

CURRICULUM VITAE

NAME Kristiana Kandere-Grzybowska	POSITION TITLE Senior Research Fellow/ Adjunct Professor
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EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	MTH/YR(s)	FIELD OF STUDY
College of Saint Rose, Albany, NY, USA	B.A.	1998	Biology
Tufts University School of Medicine, Boston, MA, USA	Ph.D.	2003	Biochemistry
Northwestern University Medical School, Chicago, IL, USA	Postdoctoral	2006	Cell and Molecular Biology

A. Positions and Honors:

Professional Experience

- 1998-2003 Graduate student, Department of Biochemistry, Tufts University School of Medicine, Boston, MA, USA.
- 2003-2006 Postdoctoral fellow, Department of Cell and Molecular Biology, Northwestern University School of Medicine, Chicago, IL, USA
- 2006 Consultant with SVision LLC (Bellevue, WA, USA)
- 2006-2009 Research Associate, Department of Chemical and Biological Engineering, Northwestern University, Evanston, IL, USA
- 2009-2014 Research Assistant Professor, Department of Chemical and Biological Engineering, Northwestern University, Evanston, IL, USA
- 2015-2020 Research Fellow, Center for Soft and Living Matter, Institute for Basic Science, Republic of Korea.
- 2020-present Senior Research Fellow, Center for Soft and Living Matter, Institute for Basic Science, Republic of Korea.
- 2015-present Adjunct Professor, School of Life Science, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Republic of Korea

Professional Memberships

- 1997 Sigma Xi, Scientific Research Society
- 2004 American Society of Cell Biology

Honors/Awards

- 1994 Full athletic scholarship for undergraduate studies--*The College of Saint Rose*, Albany, NY, USA
- 1996, 1997 NYCAC and ECAC player of the year (basketball)
- 1998 Graduated summa cum laude, *The College of Saint Rose*
- 1998 GTE/CoSIDA National Academic Player of the Year--*College Division*
- 1998 National Player of the Year—*Women's Division II Bulletin*
- 2003 National Collegiate Association of Athletics (NCAA) scholarship for graduate studies
- 2003 Multidisciplinary Postdoctoral Fellowship, Department of Defense (DOD) Breast Cancer Research Program, USA
- 2009 Athletics Hall of Fame, *The College of Saint Rose*

B. Scientific interests: molecular dynamic live cell imaging, cell and cytoskeleton micropatterning via micro/nano-fabrication; intracellular/cytoskeleton dynamics and patterns of cancer cell motility; interactions of nanomaterials with biological systems, mixed-charge nanomaterials with cancer-specific cytotoxicity.

C. Highlights of Scientific Contributions. Kandere-Grzybowska pioneered the microetching method (also called Wet Stamping, or *WETS*) for cell micropatterning that is compatible with various high resolution live-cell imaging modalities, such as wide-field digital fluorescence, confocal and total internal reflection (TIRF) microscopies (*Nature Methods*, 2005). She and colleagues then used *WETS* to study intracellular cell motility sub-processes, such as cell polarization (*Soft Matter*, 2010), microtubule guidance (*J. Cell Sci.*, 2012) and cell micromechanics (*Adv. Mater.*, 2012) in micropatterned cells with geometrically-defined shapes (also called Treadmills). *WETS* were also used to demonstrate that asymmetric continuous ratchet-shape patterns (Ratchets) direct cell motions. Specifically, motions of cancer cells were directed in the direction opposite to that by normal cells leading to partial sorting out of mixed cell populations (*Nature Physics*, 2009). Finally, using continuous linear patterns (or Lines or 1D microtracks) generated by *WETS* revealed that metastatic cells, but not non-metastatic cells, use cell-intrinsic, predator-like Lévy walk patterns (*Nature Communications*, 2018). Based on these publications, Kandere-Grzybowska with Prof. Bartosz Grzybowski co-wrote three funded NIH/USA grant applications (see details below). Kandere-Grzybowska is an author of 34 publications which have been cited 3020 times (based on Google Scholar) with h-index 23.

