# PANKAJ KAPAHI


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| **Address** | Buck Institute for Research on Aging<br>8001 Redwood Blvd.<br>Novato, CA 94945 |
| **Telephone** | 415-209-2201 |
| **Fax** | 415-209-9920 |
| **E-mail** | pkapahi@buckinstitute.org |


## EDUCATION

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| 1995-1999 | **Ph.D.** - University of Manchester, UK. |
| 1992- 1995 | **BSc** - St. Georges Hospital Medical School, University of London.<br>*Magna Cum Laude*. First class honors in Biochemistry with Medical Sciences. |
| 1990 | **A levels** - Physics (A), Chemistry (A) and Maths (A). |

## EMPLOYMENT HISTORY

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| 02/14 – present | Buck Institute for Research on Aging, Novato, CA.<br>*Professor* |
| 06/12 – present | University of California, San Francisco, Dept of Urology<br>*Adjunct Associate Professor.* |
| 02/10 – 02/14 | Buck Institute for Research on Aging, Novato, CA.<br>*Associate Professor.* |
| 09/04 **–** 01/10 | Buck Institute for Research on Aging, Novato, CA.<br>*Assistant Professor.* |
| 01/00 – 09/04 | Division Biology, California Institute of Technology, Pasadena, CA.<br>*Postdoctoral Research Fellow*. Mentor: Dr. Seymour Benzer. |
| 01/99 – 01/00 | Department of Pharmacology, University of California, San Diego, CA.<br>*Postdoctoral Research Fellow*. Mentor: Dr. Michael Karin. |
| 09/95 – 01/99 | Department of Gerontology, University of Manchester, Manchester, UK.<br>*Graduate student.* Mentor: Dr. Thomas B. L. Kirkwood. |
| 06/90 – 08/92 | Rheumatology Unit, Hammersmith Hospital, London, UK.<br>*Research Associate.* Mentor: Dr. Dorian O. Haskard. |

## HONORS AND AWARDS

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| 2015 | Glenn AFAR award |
| 2011 | Julie Martin AFAR Mid-Career Award in Aging Research. |
| 2010 | Gerontological Society of America's Nathan Shock New Investigator Award. |
| 2010 | EUREKA Award, National Institute of Aging. |
| 2006 | 'Breakthrough in Gerontology' (BIG) award from the Glenn/AFAR Foundation. |
| 2005 | Ellison New Scholar Award. |
| 2001 | Project grant from American Federation of Aging Research. |
| 2001 | John Douglas Alzheimer Foundation Postdoctoral Fellowship. |
| 1998 | Wellcome Prize International Postdoctoral Fellowship. |
| 1998 | Wellcome Prize Ph.D. Studentship. |
| 1995 | The Pollock Prize (*Magna Cum Laude*). |

## PROFESSIONAL ORGANIZATIONS

**Memberships**
2016-Pres. American Aging Association
2006 – Pres. The Gerontological Society of America
2006 – Pres. Genetics Society of America

**Service to Professional Organizations**
Organizer, Bay Area Worm Meeting, 2009-present.
Chair, Gordon Conference on Biology of Aging, 2013.
Organizing Committee Member, Aging, Metabolism, Stress, Pathogenesis, and Small RNAs in *C. elegans*, UW-Madison, August 2010.
Organizer, Buck Institute Symposium, 2007, "Nutrient Signaling and Aging," November 2007.
Initiated the formation of the Joint Masters Research Program between Dominican University and Buck Institute.

**Service to Scientific Journals**
20202- Pres. Editor E-Life
2009- Pres. Section Editor, Aging Cell
2009- 2014. Editor, PLoS one
2010- Pres. Editorial board, Aging
2010- Pres. Editorial board, Healthspan
2011- Pres. Member of 'Faculty of 1000'.

