

Martin Mwangi Thuo, PhD

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Educational History

2009 – 2013 Post-doctoral Fellow, **Harvard University**, Cambridge, USA

Mary-Fieser Fellow (2009-2010), Nanoscale Science & Engineering Fellow (2011-2013)

Prof. George M. Whitesides group

- *Charge transport across self-assembled monolayers*: Demonstration that the 'odd-even effect' is due to interfacial sterics, and not electronic, properties of the molecules. Designed a study demonstrating that rectification observed in SAM-based junctions was due to the molecule and not the junction architecture.
- *Paper-based devices*: Developed hydrophobic paper devices by chemi-sorption for microfluidic devices. Microfluidic devices by embossing and stacking paper. Supported the development of 1D and 3D MEMS sensors and studies on paper-based 3D cell cultures.
- *CO₂*: Free electron solution-based one-electron coupling of CO₂ to oxalate.

2004 – 2008 PhD, **University of Iowa**. Iowa City, IA USA

- *Cascade reactions*: Developed "pot-in-pot" reactions based on selective flux across polymeric membranes to isolate incompatible solvents and reagents.
- *Site-Isolation of catalysts and reagents*: Occluded catalysts in polymeric membranes for use with incompatible solvents or reagents.
- *Ultra-large Polymers*: Synthesized maleimide derived ultra-large comb-block polymers (> 1 million g/mole). These polymers self-assemble into nanometer size rigid rods

2002 – 2004 MS, **Simon Fraser University**. Burnaby, BC Canada (Transferred to University of Iowa)

- *Chloro-amide rearrangements*: Investigated the conversion of α -chloroamides to ketones in bicyclo[2.2.1]heptanes systems. First closely correlated confirmation of Huckel's assumption on the absolute stereo-chemical configuration of (+)-norcamphor using anomalous dispersion of x-rays by Cl.

1996 – 2002 B.Ed(sc), MS, **Kenyatta University**. Nairobi, Kenya

- *Tsetse Fly allomonas*: Developed stereo-selective routes to chiral δ -octalactones and investigated their effects on the host-seeking behavior of *G. morsitans morsitans*
- *Honors thesis*: Fraction of three medicinal plants for anti-malarial compounds. Employed a bioassay guided approach that led to isolation of one active compound.

Publications:

1. Plettner, E.; Mohle, A.; Mwangi, M. T.; Griscti, J.; Patrick, B. O.; Nair, R.; Batchelor, R. J.; Einstein, F., 2-Chlorobicyclo[2.2.1]hept-5-ene-2-carboxamide and 2-chlorobicyclo[2.2.1]heptane-2-carboxamide as precursors of bicyclo[2.2.1]hept-5-en-2-one and bicyclo[2.2.1]heptan-2-one: resolution, absolute configuration and hydrogen-bonding properties. *Tet. Asym.* 2005, 16 (16), 2754-2763 (IF 2.65)

