Natasha Jaiswal, Ph.D.
Assistant Professor of Health and Kinesiology
Faculty Associate, Center on Aging and the Life Course
Purdue University
800 W. Stadium Avenue, West Lafayette, IN – 47907 E-mail:
jaiswa19@purdue.edu

Curriculum Vitae

Contents

Research Background

I completed my postdoctoral training in Dr. Paul Titchenell's laboratory at the University of Pennsylvania, where my focus was on employing systems-based approaches to dissect metabolic diseases in the context of skeletal muscle. During my time in the Titchenell lab, I independently established intricate techniques, including primary myoblast isolation, ex vivo cultures, whole muscle mounts, and excitation-contraction coupling, among others. These techniques were instrumental in addressing fundamental questions in muscle physiology.

A notable contribution of my work was the discovery, *published in Molecular Metabolism and selected for the cover page article of the journal*, that AKT, a kinase central to the insulin signaling pathway, is not an obligate intermediate for regulating glucose uptake in skeletal muscle. This surprising finding supports a novel hypothesis suggesting the existence of a pathway, in addition to AKT, required for insulin's action in skeletal muscles for glucose uptake *(Manuscript in preparation for nature metabolism)*.

Additionally, I confirmed *in vivo* that AKT is essential for skeletal muscle growth and oxidative properties. I mapped the cellular pathways downstream of AKT that are both required and *sufficient to control muscle growth and function, with the results published* in the Journal of Cachexia Sarcopenia and Muscle. Consequently, my postdoctoral work has redefined our current understanding of skeletal muscle insulin signaling and insulin resistance. Furthermore, I introduced a new field of study and innovative techniques, including successful single fiber isolation and the development of a GLUT4 translocation assay in single muscle fibers. These advancements have opened up new avenues for research in the field of skeletal muscle physiology.

Research Interest

Skeletal muscle shows a high structural and functional heterogeneity and a high degree of plasticity, namely its structure and function can deeply adapt to physiologic and pathologic conditions such as exercise training, disuse, ageing, muscular dystrophy, chronic non muscle diseases, drug administration. Skeletal muscle plasticity is of paramount importance to enable the body to improve or simply maintain physical performance, and to cope with changes in energy and amino acid supply such as those occurring in starvation or chronic diseases. My research program explores two crucial facets of skeletal muscle physiology i.e. glucose homeostasis and muscle performance in physiology and diseased condition.

The research projects are distinctly focused on the two interesting themes:

a. Role of metabolic signaling in the maintenance of skeletal muscle and neuromuscular junction (NMJ) plasticity.

Project Description: The AKT signaling pathway in skeletal muscle plays a crucial role in regulating various cellular processes, including glucose homeostasis and muscle growth. While previous findings have established that skeletal muscle specific AKT signaling is not essential for glucose uptake in skeletal muscles, it is indispensable for muscle growth and function. Intriguingly, preliminary data suggest that skeletal muscle-specific insulin signaling via AKT governs the structural stability of the Neuromuscular Junction (NMJ), a chemical synapse between a motor neuron and skeletal muscle critical for muscle contraction. This project aims to investigate the molecular mechanisms through which insulin signaling in skeletal muscle regulates NMJ stability and morphology. Cutting-edge techniques such as RNA in situ hybridization will be employed to track Acetylcholine Receptor (AChR) turnover, providing insights into the dynamic aspects of NMJ maintenance. Additionally, a gene therapy approach will be utilized to elucidate the sufficiency of downstream molecules regulated by AKT in maintaining NMJ stability. Furthermore, this project will delve into how these molecular mechanisms contribute to muscle performance under both physiological and pathological conditions. Understanding the intricate interplay between insulin signaling and NMJ stability not only advances our knowledge of fundamental cellular processes but also holds potential implications for therapeutic interventions in conditions affecting skeletal muscle function.

b. Understanding the molecular mechanism to changes in body composition in obesity and sarcopenia using genetic mouse models and humans:

Project Description: Insulin resistance in skeletal muscle is a key defect mediating the link between obesity and type 2 diabetes, a disease that typically affects people in later life. Sarcopenia, an age-induced loss of muscle mass and function, promotes a higher risk of metabolic disorders including type 2 diabetes, which is exacerbated during obesity. The combination of sarcopenia and increased body fat in older adults, which was recently defined as sarcopenic obesity, represents a serious public health concern. Unfortunately, the underlying mechanisms of

skeletal muscle insulin resistance and loss of lean mass in 'sarcopenic obesity' remain elusive. There is a growing appreciation of the varied intra-organ or intracellular crosstalk that contributes to metabolic dysregulation. In this project we are interested in studying the crosstalk between skeletal muscle and adipose tissue and elucidate the molecular mechanism for muscle-adipose communication that contributes to the loss in lean mass and altered glucose homeostasis in skeletal muscle during sarcopenic obesity.

