

Curriculum Vitae

Mark Woodford PhD

Department of Urology
Biochemistry and Molecular Biology
SUNY Upstate Medical University
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Syracuse, NY 13210, USA
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EDUCATION AND QUALIFICATIONS

- 2017-2021: **PhD** Biochemistry and Molecular Biology. Advisor: Mehdi Mollapour. GPA: 3.87
Department of Biochemistry and Molecular Biology/Urology, SUNY Upstate Medical
University, Syracuse, NY, USA
- 2004-2008: **BS** Biotechnology
SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

ACADEMIC EMPLOYMENTS

- 2022-Present Assistant Professor, Department of Urology, SUNY Upstate Medical University, Syracuse,
NY
- 2021-2022 Post-Doctoral Researcher, Department of Urology, SUNY Upstate Medical University,
Syracuse, NY
- 2017-2021 Graduate Assistant, Department of Urology, SUNY Upstate Medical University, Syracuse,
NY
- 2012-2017 Instructional Support Associate, Department of Urology, SUNY Upstate Medical
University, Syracuse, NY
- 2011-2012 Senior Research Support Specialist, Department of Medicine, SUNY Upstate Medical
University, Syracuse, NY
- 2009-2011: Research Support Specialist, Department of Microbiology and Immunology, SUNY
Upstate Medical University, Syracuse, NY
- 2007-2008: Undergraduate Researcher, Department of Microbiology and Immunology, SUNY Upstate
Medical University, Syracuse, NY
- 2006-2008: Undergraduate Researcher, Department of Environmental and Forest Biology, SUNY
College of Environmental Science and Forestry, Syracuse, NY

HONORS AND AWARDS

- 2014: New York State/United University Professionals (NYS/UUP) Individual Development
Award Recipient
- 2016: Best Poster - American Urological Association Annual Meeting, San Diego, CA, USA

- 2018: Best Poster - American Urological Association Annual Meeting, San Francisco, CA, USA
- 2019: NYS/UUP Individual Development Award Recipient
- 2019: 2nd Prize: Poster, Charles Ross Memorial Student Research Day, SUNY Upstate Medical University, Syracuse, NY, USA
- 2020: NYS/UUP Individual Development Award Recipient
- 2020: Graduate Student Association Written Research Proposal Award, SUNY Upstate Medical University, Syracuse, NY, USA

PROFESSIONAL MEMBERSHIPS

- 2014 – present: Member, Cell Stress Society International
- 2020 – present: Member, American Association for the Advancement of Science
- 2021 – present: Member, Society for Basic Urologic Research
- 2021 – present: Member, American Urological Association

CONFERENCE ORGANIZING COMMITTEE

- 2015: The 6th BHD Symposium and 1st International Upstate Kidney Cancer Symposium, Syracuse, NY, USA

AD HOC JOURNAL REVIEWER

Oncogene, Cell Stress and Chaperones, Scientific Reports, BioMed Central (BMC) (Springer-Nature Publishing)

SCIENTIFIC PUBLICATIONS

30 PEER REVIEWED RESEARCH ARTICLES, REVIEWS and BOOK CHAPTERS

Wengert LA, Backe SJ, Bourboulia D, Mollapour M, **Woodford, MR**. TRAP1 Chaperones the Metabolic Switch in Cancer. *Biomolecules* 2022, 12, 786. <https://doi.org/10.3390/biom12060786>

Sager RA, Backe SJ, Ahanin E, Smith G, Nsouli I, **Woodford MR**, Bratslavsky G, Bourboulia D, Mollapour M. Therapeutic potential of CDK4/6 inhibitors in renal cell carcinoma. *Nat Rev Urol*. 2022. <https://doi.org/10.1038/s41585-022-00571-8>. PMID: 35264774