## PERSONAL STATEMENT

As a student of Seymour Benzer and Michael Karin, I have been inspired to carry out rigorous and innovative science as well as the value of good mentoring. In particular, the work of Seymour has inspired me to establish invertebrate models that are important to understanding important biological problems and human diseases. Seymour had a remarkable career, which led to landmark discoveries in fields of genetics, circadian clock biology, development, behavior and memory using the fly as a model. Towards the later part of his career in the 1980s, he pioneered the use of invertebrates in modeling human diseases which was initially met with skepticism but over time led to many breakthroughs. The experience in Seymour's laboratory was transformative and enlightening as it helped me realize the power of genetic approaches using invertebrate model systems for understanding biology and modeling human diseases. The power of the invertebrate models is beautifully captured in his biography 'Time, love and memory', which strongly influenced my decision to join his laboratory. This experience has been instrumental in guiding my lab's research at the Buck Institute for Research on Aging, since 2004.

My laboratory has made significant contributions in the areas of nutrient responses, aging, and metabolism. We were one of the first to identify the role of target of rapamycin (TOR) and implicate mRNA translation in mediating lifespan extension by dietary restriction. This work has led to a paradigm shift in the understanding mechanistic underpinnings of dietary restriction (DR). TOR has emerged as one of the most promising targets for lifespan extension and age-related diseases. Inhibition of the TOR pathway has been shown to extend lifespan in yeast, worms, flies and recently even mice. My laboratory studies the effects of nutritional manipulation on metabolism and healthspan using worms and flies. A key contribution of the laboratory has been that modulation of mRNA translation, a critical output of the TOR pathway, plays a significant role in determining lifespan in worms and flies. We

demonstrated that inhibition of cap-dependent protein translation via eIF4E binding protein (4EBP) downstream of the TOR pathway played a critical role in regulating lifespan extension by DR in *D. melanogaster.* More recently, we demonstrated that inhibition of eIF4G extends lifespan by preferentially enhancing translation of genes associated with stress responses. We also identified a critical role for enhanced fat turnover upon DR in mediating the lifespan extension upon DR. My laboratory employs an interdisciplinary approach, combining biochemical, genetic and genomic techniques, to understand how nutrients modulate changes in lifespan and metabolism using *D. melanogaster*, *C. elegans* and recently mammalian cell culture. More recently, we have also identified a critical role for circadian clocks in mediating the lifespan extension and changes in fat metabolism upon dietary restriction.

## CONTRIBUTIONS TO SCIENCE

**(over 85 peer reviewed articles, h index- 42 and i-10 index- 74)**

**1. Investigating mechanisms of lifespan extension by dietary restriction.** One of the major goals of my lab has been to understand the mechanisms that determine lifespan extension by dietary restriction, a robust mechanism of lifespan extension across species. Following our discovery of the role of TOR in mediating the effects of dietary restriction, we have focused on downstream effectors that modulate nutrient-dependent responses to dietary restriction. We have recently uncovered a significant role of peripheral circadian clocks in this process. Understanding the link between metabolism and aging is one of the holy grails in the field. We demonstrated for the first time that lifespan extension by dietary restriction enhances fatty acid synthesis and degradation. We also demonstrated that enhanced fatty acid metabolism in the muscle and increased physical activity are required for lifespan extension by dietary restriction (Katewa et al. 2012). In recent work using metabolomics, we have also demonstrated that DR reverses the age-related changes in the metabolome (Laye et al. 2015). In a prior study, we have identified a role for 4E-BP and differential mRNA translation as a mediator of metabolism and lifespan extension upon dietary restriction. We identified a novel role for 4E-BP in enhancing mitochondrial mRNA translation upon DR through their 5'UTR element, demonstrating a novel mode of increasing mitochondrial function by enhancing translation of nuclear-encoded mitochondrial genes.