Research Skills

Obesity · Muscle Physiology · Neuromuscular junction · Skeletal muscle physiology · Obesity Research · Crispr cas9 . Metabolomics . GLUT4 translocations

Education background and training

2015:	Ph.D. (Biochemistry) Thesis title: Nutritional Modification induced insulin Resistance: Tissue-specific role of Inflammation and Oxidative Stress. Central Drug Research Institute, India.
2016:	Dr. D.S. Kothari Fellow, Indian Institute of Science and University of California.
2017:	Postdoctoral fellow, University of Pennsylvania
2023:	Senior investigator, University of Pennsylvania
2024:	Assistant Professor, Purdue University

Research support

2021:	Pilot career development grant Skeletal muscle aging and neuromuscular junction Disintegration San Antonio Nathan Shock Centre
2015:	D.S. Kothari grant Indian Institute of Science, India

Publications

1. **N Jaiswal,** M Gavin, E Loro, J Sostre-Colón, PA Roberson, K Uehara, N R Fuentes, M Neinast, Z Arany, S R Kimball, T S Khurana, P M Titchenell. AKT controls protein synthesis and oxidative metabolism via combined mTORC1 and FOXO1 signaling to govern muscle physiology. Journal of Cachexia, Sarcopenia and Muscle (2021). *Impact 12.9*
2. E Nunn, **N Jaiswal**, M Gavin, K Uehara, M Stefkovich, K Drareni, R Calhoun, M Lee, C Holman, J Baur, S Patrick, P. Titchenell. Antibody Blockade of Activin Type II Receptors Preserves Skeletal Muscle Mass and Enhances Fat Loss During GLP-1 Receptor Agonism. Molecular metabolism (Accepted, January, 2024). *Impact 7.4*
3. **N Jaiswal**, MG Gavin, WJ Quinn III, TS Luongo, RG Gelfer, JA Baur, PM Titchenell. The role of skeletal muscle Akt in the regulation of muscle mass and glucose homeostasis. Molecular metabolism 28, 1-13 (2019). *Impact 7.4*
4. **N Jaiswal,** S Agrawal, A Agrawal. High fructose-induced metabolic changes enhance inflammation in human dendritic cells. Clinical & Experimental Immunology 197 (2), 237-249 (2019).
5. B Ahn, S Wan, **N Jaiswal,** RB Vega, DE Ayer, PM Titchenell, X Han, KJ Won, DP Kelly. MondoA drives muscle lipid accumulation and insulin resistance. JCI insight 4 (15) (2019). *Impact 9.2*
6. F Rahmatpanah*, S Agrawal*, **N Jaiswal*,** H M Ngyuen, M McClelland, A Agrawal. Airway epithelial cells prime plasmacytoid dendritic cells to respond to pathogens via secretion of growth factors. Mucosal Immunology 12 (1), 77-84 (2019). (*equal first author). *Impact 7.2*
7. **N Jaiswal,** CK Maurya, D Arha, DR Avisetti, A Prathapan, PS Raj, KJ Raj, SV Kalivendi, AK Tamrakar. Fructose induces mitochondrial dysfunction and triggers apoptosis in skeletal muscle cells by provoking oxidative stress. Apoptosis 20 (7), 930-947 (2015).
8. **N Jaiswal,** CK Maurya, J Pandey, AK Rai, AK Tamrakar. Fructose-induced ROS generation impairs glucose utilization in L6 skeletal muscle cells. Free radical research 49 (9), 1055-1068 (2015).