Woodford MR, Andreou A, Baba M, van de Beek I, Malta CD, Glykofridis I, Grimes H, Henske EP, Iliopoulos O, Kurihara M, Lazor R, Linehan WM, Matsumoto K, Marciniak SJ, Namba Y, Pause A, Rajan N, Ray A, Schmidt LS, Shi W, Steinlein OK, Thierauf J, Zoncu R, Webb A, Mollapour M. Seventh BHD International Symposium: recent scientific and clinical advancement. *Oncotarget*. 2022 Jan 20;13:173-181. doi: 10.18632/oncotarget.28176. eCollection 2022. PMID: 35070081

Woodford MR, Backe SJ, Wengert LA, Dunn DM, Bourboulia D, Mollapour M. Hsp90 chaperone code and the tumor suppressor VHL cooperatively regulate the mitotic checkpoint. *Cell Stress Chaperones*. 2021 Nov;26(6):965-971. doi: 10.1007/s12192-021-01240-2. Epub 2021 Sep 29. PMID: 34586601; PMCID: PMC8578495.

Woodford MR, Baker-Williams AJ, Sager RA, Backe SJ, Blanden AR, Hashmi F, Kancherla P, Gori A, Loiselle DR, Castelli M, Serapian SA, Colombo G, Haystead TA, Jensen SM, Stetler-Stevenson WG, Loh SN, Schmidt LS, Linehan WM, Bah A, Bourboulia D, Bratslavsky G, Mollapour M. The tumor suppressor folliculin inhibits lactate dehydrogenase A and regulates the Warburg effect. *Nat Struct Mol Biol*. 2021 Aug;28(8):662-670. doi: 10.1038/s41594-021-00633-2. Epub 2021 Aug 11. PubMed PMID: 34381247.

Woodford MR, Backe SJ, Sager RA, Bourboulia D, Bratslavsky G, Mollapour M. The Role of Heat Shock Protein-90 in the Pathogenesis of Birt-Hogg-Dubé and Tuberous Sclerosis Complex Syndromes. *Urol Oncol*. 2021 Jun;39(6):322-326. doi: 10.1016/j.urolonc.2020.03.016. Epub 2020 Apr 21. Review. PubMed PMID: 32327294; PubMed Central PMCID: PMC7572595.

Backe SJ, Sager RA, **Woodford MR**, Makedon AM, Mollapour M. Post-translational modifications of Hsp90 and translating the chaperone code. *J Biol Chem*. 2020 Aug 7;295(32):11099-11117. doi: 10.1074/jbc.REV120.011833. Epub 2020 Jun 11. Review. PubMed PMID: 32527727; PubMed Central PMCID: PMC7415980.

Paladino A, **Woodford MR**, Backe SJ, Sager RA, Kancherla P, Daneshvar MA, Chen VZ, Bourboulia D, Ahanin EF, Prodromou C, Bergamaschi G, Strada A, Cretich M, Gori A, Veronesi M, Bandiera T, Vanna R, Bratslavsky G, Serapian SA, Mollapour M, Colombo G. Chemical Perturbation of Oncogenic Protein Folding: from the Prediction of Locally Unstable Structures to the Design of Disruptors of Hsp90-Client Interactions. *Chemistry*. 2020 Aug 3;26(43):9459-9465. doi: 10.1002/chem.202000615. Epub 2020 Jul 8. PubMed PMID: 32167602; PubMed Central PMCID: PMC7415569.

Woodford MR, Chen VZ, Backe SJ, Bratslavsky G, Mollapour M. Structural and functional regulation of lactate dehydrogenase-A in cancer. *Future Med Chem*. 2020 Mar;12(5):439-455. doi: 10.4155/fmc-2019-0287. Epub 2020 Feb 17. PubMed PMID: 32064930.

D'Annessa I, Hurwitz N, Pirota V, Beretta GL, Tinelli S, **Woodford M**, Freccero M, Mollapour M, Zaffaroni N, Wolfson H, Colombo G. Design of Disruptors of the Hsp90-Cdc37 Interface. *Molecules*. 2020 Jan 15;25(2). doi: 10.3390/molecules25020360. PubMed PMID: 31952296; PubMed Central PMCID: PMC7024268.