Her more recent work focuses on understanding the cellular mechanisms of cancer-specific, selective cytotoxicity of mixed-charge gold nanoparticles (*Angew. Chem.*, 2016). A combination of chemistry (nanoparticle synthesis/functionalization), nanomaterial characterization (DLS, ICP-MS) and cell biological approaches (live-cell confocal microscopy, bio-TEM, proteomics) are used to investigate selective targeting and destruction of endolysosomal system in cancer cells (*Nat. Nanotechnol.*, 2020; *Acc. Mater. Res.*, 2020).

D. Peer-Reviewed Publications

34. Siek, M., **Kandere-Grzybowska, K.*** & Grzybowski, B.A.* Mixed-Charge, pH-Responsive nanoparticles for selective interactions with cells, organelles, and bacteria. [Review] *Acc. Mater. Res.* 1, 3, 188–200 (2020). <https://doi.org/10.1021/accountsmr.0c00041>
33. Borkowska, M., Siek, M., Kolygina, D., Sobolev, Y., Lach, S., Kumar S., Cho, Y.K, **Kandere-Grzybowska, K.*** & Grzybowski, B.A.* Targeted crystallization of mixed-charge nanoparticles in lysosomes induces selective death of cancer cells. *Nat. Nanotechnol.* 15, 331–341 (2020). <https://doi.org/10.1038/s41565-020-0643-3> [COVER ART] <https://rdcu.be/b21hN>
32. Huda, S., Weigel, B., Wolf, K., Tretiakov, K., Wilk, G., Iwasa, M., Banaszak, M., Soh, S., Makurath, M., Friedl, P., Borisov, G.G., **Kandere-Grzybowska, K.*** & Grzybowski, B.A.* Lévy-like movement patterns of metastatic cancer cells revealed in microfabricated systems and implicated *in vivo*. *Nat. Commun.* 9, 4539 (2018). <https://rdcu.be/barxd>
31. **Kandere-Grzybowska, K.** & Grzybowski B.A. Nanosystems: Programmed communication. *Nat. Nanotechnol.*, 12, 291-292 (2017). <http://rdcu.be/oUnd>
30. Pillai, P.P., Kowalczyk, B., **Kandere-Grzybowska, K.**, Borkowska, M., & Grzybowski, B.A.* Engineering gram selectivity of mixed-charge gold nanoparticles by tuning the balance of surface charges. *Angew. Chem. Int. Ed. Engl.* 55, 1-6, (2016). doi: 10.1002/anie.201602965 <http://onlinelibrary.wiley.com/doi/10.1002/anie.201602965/epdf>
29. Huda, S., Pilans, D., Makurath, M., Hermans, T., **Kandere-Grzybowska, K.*** & Grzybowski, B.A.* Microfabricated systems and assays for studying the cytoskeletal organization, micromechanics, and motility patterns of cancerous cells. [Review] *Adv. Mater. Interfaces*, 1, 1400158 (2014). doi: 10.1002/admi.201400158 <http://onlinelibrary.wiley.com/doi/10.1002/admi.201400158/abstract>
28. Wilk, G., Iwasa, M., Fuller, P.E., **Kandere-Grzybowska, K.** & Grzybowski, B.A. Universal area distributions in the monolayers of confluent mammalian cells. *Phys. Rev. Lett.* 112, 138104 (2014).

<http://journals.aps.org/prl/pdf/10.1103/PhysRevLett.112.138104>

27. Hermans, T.M., Pilans, D., Huda, S., Fuller, P., **Kandere-Grzybowska, K.** & Grzybowski, B.A. Motility efficiency and spatiotemporal synchronization in non-metastatic vs. metastatic breast cancer cells. *Integr. Biol. (Camb)* **5**, 1464-1473 (2013).

<http://pubs.rsc.org/en/Content/ArticlePDF/2013/IB/c3ib40144h>

26. Soh, S., Banaszak, M., **Kandere-Grzybowska, K.** & Grzybowski B.A. Why cells are microscopic: A transport-time perspective. *J. Phys. Chem. Lett.* **4**, 861-865 (2013).

