin and myoglobin systems. Main achievements were the description of radiationless interactions between tryptophan and heme and the studies of heme dissociation in natural hemoproteins. My expertise in physics and fluorescence also led to many applications of FRET in protein dynamics studies.
   a. Discontinuous Release of Heat at Successive Steps of Oxygenation in Human and Bovine Hemoglobin at pH 9.0. Bucci, E., C. Fronticelli, **Z. Gryczynski**. *Biochemistry*, Vol. **30**, (1991), 3195-3199.
   b. Heme-Protein Interactions in Horse Heart Myoglobin at Neutral pH and Exposed to Acid Investigated by Time-resolved Fluorescence in the Pico- to Nanosecond Time Range. **Gryczynski, Z**, J. Lubkowski and E. Bucci., *J. Biol. Chem*. Vol. **270**, (1995), 19232-19237.
   c. Time-Resolved Fluorescence of Hemoglobin Species. **Gryczynski, Z**., Beretta S., Lubkowski J., Razynska A., Gryczynski I, and Bucci E.. *Biophys. Chem*. Vol. **64**, (1997), 81-91.
   d. Fluorescence of Myoglobin and Hemoglobin. **Gryczynski, Z**., J. Lubkowski and E. Bucci. *Meth. of Enzymology*. Vol. **78**, (1997), 538-569.

3. Also in late 90s', my expertise in physics and fluorescence led me to many applications of FRET in protein dynamics studies. These applications resulted in collaborations with Dr. Kobilka (2012 Nobel Prize), Dr. Prusiner (1996 Nobel Prize) and many more prominent scientists. These examples are:
   a. A FRET-Based Sensor Reveals ATP Hydrolysis Dependent Large Conformational Changes and Three Distinct States of the Molecular Motor Myosin. W. Shih, **Z. Gryczynski**, L. Lakowicz, and J. Spudich. *Cell*, Vol. **102**, (2000) 683-694.

b. Functionally Different Agonists Induce Distinct Conformations in the G Protein Coupling Domain of the S_2 AdrenergicReceptor. P. Ghanouni, **Z. Gryczynski**, J.J. Steenhuist, T.W. Lee, D.L. Farrens, J. R. Lakowicz, and B. K. Kobilka. *J. Biol. Chem*. Vol. **276** (27), (2001), 24433-24436.
c. The peculiar nature of unfolding of the human prion protein. (2004), Baskakov, I. V., Legname, G., **Gryczynski, Z**., Prusiner, S. B. *Protein Science*, **13**(3), 586-595.
d. Forster Resonance Energy Transfer Evidence for Lysozyme Oligomerization in Lipid Environment (2010) Trusova, V. M., G. P. Gorbenko, P. Sarkar, R. Luchowski, I. Akopova, L. D. Patsenker, O. Klochko, A. L. Tatarets, Y. O. Kudriavtseva, E. A. Terpetschnig, I. Gryczynski, and **Z. Gryczynski**. *J. Phys. Chem. B***, 114***,* 16773–16782.

4. In the middle of the 90s' my work also shifted to non-linear optical processes which include two-, three-, and four-photon excitation and light stimulated emission (light quenching) for modulating the excited state distribution. Selected examples of my contributions:
   a. Time Resolved Fluorescence Intensity and Anisotropy Decays of 2,3-Diphenyloxazole by two-Photon and Frequency- Domain Fluorometry. Lakowicz,J.R., I. Gryczynski, **Z. Gryczynski**, E. Danielsen, and M.J. Wirth., *J. Phys. Chem.*, Vol. **96**,(1992), 3000-3006.
   b. Two-Color Two-Photon Excitation of Fluorescence. Lakowicz, J.R., I. Gryczynski, H. Malak and **Z. Gryczynski**. *Photochem. Photobiol*. Vol. **64**, (1996), 632-635.
   c. Two-Photon Excitation by the Evenescent Wave from Total Internal Reflection. Gryczynski, I., **Z. Gryczynski**, and J.R. Lakowicz. *Annal. Biochem.* Vol. **247**, (1997), 69-76.
   d. Fluorescence Anisotropy Controlled by Light Quenching. I. Gryczynski, **Z. Gryczynski** and J.R. Lakowicz *Photochem. Photobiol*. Vol. **67**, (1998), 641-646.

5. Starting in early 2000 I have been also pioneering the new field of metal enhanced fluorescence (MEF) and surface plasmon coupled emission (SPCE). This is a new, emerging field of plasmonics that together with nanotechnology holds great promise for unprecedented applications in biomedical diagnostics. This research resulted in many publications. Some examples include:
   a. Directional surface plasmon-coupled emission: A new method for high sensitivity detection (2003). Lakowicz J.R., Malicka J., Gryczynski I., **Gryczynski Z**., Biochem. *Biophys. Res. Commun*., 307, 435-439.
   b. Surface Plasmon Coupled Emission - Novel Technology for Studying Thin Layers of BioMolecular Assemblies. **Gryczynski, Z**., E. G. Matveeva, N. Calander, J. Zhang, J. R. Lakowicz, and I. Gryczynsk. In: *Surface plasmon Nanophotonics* edition M.L. Brongersma and P.G. Kik. 2007 Springer, pp. 247-265.
   c. Fluorescence Amplification by Electrochemically Deposited Silver Nanowires with Fractal Architecture. Goldys, M., Drozdowicz-Tomsia, K., Xie, F., Shtoyko, T. Matveeva, E.G., Gryczynski, I., **Gryczynski, Z**. *JACS*, 2007, **129**, 12117-12122.
   d. Enhancement of Single-Molecule Fluorescence Signals by Colloidal Silver Nanoparticles in Studies of Protein Translation (2011) Bharill, S., Chen, C., Stvens, B., Kaur, J., Smilansky, Z., Mandecki, W., Gryczynski, I., **Gryczynski, Z**., Cooperman, B.S., Goldman, Y.E., *ACS NANO*, 5, 399-407.

My NCBI list of publication can by find at
http://www.ncbi.nlm.nih.gov/sites/myncbi/1nEtco2cBvnkp/bibliography/49099631/public/?sort=date&direction=ascending