Woodford MR, Hughes M, Sager RA, Backe SJ, Baker-Williams AJ, Bratslavsky MS, Jacob JM, Shapiro O, Wong M, Bratslavsky G, Bourboulia D, Mollapour M. Mutation of the co-chaperone Tsc1 in bladder cancer diminishes Hsp90 acetylation and reduces drug sensitivity and selectivity. *Oncotarget*. 2019 Oct 8;10(56):5824-5834. doi: 10.18632/oncotarget.27217. eCollection 2019 Oct 8. PubMed PMID: 31645902; PubMed Central PMCID: PMC6791385.

Baker-Williams AJ, Hashmi F, Budzyński MA, **Woodford MR**, Gleicher S, Himanen SV, Makedon AM, Friedman D, Cortes S, Namek S, Stetler-Stevenson WG, Bratslavsky G, Bah A, Mollapour M, Sistonen L, Bourboulia D. Co-chaperones TIMP2 and AHA1 Competitively Regulate Extracellular HSP90:Client MMP2 Activity and Matrix Proteolysis. *Cell Rep*. 2019 Aug 13;28(7):1894-1906.e6. doi: 10.1016/j.celrep.2019.07.045. PubMed PMID: 31412254; PubMed Central PMCID: PMC8276117.

Sager RA, **Woodford MR**, Backe SJ, Makedon AM, Baker-Williams AJ, DiGregorio BT, Loisel DR, Haystead TA, Zachara NE, Prodromou C, Bourboulia D, Schmidt LS, Linehan WM, Bratslavsky G, Mollapour M. Post-translational Regulation of FNIP1 Creates a Rheostat for the Molecular Chaperone Hsp90. *Cell Rep*. 2019 Jan 29;26(5):1344-1356.e5. doi: 10.1016/j.celrep.2019.01.018. PubMed PMID: 30699359; PubMed Central PMCID: PMC6370319.

Sager RA, **Woodford MR**, Mollapour M. The mTOR Independent Function of Tsc1 and FNIPs. *Trends Biochem Sci*. 2018 Dec;43(12):935-937. doi: 10.1016/j.tibs.2018.09.018. Epub 2018 Oct 22. PubMed PMID: 30361061; PubMed Central PMCID: PMC6324182.

Sager RA, **Woodford MR**, Shapiro O, Mollapour M, Bratslavsky G. Sporadic renal angiomyolipoma in

a patient with Birt-Hogg-Dubé: chaperones in pathogenesis. *Oncotarget*. 2018 Apr 24;9(31):22220-22229. doi: 10.18632/oncotarget.25164. eCollection 2018 Apr 24. PubMed PMID: 29774133; PubMed Central PMCID: PMC5955167.

Sánchez-Pozo J, Baker-Williams AJ, **Woodford MR**, Bullard R, Wei B, Mollapour M, Stetler-Stevenson WG, Bratslavsky G, Bourboulia D. Extracellular Phosphorylation of TIMP-2 by Secreted c-Src Tyrosine Kinase Controls MMP-2 Activity. *iScience*. 2018 Mar 23;1:87-96. doi: 10.1016/j.isci.2018.02.004. Epub 2018 Mar 23. PubMed PMID: 30227959; PubMed Central PMCID: PMC6135941.

Sager RA, **Woodford MR**, Neckers L, Mollapour M. Detecting Posttranslational Modifications of Hsp90. *Methods Mol Biol*. 2018;1709:209-219. doi: 10.1007/978-1-4939-7477-1_16. PubMed PMID: 29177662; PubMed Central PMCID: PMC6376113.