<http://pubs.acs.org/doi/abs/10.1021%2Fjz3019379>

25. Huda, S., Soh, S., Pilans, D., Byrska-Bishop, M., Kim, J., Wilk, G., Borisy, G.G., **Kandere-Grzybowska, K.*** & Grzybowski B.A.*. Microtubule guidance tested through controlled cell geometry. *J. Cell Sci.* **125**, 5790-5799 (2012).

<http://jcs.biologists.org/content/early/2012/09/19/jcs.110494.long>

24. Soh, S., **Kandere-Grzybowska, K.***, Mahmud, G., Huda, S., Patashinski, A.Z., & Grzybowski, B.A.* Tomography and static-mechanic properties of adherent cells. *Adv. Mater.* **24**, 5719-2620 (2012).

<http://onlinelibrary.wiley.com/doi/10.1002/adma.201200492/pdf>

23. Mahmud, G., Huda, S., Yang, W., **Kandere-Grzybowska, K.,*** Pilans, D., Jiang, S. & Grzybowski B.A.* Carboxybetaine methacrylate polymers offer robust, long-term protection against cell adhesion. *Langmuir* **27**, 10800-10804 (2011).

<http://pubs.acs.org/doi/ipdf/10.1021/la201066y>

22. **Kandere-Grzybowska, K.,*** Soh, S., Mahmud, G., Komarova, Y., Pilans, D. & Grzybowski B.A.* Short-term molecular polarization of cells on symmetric and asymmetric micropatterns. *Soft Matter* **6**, 3257-3268 (2010).

<http://pubs.rsc.org/en/content/articlepdf/2010/sm/b922647h>

21. Soh, S., Byrska, M., **Kandere-Grzybowska, K.** & Grzybowski, B.A. Reaction-Diffusion systems in intracellular molecular transport and control. [Review] *Angew. Chem. Int. Ed. Engl.* **49**, 4170-4198 (2010).

<http://onlinelibrary.wiley.com/doi/10.1002/anie.200905513/pdf>

20. Mahmud, G., Campbell, C.J., Bishop, K.J.M., Komarova, Y.A., Chaga, O., Soh, S., Huda, S., **Kandere-Grzybowska, K.*** & Grzybowski B.A.* Directing cell motions on micropatterned ratchets. *Nature Physics* **5**, 606-612 (2009).

<http://www.nature.com/nphys/journal/v5/n8/pdf/nphys1306.pdf>

19. Kowalczyk, B., Byrska, M., Mahmud, G., Huda, S., **Kandere-Grzybowska, K.** & Grzybowski B.A. Nanoparticle-based solution deposition of gold films supporting bioresistant SAMs. *Langmuir* **25**, 1905-1907 (2009).

18. **Kandere-Grzybowska, K.**, Campbell, C.J., Mahmud, G., Komarova, Y., Soh, S. & Grzybowski B.A. Cell motility on micropatterned treadmills and tracks. *Soft Matter* **3**, 1-9 (2007).

<http://pubs.rsc.org/en/content/articlepdf/2007/sm/b617308j>

17. **Kandere-Grzybowska, K.**, Kempuraj, D., Cao, J., Cetrulo, C.L. & Theoharides T.C. Regulation of IL-1-induced selective IL-6 release from human mast cells and inhibition by quercetin. *Br. J. Pharmacol.* **148**, 208-215 (2006).

16. **Kandere-Grzybowska, K.**, Campbell C., Komarova Y., Grzybowski B.A., Borisy G.G. Molecular dynamics imaging in micropatterned living cells. *Nature Methods* **2**, 739-741 (2005). [COVER ART]

<http://www.nature.com/nmeth/journal/v2/n10/pdf/nmeth796.pdf>

15. Theoharides, T.C., Donelan, J., **Kandere-Grzybowska, K.**, Konstantinidou, A. The role of mast cells in migraine pathophysiology. *Brain Res. Brain Res. Rev.* **49**, 65-76 (2005).