1. Peripheral clocks modulate lifespan and fat metabolism upon dietary restriction. Katewa SD, Akagi K, Bose N, Rakshit K, Camarella T, Zheng X, Hall D, Davis S, Nelson CS, Brem RB, Ramanathan A, Sehgal A, Giebultowicz JM, **Kapahi P**. *Cell Metab* 2016 Jan 12;23(1):143-54 PMID: 26626459. PMC4715572
2. Laye M, Tran, VL, Jones D, **Kapahi P***, Promislow D*. The effects of age and dietary restriction on the tissue-specific metabolome of *Drosophila***.** (2015) *Aging Cell* 14(5):797-808. PMC4568967 *Joint senior authors
3. Katewa D, Demontis F, Kolipinski M, Hubbard A, Gill M, Perrimon N, Melov S, **Kapahi P** (2012) Intra-myocellular triglyceride turnover plays a critical role in mediating responses to dietary restriction in *Drosophila melanogaster. Cell Metab* 16:97-103. PMC3400463
4. Zid BM, Rogers AN, Katewa SD, Vargas MA, Kolipinski MC, Lu TA, **Kapahi P**. (2009) 4E-BP extends lifespan upon dietary restriction by enhancing mitochondrial activity in Drosophila. *Cell* 139:149-60. PMC2759400.

**2. Identification of TOR as a key mediator of lifespan extension in flies and worms.** During my work as a postdoctoral fellow, I was one of the first to identify the role of target of rapamycin (TOR) in mediating lifespan extension by dietary restriction. This work has led to a paradigm shift in the understanding mechanistic underpinnings of dietary restriction (DR). TOR has emerged as one of the most promising

targets for lifespan extension and age-related diseases. Inhibition of the TOR pathway has been shown to extend lifespan in yeast, worms, flies and even mice. We have also undertaken more in-depth investigating the role of S6 Kinase in modulating lifespan, leading to the identification of a novel role for HIF-1 and IRE-1 as part of a nutrient-responsive pathway which acts downstream of the S6 kinase to mediate the effects of dietary restriction in *C. elegans*. Furthermore, in a recent study we observed an almost five-fold extension in lifespan by combining long-lived insulin-like receptor, *daf-2*, with S6 kinase mutants, opening the possibility of synergistic lifespan extension by combining treatments that inhibit insulin-like signaling and TOR pathways in other species.


1. Chen D, Li P. W., Goldstein, B. A., Cai, W., Thomas, E. L., Chen, F., Hubbard, A. E., Melov, S., **Kapahi, P**. (2013) Germline Signaling Mediates the Synergistically Prolonged Longevity Produced by Double Mutations in daf-2 and rsks-1 in C. elegans. *Cell Rep*, 5:1600-10. PMC3904953
2. **Kapahi P,** Chen D, Rogers AN, Katewa SD, Li PW, Thomas EL, Kockel L. (2010) With TOR, less is more: a key role for the conserved nutrient-sensing TOR pathway in aging. *Cell Metab* 11:453-65. PMC2885591.
3. Chen D, Thomas EL, **Kapahi P**. (2009) HIF-1 modulates dietary restriction-mediated lifespan extension via IRE-1 in *Caenorhabditis elegans*. *PLoS Genet* **5**:e1000486. PMC2676694.
4. **Kapahi P**, Zid BM, Harper T, Koslover D, Sapin V, Benzer S. (2004) Regulation of lifespan in Drosophila by modulation of genes in the TOR signaling pathway. *Curr Biol* **14**:885-90. PMC2754830.


**3. Identification of a critical role for inhibition of mRNA translation in slowing aging by mediating antagonistic pleiotropy using *C. elegans*.** The first study on this list identified for the first time that inhibition of mRNA translation extends lifespan. In the second study, we used a novel genetic screen to identify genes involved in mRNA translation and protein synthesis play a fundamental role in growth and development, but if inhibited later in life, they extend lifespan. The last two studies identify the mechanism by which inhibiting mRNA translation extends lifespan. We demonstrated that inhibition of global mRNA translation or inhibition of insulin signaling pathway paradoxically enhances mRNA translation of stress response gene expression that mediates this observed lifespan extension.