Woodford MR, Sager RA, Marris E, Dunn DM, Blanden AR, Murphy RL, Rensing N, Shapiro O, Panaretou B, Prodromou C, Loh SN, Gutmann DH, Bourboulia D, Bratslavsky G, Wong M, Mollapour M. Tumor suppressor Tsc1 is a new Hsp90 co-chaperone that facilitates folding of kinase and non-kinase clients. *EMBO J*. 2017 Dec 15;36(24):3650-3665. doi: 10.15252/embj.201796700. Epub 2017 Nov 10. PubMed PMID: 29127155; PubMed Central PMCID: PMC5730846.

Dushukyan N, Dunn DM, Sager RA, **Woodford MR**, Loisel DR, Daneshvar M, Baker-Williams AJ, Chisholm JD, Truman AW, Vaughan CK, Haystead TA, Bratslavsky G, Bourboulia D, Mollapour M. Phosphorylation and Ubiquitination Regulate Protein Phosphatase 5 Activity and Its Prosurvival Role in Kidney Cancer. *Cell Rep*. 2017 Nov 14;21(7):1883-1895. doi: 10.1016/j.celrep.2017.10.074. PubMed PMID: 29141220; PubMed Central PMCID: PMC5699234.

Chelluri R, Caza T, **Woodford MR**, Reeder JE, Bratslavsky G, Byler T. Valproic Acid Alters Angiogenic and Trophic Gene Expression in Human Prostate Cancer Models. *Anticancer Res*. 2016 Oct;36(10):5079-5086. doi: 10.21873/anticancer.11077. PubMed PMID: 27798867.

Oberoi J, Dunn DM, **Woodford MR**, Mariotti L, Schulman J, Bourboulia D, Mollapour M, Vaughan CK. Structural and functional basis of protein phosphatase 5 substrate specificity. *Proc Natl Acad Sci U S A*. 2016 Aug 9;113(32):9009-14. doi: 10.1073/pnas.1603059113. Epub 2016 Jul 27. PubMed PMID: 27466404; PubMed Central PMCID: PMC4987771.

Woodford MR, Dunn DM, Blanden AR, Capriotti D, Loisel D, Prodromou C, Panaretou B, Hughes PF, Smith A, Ackerman W, Haystead TA, Loh SN, Bourboulia D, Schmidt LS, Marston Linehan W, Bratslavsky G, Mollapour M. The FNIP co-chaperones decelerate the Hsp90 chaperone cycle and enhance drug binding. *Nat Commun*. 2016 Jun 29;7:12037. doi: 10.1038/ncomms12037. PubMed PMID: 27353360; PubMed Central PMCID: PMC4931344.

Bratslavsky G, **Woodford MR**, Daneshvar M, Mollapour M. Sixth BHD Symposium and First International Upstate Kidney Cancer Symposium: latest scientific and clinical discoveries. *Oncotarget*. 2016 Mar 29;7(13):15292-8. doi: 10.18632/oncotarget.7733. PubMed PMID: 26933819; PubMed Central PMCID: PMC4941241.

Woodford MR, Truman AW, Dunn DM, Jensen SM, Cotran R, Bullard R, Abouelleil M, Beebe K, Wolfgeher D, Wierzbicki S, Post DE, Caza T, Tsutsumi S, Panaretou B, Kron SJ, Trepel JB, Landas S, Prodromou C, Shapiro O, Stetler-Stevenson WG, Bourboulia D, Neckers L, Bratslavsky G, Mollapour M. Mps1 Mediated Phosphorylation of Hsp90 Confers Renal Cell Carcinoma Sensitivity and Selectivity to

Hsp90 Inhibitors. *Cell Rep.* 2016 Feb 2;14(4):872-884. doi: 10.1016/j.celrep.2015.12.084. Epub 2016 Jan 21. PubMed PMID: 26804907; PubMed Central PMCID: PMC4887101.

Woodford MR, Dunn DM, Ciciarelli JG, Beebe K, Neckers L, Mollapour M. Targeting Hsp90 in Non-Cancerous Maladies. *Curr Top Med Chem.* 2016;16(25):2792-804. doi: 10.2174/1568026616666160413141753. Review. PubMed PMID: 27072697.