14. Smoukov, S.K, Bitner, A., Campbell, C.J., **Kandere-Grzybowska, K.**, Grzybowski, B.A. Nano- and microscopic surface wrinkles of linearly increasing heights prepared by periodic precipitation. *J. Am. Chem. Soc.* **127**, 17803-17807 (2005).

13. Kempuraj, D., Papadopoulou, N.G., Lytinas, M., **Kandere-Grzybowska, K.**, Madhappan, B., Boucher, W., Christodoulou, S., Athanassiou, A., Theoharides, T.C. Corticotropin-releasing hormone and its structurally related urocortin are synthesized and secreted by human mast cells. *Endocrinology* **145**, 43-48 (2004).

12. **Kandere-Grzybowska K.**, Letourneau R., Kempuraj D., Donelan J., Poplawski S., Boucher W., Athanassiou A., Theoharides T.C. IL-1 induces vesicular secretion of IL-6 without degranulation from human mast cells. *J. Immunol.* **171**, 4830-4836 (2003).
11. Kempuraj, D., Huang, M., **Kandere-Grzybowska, K.**, Basu, S., Boucher, W., Letourneau, R., Athanassiou, A., Theoharides, T.C. Azelastine inhibits secretion of IL-6, TNF-alpha and IL-8 as well as NF-kappaB activation and intracellular calcium ion levels in normal human mast cells. *Int. Arch Allergy Immunol.* **132**, 231-239 (2003).
10. Alexandrakis, M., Letourneau, R., Kempuraj, D., **Kandere-Grzybowska, K.**, Huang, M., Christodoulou, S., Boucher, W., Seretakis, D., Theoharides, T.C. Flavones inhibit proliferation and increase mediator content in human leukemic mast cells (HMC-1). *Eur. J. Haematol.* **71**, 448-454 (2003).
9. **Kandere-Grzybowska, K.**, Gheorghe, D., Priller, J., Esposito, P., Huang, M., Gerard, N., Theoharides, T.C. Stress-induced dura vascular permeability does not develop in mast cell-deficient and neurokinin-1 receptor knockout mice. *Brain Res.* **980**, 213-220 (2003).
8. Kempuraj, D., Frydas, S., **Kandere, K.**, Madhappan, B., Letourneau, R., Christodoulou, S., Boucher, W., Riccioni, G., Conti, P., Theoharides, T.C. Interleukin-19 (IL-19) network revisited. *Int. J. Immunopathol. Pharmacol.* **16**, 95-97 (2003).
7. Conti, P., Kempuraj, D., **Kandere, K.**, Di Gioacchino, M., Barbacane, R.C., Castellani, M.L., Felaco, M., Boucher, W., Letourneau, R., Theoharides, T.C. IL-10, an inflammatory/inhibitory cytokine, but not always. *Immunol. Lett.* **86**: 123-129 (2003).
6. Huang, M., Berry, J., **Kandere, K.**, Lytinas, M., Karalis, K., Theoharides, T.C. Mast cell deficient W/W(v) mice lack stress-induced increase in serum IL-6 levels, as well as in peripheral CRH and vascular permeability, a model of rheumatoid arthritis. *Int. J. Immunopathol. Pharmacol.* **15**, 249-254 (2002).
5. Kempuraj, D., Huang, M., **Kandere, K.**, Boucher, W., Letourneau, R., Jeudy, S., Fitzgerald, K., Spear, K., Athanassiou, A., Theoharides, T.C. Azelastine is more potent than olopatadine in inhibiting interleukin-6 and tryptase release from human umbilical cord blood-derived cultured mast cells. *Ann. Allergy Asthma Immunol.* **88**, 501-506 (2002).
4. Conti, P., Kempuraj, D., **Kandere, K.**, Di Gioacchino, M., Reale, M., Barbacane, R.C., Castellani, M.L., Mortari, U., Boucher, W., Letourneau, R., Theoharides, T.C. Interleukin-16 network in inflammation and allergy. *Allergy Asthma Proc.* **23**: 103-108 (2002).
3. Lytinas, M., Kempuraj, D., Huang, M., **Kandere, K.**, Boucher, W., Letourneau, R., Jeudy, S., Fitzgerald, K., Spear, K., Athanassiou, A., Theoharides, T.C. Azelastine's inhibition of histamine and tryptase release from human umbilical cord blood-derived cultured mast cells as well as rat skin mast cell-induced vascular permeability: comparison with olopatadine. *Allergy Asthma Proc.* **23**: 45-51 (2002).
2. Esposito, P., Chandler, N., **Kandere, K.**, Basu, S., Jacobson, S., Connolly, R., Tutor, D., Theoharides, T.C. Corticotropin-releasing hormone and brain mast cells regulate blood-brain-barrier permeability induced by acute stress. *J Pharmacol. Exp. Ther.* **303**:1061-1066 (2002).
1. Esposito, P., Gheorghe, D., **Kandere, K.**, Pang, X., Connolly, R., Jacobson, S., Theoharides, T.C. Acute stress increases permeability of the blood-brain-barrier through activation of brain mast cells. *Brain Res.* **888**: 117-127 (2001).