9. **N Jaiswal,** N Gunaganti, CK Maurya, T Narender, AK Tamrakar. Free fatty acid induced impairment of insulin signaling is prevented by the diastereomeric mixture of calophyllic acid and isocalophyllic acid in skeletal muscle cells. European journal of pharmacology 746, 70-77 (2015).
10. **N Jaiswal,** V Bhatia, SP Srivastava, AK Srivastava, AK Tamrakar. Antidiabetic effect of Eclipta alba associated with the inhibition of alpha-glucosidase and aldose reductase. Natural Product Research 26 (24), 2363-2367 (2012).
11. **N Jaiswal,** CK Maurya, K Venkateswarlu, P Sukanya, AK Srivastava, T Narender, AK Tamrakar. 4-Hydroxyisoleucine ameliorates fatty acid-induced insulin resistance and inflammatory response in skeletal muscle cells. European journal of nutrition 51 (7), 893-898 (2012).
12. **N Jaiswal,** S Srivastava, V Bhatia, A Mishra, A Sonkar, T Narender, AK Srivastava, AK Tamrakar. Inhibition of Alpha-Glucosidase by Acacia niloticaPrevents Hyperglycemia along with Improvement of Diabetic Complications via Aldose Reductase Inhibition. J Diabetes Metab S 6 (004) (2012).
13. **N Jaiswal,** PP Yadav, R Maurya, AK Srivastava, AK Tamrakar. Karanjin from Pongamia pinnata induces GLUT4 translocation in skeletal muscle cells in a phosphatidylinositol-3-kinase-independent manner. European journal of pharmacology 670 (1), 22-28 (2011).
14. AK Rai, **N Jaiswal**, CK Maurya, A Sharma, I Ahmad, S Ahmad, AP Gupta, JR Gayen, AK Tamrakar. Fructoseinduced AGEs-RAGE signaling in skeletal muscle contributes to impairment of glucose homeostasis. The Journal of nutritional biochemistry 71, 35-44 (2019).
15. G Taneja, CP Gupta, S Mishra, R Srivastava, N Rahuja, AK Rawat, et al., Synthesis of substituted 2 H- benzo [e] indazole-9-carboxylate as a potent antihyperglycemic agent that may act through IRS-1, Akt and GSK-3β pathways. MedChemComm 8 (2), 329-337 (2017).
16. J Prasad, CK Maurya, J Pandey, **N Jaiswal,** G Madhur, AK Srivastava, T Narender, AK Tamrakar. Diastereomeric mixture of calophyllic acid and isocalophyllic acid stimulates glucose uptake in skeletal muscle cells: Involvement of PI-3-Kinase-and ERK1/2-dependent pathways. Molecular and cellular endocrinology 370 (1-2), 11-19 (2013).
17. J Gupta, DP Singh, PC Verma, N Rahuja, R Srivastava, I Ahmad, et al., Pregnane-Oximino-Alkyl-Amino- Ether Compound as a Novel Class of TGR5 Receptor Agonist Exhibiting Antidiabetic and Anti-Dyslipidemic Activities. Pharmacology, 1-15 (2020).
18. CK Maurya, R Singh, **N Jaiswal,** K Venkateswarlu, T Narender, AK Tamrakar. 4-Hydroxyisoleucine ameliorates fatty acid-induced insulin resistance and inflammatory response in skeletal muscle cells. Molecular and cellular endocrinology 395 (1-2), 51-60 (2014).
19. T Narender, G Madhur, **N Jaiswal,** M Agrawal, CK Maurya, N Rahuja, Synthesis of novel triterpene and N-allylated/N-alkylated niacin hybrids as α-glucosidase inhibitors. European journal of medicinal chemistry 63, 162169 (2013).
20. G Naresh, **N Jaiswal,** P Sukanya, AK Srivastava, AK Tamrakar. Glucose uptake stimulatory effect of 4-hydroxypipecolic acid by increased GLUT 4 translocation in skeletal muscle cells. Bioorganic & medicinal chemistry letters 22 (17), 5648-5651 (2012).
21. MF Khan, P Dixit, **N Jaiswal,** AK Tamrakar, AK Srivastava, R Maurya. Chemical constituents of Kigelia pinnata twigs and their GLUT4 translocation modulatory effect in skeletal muscle cells. Fitoterapia 83 (1), 125-129. (2012).
22. HC Upadhyay, **N Jaiswal,** AK Tamrakar, AK Srivastava, N Gupta, SK Srivastava. Antihyperglycemic agents from Ammannia multiflora. Natural product communications 7 (7), (2012).
23. VP Pandey, **N Jaiswal,** AK Srivastava, SK Shukla, RP Tripathi. Synthesis and Enzyme Inhibitory Activities of Highly Functionalized Pyridylmethyl-C-β-D-Glycosides. Journal of Carbohydrate Chemistry 30 (3), 132- 146 (2011).
24. SS Bisht, **N Jaiswal,** A Sharma, S Fatima, R Sharma, N Rahuja, AK Srivastava, V Bajpai, RP Tripathi. A convenient synthesis of novel pyranosyl homo-C-nucleosides and their antidiabetic activities. Carbohydrate research 346 (10), 1191-1201 (2011).
25. N Anand, **N Jaiswal,** SK Pandey, AK Srivastava, RP Tripathi. Application of click chemistry towards an efficient synthesis of 1, 2, 3-1H-triazolyl glycohybrids as enzyme inhibitors. Carbohydrate research 346 (1), 16-25 (2011).
26. AK Tamrakar, **N Jaiswal,** PP Yadav, R Maurya, AK Srivastava. Pongamol from Pongamia pinnata stimulates glucose uptake by increasing surface GLUT4 level in skeletal muscle cells. Molecular and Cellular Endocrinology 339 (1-2), 98-104 (2011).