1. Pan KZ, Palter JE, Rogers AN, Olsen A, Chen D, Lithgow GJ, **Kapahi P**. (2007) Inhibition of mRNA translation extends lifespan in *Caenorhabditis elegans*. *Aging Cell.* 6(1):111-9. PMC2745345.
2. Chen D, Pan KZ, Palter JE, **Kapahi P**. (2007) Longevity determined by developmental arrest genes in *Caenorhabditis elegans*. *Aging Cell.* 6(4):525-33. PMC2746107.
3. Rogers AN, Chen D, McColl G, Czerwieniec G, Felkey K, Gibson BW, Hubbard A, Melov S, Lithgow GJ, **Kapahi P**. (2011) Life span extension via eIF4G inhibition is mediated by posttranscriptional remodeling of stress response gene expression in *C. elegans*. *Cell Metab.* 2011 Jul 6;14(1): 55-66. PMC3220185
4. McColl G, Rogers AN, Alavez S, Hubbard AE, Melov S, Link CD, Bush AI, **Kapahi P***, Lithgow GJ* (2010) Insulin-like signaling determines survival during stress via posttranscriptional mechanisms in *C. elegans*. *Cell Metab.* (** joint last authors)* 12(3)**:** 260-272 PMC2945254


**4. Modeling disease and behavioral processes.** The following studies are examples where we are modelling human diseases or biological processes in invertebrates or mice and examining their pathogenesis.


1. Tiffany Zee, Neelanjan Bose, Jarcy Zee, Jennifer N Beck, See Yang, Jaspreet Parihar, Min Yang, Sruthi Damodar, David Hall, Monique N O'Leary, Arvind Ramanathan, Roy R Gerona, David W Killilea, Thomas Chi, Jay Tischfield, Amrik Sahota, Arnold Kahn, Marshall L Stoller, **Pankaj Kapahi** (2017) "α-Lipoic acid treatment prevents cystine urolithiasis in a mouse model of cystinuria." Nat. Med., 23:3 288-290

In this study we demonstrate that lipoic acid can significantly ameliorate cystine formation in a mouse model. We demonstrate a novel mechanism of stone prevention by enhancing solubility of cystine using bot *in vitro* and *in vivo* assays.

2. Chaudhuri J, Bose N, Gong J, Hall D, Rifkind A, Bhaumik D, Peiris TH, Chamoli M, Le CH, Liu J, Lithgow GJ, Ramanathan A, Xu XZ, **Kapahi P**. A Caenorhabditis elegans Model Elucidates a Conserved Role for TRPA1-Nrf Signaling in Reactive α-Dicarbonyl Detoxification.(2016) *Curr Biol.* (16)31073-9. PMID:27773573

   In this study we demonstrate that *C. elegans* can be used to study the effects of AGE accumulations and that it leads to pathologies reminiscent of diabetic complications. We also identify TRPA1 as a sensor for MGO that activates SKN-1. A drug screen identified podocarpic acid that can activate TRPA1 and ameliorate the consequences of AGE accumulation.

3. Chi T, Kim MS, Kahn A, Flechner L, Blaschko S, Lang S, Zee T, Muteliefu G, Bond N, Kolipinski M, Fakra SC, Miller J, Killilea DW, Brückner K, **Kapahi P***, and Stoller ML*. (2015) A *Drosophila* Model Identifies a Critical Role for Zinc Physiology in Initiating Kidney Stone Disease. (2015) *PLOS One*, 10(5):e0124150 PMID: 25970330 * Joint senior authors

   In this study in collaboration with Dr. Stoller, a stone surgeon, we established a model for kidney stone disease using *D. melanogaster*. We observed that knockdown of xanthine dehydrogenase just like in humans can cause hypoxanthine accumulation and stone formation in a diet dependent manner.

4. Vargas M, Yamaguchi A, Luo N, **Kapahi P**. (2010) A role for S6 Kinase mediates post mating dietary switch and nutrient preferences in *D. melanogaster. Curr Biol.* 20(11):1006-11. PMID: 20471266 PMCID: PMC2885474.

   This study demonstrated that flies exhibit nutrient preference to sugar or protein depending on their prior physiological state. Flies deprived of protein or after mating display a strong preference towards a protein-rich diet, which is regulated by expression of S6 Kinase in the brain.