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2. Mwangi, M. T.; Runge, M. B.; Bowden, N. B., Occlusion of Grubbs' Catalysts in Active Membranes of Polydimethylsiloxane: Catalysis in Water and New Functional Group Selectivity. *J. Amer. Chem. Soc.* 2006, *128* (45), 14434-14435 (IF 9.91)
3. Runge, M. B.; Mwangi, M. T.; Bowden, N. B., New selectivities from old catalysts. Occlusion of Grubbs' catalysts in PDMS to change their reactions. *J. Organomet. Chem.* 2006, *691* (24-25), 5278-5288 (IF 2.38)
4. Runge, M. B.; Mwangi, M. T.; Miller, A. L., II; Perring, M.; Bowden, N. B., Cascade reactions using LiAlH_4 and Grignard reagents in the presence of water. *Angew. Chem., Int. Ed.* 2008, *47* (5), 935-939 (IF 13.46)
5. Mwangi, M. T.; Runge, M. B.; Hoak, K. M.; Schulz, M. D.; Bowden, N. B., A materials approach to site-isolation of Grubbs catalysts from incompatible solvents and *m*-chloroperoxybenzoic acid. *Chem.—Eur. J.* 2008, *14* (22), 6780-6788 (IF 5.93)
6. Mwangi, M. T.; Gikonyo, N. K.; Ndiege, I. O., Repellent properties of δ -octalactone against the tsetse fly, *Glossina morsitans morsitans*. *J. Insect Sci.* 2008, *8*, 43 (IF 1.01)
7. Mwangi, M. T.; Schulz, M. D.; Bowden, N. B., Sequential Reactions with Grubb's Catalyst and AD-mix- α/β Using PDMS Thimbles. *Org. Letts.* 2009, *11* (1), 33-36 (IF 5.86)
8. Runge, M. B.; Mwangi, M. T.; Miller, A. L., II; Perring, M.; Hoak, K. M.; Schulz, M. D.; Bowden, N. B., PDMS Thimbles for the development of cascade reactions: A materials approach to organic chemistry. *PMSE Preprints* 2009, *100*, 690-691
9. Atkinson, M. B. J.; Sokolov, A. N.; Bucar, D.-K.; Mariappan, S. V. S.; Mwangi, M. T.; Tiedman, M. C.; MacGillivray, L. R., Applications of hydrogen-bond-acceptor templates to direct in-phase reactivity of a diene diacid in the solid state. *Photochem. Photobiol. Sci.* 2011, *10* (9), 1384-1386 (IF 2.41)
10. Thuo, M. M.; Reus, W. F.; Nijhuis, C. A.; Barber, J. R.; Kim, C.; Schulz, M. D.; Whitesides, G. M., Odd-Even Effects in Charge Transport across Self-Assembled Monolayers. *J. Amer. Chem. Soc.* 2011, *133* (9), 2962-2975 (IF 9.91)
11. Liu, X.-Y.; Mwangi, M.; Li, X.-J.; O'Brien, M.; Whitesides, G. M., Paper-based piezoresistive MEMS sensors. *Lab on a Chip* 2011, *11* (13), 2189-2196. (IF 6.26)
12. Derda, R.; Tang, S. K. Y.; Laromaine, A.; Mosadegh, B.; Hong, E.; Mwangi, M.; Mammoto, A.; Ingber, D. E.; Whitesides, G. M., Multizone paper platform for 3D cell cultures. *PLoS One* 2011, *6* (5), e18940 (IF 4.09)
13. Liu, X.-Y.; O'Brien, M.; Mwangi, M., Xiujun Li, Whitesides, George M. (2011) "Paper-based piezoresistive MEMS force sensors" MEMS 2011 Conference proceedings
14. Cademartiri, L.; Thuo, M. M.; Nijhuis, C. A.; Reus, W. F.; Tricard, S.; Barber, J. R.; Sodhi, R. N. S.; Brodersen, P.; Kim, C.; Chiechi, R. C.; Whitesides, G. M., Electrical Resistance of $\text{Ag}^{\text{TS}}\text{-S}(\text{CH}_2)_n\text{-CH}_3//\text{Ga}_2\text{O}_3/\text{EGaIn}$ Tunneling Junctions. *J. Phys. Chem. C* 2012, *116* (20), 10848-10860 (IF 4.81)
15. Reus, W. F.; Nijhuis, C. A.; Barber, J. R.; Thuo, M. M.; Tricard, S.; Whitesides, G. M., Statistical Tools for Analyzing Measurements of Charge Transport. *J. Phys. Chem. C* 2012, *116* (11), 6714-6733 (IF 4.81)
16. Reus, W. F.;[#] Thuo, M. M.;[#] Shapiro, N. D.; Nijhuis, C. A.; Whitesides, G. M., The SAM, Not the Electrodes, Dominates Charge Transport in Metal-Monolayer// Ga_2O_3 /Gallium-Indium Eutectic Junctions. *ACS Nano* 2012, *6* (6), 4806-4822 ([#] co-first author) (IF 11.42)