27. R Srivastava, SP Srivastava, **N Jaiswal,** A Mishra, R Maurya, AK Srivastava. Antidiabetic and antidyslipidemic activities of Cuminum cyminum L. in validated animal models. Medicinal Chemistry Research 20 (9), 1656-1666 (2011).
28. MF Khan, M Kumar, **N Jaiswal,** AK Srivastava, R Maurya. α-Glucosidase inhibitor constituents from Bombax ceiba. Trends Carbohydr. Res 2, 29-34 (2010).
29. SS Bisht, S Fatima, AK Tamrakar, N Rahuja, **N Jaiswal,** AK Srivastava, RP Tripathi. Synthetic studies in butenonyl C-glycosides: preparation of polyfunctional alkanonyl glycosides and their enzyme inhibitory activity. Bioorganic & medicinal chemistry letters 19 (10), 2699-2703 (2009).

* https://scholar.google.co.in/citations?user=8HfEZBcAAAAJ&hl=en

* https://www.researchgate.net/profile/Natasha-Jaiswal-4

Articles and Manuscripts Currently in Review or Preparation

1. **N. Jaiswal**, Matthew Gavin, L. Lantier, D. Wasserman, P. M. Titchenell. AKT negatively regulates Insulin mediated AMPK signaling in skeletal muscles to maintain glucose and energy homeostasis. Manuscript in preparation in Nature metabolism.

Book chapters

1. Sandhya S. Visweswariah and Natasha Jaiswal . Guanylyl Cyclase Receptors. Encyclopedia of signaling Molecules page 2308-2315 (2017)
2. Natasha Jaiswal. In-vitro Techniques to Study Cell Signaling. Phytochemistry: An in-silico and in-vitro. 267- 277 (2019).

Patents

Country	Application no.	Patent no.	Grant no.	Title	Author
India	0262DEL2012	filed		Novel Substituted 2 H Benzo [e] indazole 9-carboxylates for the treatment of diabetes and related metabolic disorders	Atul Goel, Gaurav Taneja, Neha Rahuja, Arun Kumar Rawat, **Natasha Jaiswal,** Akhilesh Kumar Tamrakar & Arvind Kumar Srivastava
Europe	13708243	filed			
United States	14/376097	9096539	04/08/2015		
PCT	PCT/IN2013/000056	filed			
India	0193DEL2013	309213	14-03-2019		Verma Prem Chandra, Gupta Jyoti, Singh
Australia	2014208337	2014208337	25/01/2018	Antidiabetic and antidyslipidemic activities of	Dharmendra Pratap, Gupta Varsha, Kushwaha Hari Narayan,
Great Britain	1514915	GB2527958	04/09/2019		

United States	14/763480	Filed		pregnaneoximinoa minoal kyle thers	Misra Anamika, Rahuja Neha, Srivastava Rohit, **Jaiswal Natasha,** Khanna Ashok Kumar, Tamrakar Akhilesh Kumar, Singh Shio Kumar, Dwivedi Anil