**5. Inflammation and disease**. Following our observation on TOR, we have been collaborating with the Campisi lab to examine its role in cellular senescence. In a recent study, we demonstrate for the first time that inhibition of TOR inhibits the senescence-associated secretory phenotype. We have also shown that commonly used drugs like simvastatin also inhibit the SASP. These two studies have wide relevance in explaining the protective effects of inhibiting TOR and statins on many age-related diseases. In previous studies, I defined the mechanism of NF-Kappa B inhibition and inflammation reduction by modulating Ikappa B Kinase. I identified the mechanism by which Ikappa B Kinase is inhibited via a critical cysteine residue by various inhibitors of NF-Kappa B, leading to a better understanding of how prostaglandins, arsenite, and hypoestoxide inhibit NF-Kappa B. As a research assistant I was involved in the discovery soluble forms of various adhesion molecules including ICAM-1, VCAM-1 and ELAM-1 devised sandwich ELISAs. Using these assays, which are now commercially avaiable, we observed an increase in levels of circulating adhesion molecules in many diseases like rheumatoid arthritis.

1. Simvastatin suppresses breast cancer cell proliferation induced by senescent cells. Liu S, Uppal H, Demaria M, Desprez PY, Campisi J, **Kapahi P.** 2015 *Scientific Reports* 14;5:17895 PMC4677323
2. mTOR Regulates the Tumor-Promoting Senescence-Associated Secretory Phenotype. Laberge RM, Sun Y, Orjalo AV, Patil CK, Freund A, Zhou L, Curran SC, Davalos AR, Wilson-Edell KA, Liu S, Limbad C, Demaria M, Li P, Hubbard GB, Ikeno Y, Javors M, Desprez PY, Benz CC, **Kapahi P**, Nelson PS, Campisi J. (2015) *Nature Cell Biol* 17:1049-1061. PMC4691706
3. Rossi A*, **Kapahi P***, Natoli G, Takahashi T, Chen Y, Karin M. (2000) Anti-inflammatory cyclopentenone prostaglandins are direct inhibitors of IkappaB kinase. (**joint first authors*) *Nature*. 403(6765):103-8. (**joint first authors*)

4. **Kapahi P**, Takahashi T, Natoli G, Adams SR, Chen Y, Tsien RY. (2000) Inhibition of NF-kappa B activation by arsenite through reaction with a critical cysteine in the activation loop of Ikappa B kinase. *J Biol Chem*. 275(46):36062-6