Woodford MR, Dunn D, Miller JB, Jamal S, Neckers L, Mollapour M. Impact of Posttranslational Modifications on the Anticancer Activity of Hsp90 Inhibitors. *Adv Cancer Res.* 2016;129:31-50. doi: 10.1016/bs.acr.2015.09.002. Epub 2015 Oct 23. Review. PubMed PMID: 26916000.

Wolfgeher D, Dunn DM, **Woodford MR**, Bourboulia D, Bratslavsky G, Mollapour M, Kron SJ, Truman AW. The dynamic interactome of human Aha1 upon Y223 phosphorylation. *Data Brief.* 2015 Dec;5:752-5. doi: 10.1016/j.dib.2015.10.028. eCollection 2015 Dec. PubMed PMID: 26693507; PubMed Central PMCID: PMC4659802.

Dunn DM, **Woodford MR**, Truman AW, Jensen SM, Schulman J, Caza T, Remillard TC, Loiselle D, Wolfgeher D, Blagg BS, Franco L, Haystead TA, Daturpalli S, Mayer MP, Trepel JB, Morgan RM, Prodromou C, Kron SJ, Panaretou B, Stetler-Stevenson WG, Landas SK, Neckers L, Bratslavsky G, Bourboulia D, Mollapour M. c-Abl Mediated Tyrosine Phosphorylation of Aha1 Activates Its Co-chaperone Function in Cancer Cells. *Cell Rep.* 2015 Aug 11;12(6):1006-18. doi: 10.1016/j.celrep.2015.07.004. Epub 2015 Jul 30. PubMed PMID: 26235616; PubMed Central PMCID: PMC4778718.

Johnson MD, Reeder JE, O'Connell M, **Woodford M**, Walter K. CIP2A and PP2A in human leptomeninges, arachnoid granulations and meningiomas. *J Clin Neurosci.* 2014 Dec;21(12):2228-32. doi: 10.1016/j.jocn.2014.05.019. Epub 2014 Jul 8. PubMed PMID: 25012485.

Mollapour M, Bourboulia D, Beebe K, **Woodford MR**, Polier S, Hoang A, Chelluri R, Li Y, Guo A, Lee MJ, Fotooh-Abadi E, Khan S, Prince T, Miyajima N, Yoshida S, Tsutsumi S, Xu W, Panaretou B, Stetler-Stevenson WG, Bratslavsky G, Trepel JB, Prodromou C, Neckers L. Asymmetric Hsp90 N domain SUMOylation recruits Aha1 and ATP-competitive inhibitors. *Mol Cell.* 2014 Jan 23;53(2):317-29. doi: 10.1016/j.molcel.2013.12.007. PubMed PMID: 24462205; PubMed Central PMCID: PMC3964875.