Honors and Awards

2023:	NIA P30 mentorship award, Oklahoma Nathan Shock Center.
2023:	Scholarship to attend the 15th annual course Isotope Tracers in Metabolic Research: Principles and Practice of Kinetic Analysis, Vanderbilt University, Nashville.
2022:	Best scientific image award at physiology retreat, University of Pennsylvania
2020:	Art in Science award Biomedical Postdoctoral association, University of Pennsylvania.
2020:	Biomedical Postdoctoral travel grant, University of Pennsylvania.
2019:	Research story invited and selected for the Molecular metabolism journal cover page (October).
2013:	Department of Biotechnology travel grant for an international conference (India).
2013:	Department of Science and Technology travel grant (India).
2013:	Best Manuscript award for the paper presented at an international conference.
2009:	Best oral presentation award at "Diabetes mellitus and Cancer (Dia-Can '09) Meeting.
2009-2012:	CSIR-UGC Research Fellowship for pursuing Ph.D. in India Council of Scientific & Industrial Research.
2008:	Qualified Graduate Aptitude Test with 92.4 percentile.

Teaching Experience

2017:	Teaching Assistant to MD/ MD-Ph.D students Department of Basic and Clinical immunology,University of California. Spring 2017
2021:	Selected for the University of Pennsylvania's Center for Teaching and Learning (CTL) program for teaching College Students. January-March 2021

Professional Membership

2022:	Guest Editor of 'Frontiers in Cell and Developmental Biology
2019:	Member of the Board of Reviewers of 'The Reviews of Diabetes Journal'
2019:	Member of the peer-review program of the scientific Research Publishing
2019-current	Reviewer for Journals: Journal of Diabetes, Obesity, and Metabolism
2014:	Mediator of Inflammation
2014:	Journal of Diabetes
2014:	Evidence-Based Complementary and Alternative Medicine Editorial Board Member of Diabetes Research And Treatment: An Open Access Journal.
2013:	Editorial board member of The Standard International Journals Member of Indian Society of Cell Biology

Invited talk

1. Interplay between AKT and AMPK signaling in the maintenance of glucose homoestasis. Physiology retreat 2022. The University of Pennsylvania, Philadelphia.
2. Role of Akt Signaling in the regulation of glucose homeostasis, Muscle meeting 2021. The University of Pennsylvania, Philadelphia.
3. Role of Akt Signaling in the regulation of glucose homeostasis. Talking heads 2022. The University of Pennsylvania, Philadelphia.
4. Role of Akt Signaling in the regulation of skeletal muscle growth and performance, Physiology retreat 2019. The University of Pennsylvania, Philadelphia.
5. Role of Akt Signaling in the regulation of skeletal muscle growth and performance, Muscle meeting 2018. The University of Pennsylvania, Philadelphia
6. High fructose induces enhanced inflammation in human dendritic cells: Role of AGE-RAGE pathway, La Jolla Immunology Conference 2017. Salk Institute San Diago.
7. Nutritional modification induced insulin resistance, International Conference on Bioengineering and Natural Sciences 2013. Bangkok.