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17. Yoon, H. J.; Shapiro, N. D.; Park, K. M.; Thuo, M. M.; Soh, S.; Whitesides, G. M., The Rate of Charge Tunneling through Self-Assembled Monolayers Is Insensitive to Many Functional Group Substitutions. *Angew. Chem., Int. Ed.* 2012, 51 (19), 4658-4661 (IF 13.46)
18. Thuo, M. M.; Reus, W. F.; Simeone, F. C.; Kim, C.; Schulz, M. D.; Yoon, H. J.; Whitesides, G. M., Replacing -CH₂CH₂- with -CONH- Does Not Significantly Change Rates of Charge Transport through Ag^{TS}-SAM//Ga₂O₃/EGaIn Junctions. *J. Am. Chem. Soc.* 2012, 134 (26), 10876-10884 (IF 9.91)
19. Glavan, A. C., Martinez, R. V., Maxwell, E. J., Subramania, A. B., Nunes, R. M. D., Thuo, M. M., and George M. Whitesides. Rapid Fabrication of Pressure-driven Open-Channel Microfluidic Devices in Highly Hydrophobic Paper. *Adv. Function. Mat.* 24(1), 60-70 (IF 10.18)
20. Atkinson, M. B. J., Bwambok, D. K., Jie C., Prashant C., Thuo, M. M., Mace, C.R., Mirica, K.A., Myerson, A., Whitesides, G.M. Separation and Isolation of Polymorphs, Enantiomorphs, and Racemate Crystal Forms by Density Using Magnetic Levitation. *Angew. Chem. Int. Ed.* 2013 52, (39), 10208–10211 (IF 13.46)
21. Bwambok, D. K., Thuo, M M., Atkinson, M. B. J., Mirica, K.A., Shapiro, D.N., Whitesides, G. M. Paramagnetic ionic liquids for density-based measurements using magnetic Levitation. *Anal. Chem.* 2013 85 (17), 8442–8447 (IF 5.70)
22. Felice C. Simeone, Martin M. Thuo, Hyo-Jae Yoon, Jabulani R. Barber, George M. Whitesides "Defining injection conductance for charge transport by tunneling across SAMs" *J. Am. Chem. Soc.* 2013 135 (48), 18131-18144 (IF 9.91)
23. C. Zhao, M. Thuo, X.Y. Liu, "A microfluidic paper-based electrochemical biosensor array for multiplexed detection of metabolic biomarkers," *Sci. Tech. Adv. Mat.*, 2013 14 054402 (IF 3.75)
24. Mohammad H. Al-Sayah, Carleen M. Bowers, Martin M. Thuo, Mostafa Baghbanzadeh, Mathieu Gonidec, George M. Whitesides "Replacing -CH₂CH₂CH₂- with -NHCONH- near the Silver Electrode Does not Significantly Change Rates of Tunneling across Ag-SAM//Ga₂O₃/EGaIn Junctions" *NanoLett* 2013 Submitted (IF 13.03)

Publications: in Preparation (manuscripts available)

1. Martin M. Thuo, Ramses Martinez, Xinyu Liu, Manza B.J. Atkinson, Jean-Francis Bloch, George M. Whitesides "Low-Cost microfluidic devices derived from embossed hydrophobic paper"
2. Ian Tevis, Lucas Newcomb, Martin M. Thuo* "Shear-Driven Top-Down Fabrication of Multi-layered Metal-Organic Soft Core-Shell nanoparticles" (**Independent career**)

Patents

1. Xinyu Liu, Martin M. Thuo, XiuJun Li, Michael O'Brien, Yu Sun, and George M. Whitesides "MEMS force sensors fabricated using paper substrates" *U.S. Patent Application No.13/557,861 WO. 2013019510*
2. David K. Bwambok, Martin M. Thuo, Katherine Mirica, Nathan Shapiro, Manza Atkinson, and George M. Whitesides "Density based methods for separation of materials, monitoring of solid supported reactions and measuring densities of small liquid volumes and solids using ionic liquids" *US Patent Application No. 61/659,715, PCT/US13/45769 WO 2013188725 A1 20131219*
3. Martin M. Thuo, Xinyu Liu, Jean-Francis Bloch, Ana Glavan, Ramses Martinez, Wenjie Lan, George M. Whitesides "Microfluidic devices based on hydrophobic paper" *Provision applications no.:61/654.639, 61/784,907, PCT WO 2013181656 A1 20131205*

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4. Davik K. Bwambok, Wenjie Lan, E.J. Maxwell, Claudio Parolo, Anand Bala Subramaniam, Martin M. Thuo, and George M. Whitesides "Paper-Based Reference Electrode and Potentiometric Sensing Device" *U.S. Patent Application No. 61/789,883*
5. Martin M. Thuo, Alex Nemiroski, David K. Bwambok, and George M. Whitesides "Infochemistry: Decoding Information Encrypted into Material Density Using Magnetic Levitation" *Patent Pending*
6. Abraham K.B. Tawiah, Martin M. Thuo, George M. Whitesides. "Functionalized paper for oil-water separation via selective absorption" *Patent Pending*
7. Martin Thuo, Ian Tevis "multi-layered soft-core micro- and nanoparticles" *US provisional Patent application no: 61914765 (Independent Career)*

Grants:

1. 2012 –2014: "Development of low-cost diagnostic devices from biodegrade materials and can also be incinerated" Grand-Challenges Canada Grant No. 0153-01. **Role:** co-PI
2. 2012 –2013: "A low-cost, paper-based electrochemical diagnostic device for point-of-care immunoassays" Grand-Challenges Canada Grant No. 0046-01-04-01-01. **Role:** co-PI
3. 2013-2014 'The Effect of spin on charge transport by coherent-through-bond tunneling across metal-organic//metal junctions' Joseph P. Healey Grant Award No. PDG-14-12