E. Patent applications

Mixed-charge nanoparticles with anti-cancer activity. Application Date: 2020.02.2. Application No.: 10-2020-0021515

F. Other Scientific Publications

2. **Kandere-Grzybowska, K.** Differential release of mast cell cytokines. Ph.D. Thesis. Tufts University (2003)

1. Theoharides, T.C. & **Kandere, K.** Mast cell involvement in neurogenic inflammation. *Migraine: A neuroinflammatory Disease?* 115-132 (Birkhäuser Basel, 2002)

G. Invited Lectures

1. University of Latvia, Institute of Microbiology and Biotechnology. Cells on treadmills and tracks: Quantifying cell motility in cancer metastasis (Riga, Latvia, 2010).
2. Latvian Institute of Organic Synthesis. Deconstructing directional cell motility to identify molecular targets for anti-cancer therapies (Riga, Latvia, 2012).
3. Latvian Biomedical Research and Study Centre. Mechanism and control of the Lévy walks of metastatic cancer cells (Riga, Latvia, 2013).
4. Gdansk University of Technology. Mechanism and control of the Lévy walks of metastatic cancer cells (Gdansk, Poland, 2013).
5. University of Latvia, Faculty of Physics and Mathematics. Cell motility on micropatterned treadmills and tracks. (Riga, Latvia, 2015).
6. Riga Stradins University. Using substrate microfabrication and nanomaterials to target metastatic cancer. (Riga, Latvia, 2015).
7. Institute of Molecular Physics, Polish Academy of Sciences, Department of Computational Physics of Complex Systems. The control and mechanism of Lévy walk motility pattern of metastatic cancer cells. (Poznan, Poland, 2018).
8. University of Latvia, Institute of Microbiology and Biotechnology. Selective killing of cancer by self-assembly of nanoparticle crystals. (Riga, Latvia, 2019).
9. Annual Meeting, Korean Biochip Society. Selective killing of cancer cells by crystallization of mixed-charge nanoparticles in cancer lysosomes (Jeju, Landing Convention Center, Korea, 2019)