Conference Proceedings or Peer-Reviewed Abstracts

1. **Natasha Jaiswal,** Mathew Gavin, Emanuele Loro, Jaimarie Sostre-Colón, Paul A Roberson, Kahealani Uehara, Nicole R Fuentes, Michael Neinast, Zoltan Arany, Scott R. Kimball, Tejvir S. Khurana, Paul M. Titchenell. AKT controls protein synthesis and oxidative metabolism via combined mTORC1/FOXO1 to govern skeletal muscle mass and function. Kroc symposium, Smilow Centre for Translational research, 2021, University of Pennsylvania.
2. **Natasha Jaiswal**, Mathew G. Gavin, William J. Quinn, Rebecca G. Gelfer, Joesph.A. Baur, Paul M. Titchenell. The role of skeletal muscle Akt in the regulation of muscle mass and glucose homeostasis. Diabetes symposium 2020, Santa Fe, New Mexico.
3. **Natasha Jaiswal**, Mathew G. Gavin, Joesph. A. Baur, Paul M. Titchenell. Deletion of both Akt1 and Akt2 and alters muscle function and causes muscle atrophy via combined activation and inhibition of FoxO1 and mTORC1 pathway. Biomedical Postdoctoral conference, Smilow Centre for Translational research, 2019, University of Pennsylvania.
4. **Natasha Jaiswal**, Mathew G. Gavin, Joesph. A. Baur, Paul M. Titchenell. Deletion of both Akt1 and Akt2 and alters muscle function and causes muscle atrophy via combined activation and inhibition of FoxO1 and mTORC1 pathway. Spring symposium and Kroc lecture, Smilow Centre for Translational research, 2018, University of Pennsylvania.
5. **Natasha Jaiswal**, Sudhanshu Agrawal and Anshu Agrawal. High fructose induces enhanced inflammation in human dendritic cells: Role of AGE-RAGE pathway. Immunology conference 2017, Salk Institute San Diago.
6. **Natasha Jaiswal**, Sudhanshu Agrawal and Anshu Agrawal. High Fructose environment enhances dendritic cells function in humans: Role of AGE-RAGE pathway. Postdoctoral symposium-2017 at University of California Irvine. 2017.
7. **Natasha Jaiswal**, Akhilesh Tamrakar. Nutritional modification induced insulin resistance: Tissue specific role of inflammation and oxidative stress. Bangkok international conference on Bioengineering and Natural Sciences 2013.
8. **Natasha Jaiswal**, Akhilesh Tamrakar. Improving insulin resistance using natural molecules: Developing Insulin sensitizing agents to Ameleorate insulin resistance. Diabetes and metabolism-OMICS 2012.
9. **Natasha Jaiswal**, Vilay lakshmi, Rakesh Maurya and Arvind kumar Srivastava. Alpha-Glucosidase inhibitory potential in few terrestrial antidiabetic plants Authors: Diabetes and metabolism- CTDDR-2010.

Poster presentations at conferences and seminars

1. Posters and Presentations at Conferences and Seminars:
2. Poster presentation ‘Role of Akt signaling in the regulation of glucose homeostasis and skeletal muscle physiology’ at PMI symposium, 2023.
3. Poster presentation ‘Role of Akt signaling in the regulation of glucose homeostasis and skeletal muscle physiology’ at keystone symposium: Bioenergetics in Health and Diseases-2023.
4. Oral presentation, department of physiology retreat-2022.
5. Platform presentation at Biomedical Postdoctoral Symposium-2021, University of Pennsylvania.

6. Poster presentation at Kroc symposium, Smilow Centre for Translational research, 2021, University of Pennsylvania
7. Poster presentation at Kroc symposium, Smilow Centre for Translational research, 2021, University of Pennsylvania.
8. Poster presentation at Keystone symposium ”Diabetes: Glucose Control and Beyond (J5)” 2020, Santa Fe Community Convention Center, Santa Fe, NM USA.
9. Poster presentation at Ray A. and Robert L. Kroc Lecture, 2019 at Perelman School of Medicine, University of Pennsylvania. USA.
10. Poster presentation at 18th Annual Biomedical Postdoctoral Research Symposium, 2019 at Perelman School of Medicine, University of Pennsylvania. USA.
11. Regulation of Skeletal Muscle physiology and metabolism by Akt signaling, Physiology retreat 2018, University of Pennsylvania. USA.
12. Poster presentation at 17th Annual Biomedical Postdoctoral Research Symposium, 2018 at Perelman School of Medicine, University of Pennsylvania. USA.
13. Poster presentation at Ray A. and Robert L. Kroc Lecture, 2018 at Perelman School of Medicine, University of Pennsylvania. USA.
14. Poster at ‘All India conference on Cell Biology and Cell fate’ 2013 at Indian Institute of Science, India.
15. Poster at international symposium on current trends in Drug discovery Research 2013 at Central Drug Research Centre, India.
16. Poster at conference on Diabetes and metabolism-OMICS: 2012, at Central Drug Research Centre, India.
17. Attended an international symposium on current trends in Drug discovery Research in the year 2010, at Central Drug Research Centre, India.
18. Oral presentation at conference on ‘Diabetes and cancer-DIACAN’-2009, at Central Drug Research Centre, India.
19. Attended a conference on Traditional methods for the treatment of various diseases at King George Medical College Lucknow, India.