ABSTRACTS AND MEETING PRESENTATIONS

1. **Woodford MR**, Backe SJ, Sager RA, Shapiro O, Nsouli I, Wengert LA, Bratslavsky G, Bourboulia D, Mollapour M. VHL-mediated ubiquitination of the kinase Mps1 regulates the mitotic checkpoint in clear cell renal cell carcinoma, American Urological Association. New Orleans, USA. May 2022.
2. **Woodford MR**, Baker-Williams AJ, Sager RA, Backe SJ, Blanden AR, Hashmi F, Kancherla P, Gori A, Loiselle DR, Castelli M, Serapian SA, Colombo G, Haystead TA, Jensen SM, Stetler-Stevenson WG, Loh SN, Schmidt LS, Linehan WM, Bah A, Bourboulia D, Bratslavsky G, Mollapour M. The tumor suppressor folliculin inhibits lactate dehydrogenase A and regulates the Warburg effect, American Urological Association. New Orleans, USA. May 2022.
3. **Woodford MR**, Backe SJ, Sager RA, Bourboulia D, Bratslavsky G, Mollapour M. Hsp90 chaperoning of the tumor suppressor FLCN is mediated by the co-chaperones FNIP1/2, BHD Symposium, Virtual. 2021.
4. Kancherla P, Schardein J, **Woodford MR**, Backe SJ, Smith G, Sager RA, Shapiro O, Ross J, Bratslavsky G, Mollapour M. The status of the tumor suppressors VHL and CDKN2A impacts clear cell renal cell carcinoma sensitivity to CDK 4/6 inhibitors. Annual American Urological Association. Washington DC, USA, May 2020.
5. Sager RA, **Woodford MR**, Ahanin EF, Backe SJ, Makedon, AM, Baker-Williams AJ, DiGregorio B.T, Loiselle D, Haystead T.A, Zachara N.E, Prodromou C, Bourboulia D, Bratslavsky G, Mollapour M. Gradual activation of HSP90 through intricate crosstalk of post-translational modifications. Ninth International Congress on Heat Shock Proteins in Biology and Medicine, San Diego, USA. November 2019.
6. Smith B, Backe S.J, **Woodford M.R**, Shapiro, O, Mollapour M, Bratslavsky G. Molecular chaperones Hsp70 and Hsp90 stabilize and maintain HIF2 α activity in ccRCC. Ninth International Congress on Heat Shock Proteins in Biology and Medicine, San Diego, USA. November 2019.
7. Backe S.J, **Woodford M.R**, Sager R.A, Backe S.J, Baker-Williams A.J, Makedon, A.M, Schmidt L.S, Linehan, W.M, Bourboulia D, Bratslavsky G, Mollapour M. FNIP co-chaperones demonstrate unique binding strategies to decelerate Hsp90 ATPase activity. Ninth International Congress on Heat Shock Proteins in Biology and Medicine, San Diego, USA. November 2019.
8. **Woodford M.R**, Hughes M, Sager R.A, Backe S.J, Baker-Williams A.J, Chehab M, Jacob J, Shapiro O, Bratslavsky G, Bourboulia D, Mollapour M. TSC1 Co-Chaperone Expression Augments Bladder Cancer Response to HSP90 Inhibitors. Ninth International Congress on Heat Shock Proteins in Biology and Medicine, San Diego, USA. November 2019.
9. Hughes M, **Woodford M.R**, Chehab M, Shapiro O, Bratslavsky G, Bourboulia D, Mollapour M. TSC1 co-chaperone expression augments bladder cancer response to HSP90 inhibitors – Section Star Prize Essay. The Northeastern Section of the American Urological Association. Syracuse, USA. September, 2019
10. Sager R.A, **Woodford M.R**, Backe S.J, Post, D, Shapiro O, Bratslavsky G, Mollapour M. The new co-chaperones FNIP1 and Tsc1 function cooperatively to chaperone the tumor suppressor FLCN. The Northeastern Section of the American Urological Association. Syracuse, USA. September, 2019

INVITED SPEAKER

- 2022: Invited Speaker - Virtual Enzo Webinar
2021: Invited Speaker - Virtual BHD Symposium
2015: Invited Speaker - The 6th BHD Symposium and 1st International Upstate Kidney Cancer Symposium, Syracuse, NY, USA
2014: Session co-chair - Associazione di Biologia Cellulare e del Differenziamento, Cell Stress: Survival and Apoptosis Meeting. Bertinoro, Italy.

TEACHING ACTIVITIES

2018-2019: Peer Tutor – SUNY Upstate Medical University, Syracuse, NY, USA

PATENT APPLICATIONS

US Patent App. 16/915,966. Mollapour M, Bratslavsky G, Woodford MR, Bourboulia D. Compositions and methods for inhibiting lactate dehydrogenase a activity.

US Patent App. 17/099,692. Mollapour M, Colombo G, Woodford MR, Bratslavsky G, Bourboulia D. Methods for selectively inhibiting molecular chaperone clients and compositions for use thereof.