H. Conference Presentations (from 2003)

11. Borkowska, M., Siek, M., Kolygina, D., Sobolev, Y., Lach, Jeong, Y.K., **Kandere-Grzybowska, K.*** & Grzybowski, B.A.* Selective Killing of Cancer Cells by Mixed-Charge Gold Nanoparticles Targeting Endo-Lysosomal System. Annual Meeting, American Society for Cell Biology (2017).
10. Iwasa, M., **Kandere-Grzybowska, K.**, Huda, S., Makurath, M. & Grzybowski, B.A. Protein interaction network analysis of actin-driven motility of cancer cells. Annual Meeting, American Society for Cell Biology (2015).
9. Pilans, D., Huda, S., Tretiakov, K. Wilk, G., Soh S., **Kandere-Grzybowska, K.** & Grzybowski, B.A. Microsystems for targeting the Lévy Walks in metastatic cancer cells. 14th IMAT Meeting, National Cancer Institute, National Institutes of Health (2013).
8. Huda, S. Soh, S., Pilans, D., Mahmud, G., **Kandere-Grzybowska, K.** & Grzybowski, B.A. Micropatterned substrates: Tools for studying cell motility and aiding rational drug design. *FASEB Journal* 25, 930.6 (2011).
7. **Kandere-Grzybowska, K.**, Komarova, Y., Campbell, C., Mahmud, G., Soh, S., Borisy, G. & Grzybowski B.A. Deconstructing cell motility on micropatterned treadmills and tracks. 5th Era of Hope meeting for the Department of Defense Breast Cancer Research Program (2008).
6. **Kandere-Grzybowska, K.**, Komarova, Y., Campbell, C., Soh, S., Mahmud, G. & Grzybowski, B.A. Actin filament reorganization and focal adhesion targeting by microtubules in micropatterned cells. 46th Annual Meeting, American Society for Cell Biology (2006).
5. Oh, S., Alworth, S.V., **Kandere-Grzybowska, K.**, Borisy, G.G., Grzybowski, B.A. & Lee, J.S.J. Automated recognition and tracking of cells in individual cell motility assays. 46th Annual Meeting, American Society for Cell Biology (2006).
4. Oh, S., Alworth, S.V., **Kandere-Grzybowska, K.**, Borisy, G.G., Grzybowski, B.A. & Lee, J.S.J. Automated kinetic analysis in individual cell motility assays. 46th Annual Meeting, American Society for Cell Biology (2006).

3. **Kandere-Grzybowska, K.**, Campbell, C., Komarova, Y., Grzybowski, B.A., Borisy G.G. Molecular dynamic imaging in micro-patterned living cells. *Cell Structure and Function* **30**, 115, Japan Society of Cell Biology (2005).
2. **Kandere-Grzybowska, K.**, Komarova, Y., Campbell, C., Borisy, G. & Grzybowski, B.A. Molecular dynamic imaging in micro-patterned living cells. 4th Era of Hope meeting for the Department of Defense Breast Cancer Research Program (2005).
1. **Kandere-Grzybowska, K.**, Campbell, C., Komarova, Y., Grzybowski, B.A. & Borisy, G.G. Dynamics of microtubule cytoskeleton and focal adhesions in micropatterned cells. *Molecular Biology of Cell* **15**, 395A-396A, American Society for Cell Biology (2004).

I. Teaching/Mentoring Experience

1. Mentoring undergraduate and graduate students (Christopher Campbell, Goher Mahmud, Siowling Soh, Marta Byrska-Bishop, Monika Makurath, Sabil Huda, Gary Wilk and Didzis Pilans, 2009-2014) and Diana Kolygina (present) in Prof. Grzybowski's laboratory.
2. Conference Instructor of Medical School Biochemistry, Tufts University (2000).

J. Research Support (completed)

4. NIH R21 Award Number: 1R21CA173232 239,250 USD Dates: 04/01/2014-03/31/2016
Project Title: Mechanism and Control of the "Predatory", Levy Walks of Metastatic Cancer Cells.
PI Bartosz A. Grzybowski Co-PI Kristiana Kandere-Grzybowska
3. NIH R21 Award Number: 5R21CA173347 435,000 USD Dates: 09/12/2012-08/31/2015
Project Title: Microsystems for Targeting Levy Walks in Metastatic Cancer Cells
PI Bartosz A. Grzybowski Co-PI Kristiana Kandere-Grzybowska
2. NIH R21 Award Number: 1R21CA137707-01 435,154 USD Dates: 06/01/2009-05/31/2012
Project Title: Microassay Systems for Diagnosis of Cancer Cell Motility and Metastasis
PI Bartosz A. Grzybowski Co-PI Kristiana Kandere-Grzybowska
1. Multidisciplinary Postdoctoral Award, Department of Defense Breast Cancer Research Program
Award Number: W81XWH-05-1-0312 192,000 USD Dates: 03/01/2005-02/28/2008
Project Title: Focal Adhesion Regulation by Microtubule Plus Ends in Breast Cancer Migration
PI Kristiana Kandere-Grzybowska