## PUBLICATIONS

1. Pandey M, Bansal S, Bar S, Kumar AY, Nicholas S Sokol NS, Tennessen JM, **Kapahi P**, Chawla G., miR-125-chinmo pathway regulates dietary restriction-dependent enhancement of lifespan in Drosophila Elife 2021 Jun 8;10:e62621. doi: 10.7554/eLife.62621 PMID: 34100717 PMCID: PMC8233039
2. Rose J, Basisty N, Zee T, Wehrfritz C, Bose N, Desprez PY, **Kapahi P**, Stoller M, Schilling B., Comprehensive Proteomic Quantification of Bladder Stone Progression in a Cystinuric Mouse Model Using Data-Independent Acquisitions bioRxiv, Preprint 2021, available under aCC-BY-NC-ND 4.0 International license
3. BA Hodge, GT Meyerhof, SD Katewa, T Lian, C Lau, S Bar, N Leung, M Li, **Kapahi P**, . Dietary restriction and clock delay eye aging to extend lifespan in D. melanogaster bioRxiv. Preprint 2021, available under aCC-BY-NC-ND 4.0 International license
4. Khanna A, Sellegounder D, Kumar J, Chamoli M, Vargas M, **Kapahi, P**, Chinta SJ, et al. Trimethylamine modulates dauer formation, neurodegeneration, and lifespan through tyra-3/daf-11 signaling in Caenorhabditis elegans. Aging Cell. 2021;20(5):e13351. PMCID:PMC8135002
5. .Laberge RM, Sun Y, Orjalo AV, Patil CK, Freund A, Zhou L, **Kapahi,P**, et al. Author Correction: MTOR regulates the pro-tumorigenic senescence-associated secretory phenotype by promoting IL1A translation. Nat Cell Biol. 2021;23(5):564-5. PMID
6. Evans DS, O'Leary MN, Murphy R, Schmidt M, Koenig K, Presley M, **Kapahi P**, al. Longitudinal Functional Study of Murine Aging: A Resource for Future Study Designs. JBMR Plus. 2021;5(3):e10466. PMCID:PMC7990142
7. Wilson KA, Beck JN, Nelson CS, Hilsabeck TA, Promislow D, Brem RB, **Kapahi P**, et al. GWAS for Lifespan and Decline in Climbing Ability in Flies upon Dietary Restriction Reveal decima as a Mediator of Insulin-like Peptide Production. Curr Biol. 2020;30(14):2749-60 e3. PMCID:PMC7375902
8. Sharma A, Akagi K, Pattavina B, Wilson KA, Nelson C, Watson M, **Kapahi P**, et al. Musashi expression in intestinal stem cells attenuates radiation-induced decline in intestinal permeability and survival in Drosophila. Sci Rep. 2020;10(1):19080. PMCID:PMC7644626
9. Jin K, Wilson KA, Beck JN, Nelson CS, Brownridge GW, 3rd, Harrison BR, **Kapahi P**, et al. Genetic and metabolomic architecture of variation in diet restriction-mediated lifespan extension in Drosophila. PLoS Genet. 2020;16(7):e1008835. PMCID:PMC7347105
10. Adams KJ, Pratt B, Bose N, Dubois LG, St John-Williams L, Perrott KM, **Kapahi P**, et al. Skyline for Small Molecules: A Unifying Software Package for Quantitative Metabolomics. J Proteome Res. 2020;19(4):1447-58. PMCID:PMC7127945
11. Rollins JA, Shaffer D, Snow SS, **Kapahi P**, Rogers AN. Dietary restriction induces posttranscriptional regulation of longevity genes. Life Sci Alliance. 2019;2(4). PMCID:PMC6600014

12. Campisi J, **Kapahi P**, Lithgow GJ, Melov S, Newman JC, Verdin E. From discoveries in ageing research to therapeutics for healthy ageing. Nature. 2019;571(7764):183-92. PMCID:PMC7205183

13. Huang K, Chen W, Zhu F, Li PW, **Kapahi P**, Bai H. RiboTag translatomic profiling of Drosophila oenocytes under aging and induced oxidative stress. BMC Genomics. 2019;20(1):50. PMCID:PMC6335716

14. Lan J, Rollins JA, Zang X, Wu D, Zou L, Wang Z, **Kapahi P**, et al. Translational Regulation of Non-autonomous Mitochondrial Stress Response Promotes Longevity. Cell Rep. 2019;28(4):1050-62 e6. PMCID:PMC6684276

15. Lang S, Hilsabeck TA, Wilson KA, Sharma A, Bose N, Brackman DJ, **Kapahi. P**, et al. A conserved role of the insulin-like signaling pathway in diet-dependent uric acid pathologies in Drosophila melanogaster. PLoS Genet. 2019;15(8):e1008318. PMCID:PMC6695094

16. Wiley CD, Liu S, Limbad C, Zawadzka AM, Beck J, Demaria M, **Kapahi P**, et al. SILAC Analysis Reveals Increased Secretion of Hemostasis-Related Factors by Senescent Cells. Cell Rep. 2019;28(13):3329-37 e5. PMCID:PMC6907691

17. Banse SA, Lucanic M, Sedore CA, Coleman-Hulbert AL, Plummer WT, Chen E, **Kapahi P**, et al. Automated lifespan determination across Caenorhabditis strains and species reveals assay-specific effects of chemical interventions. Geroscience. 2019;41(6):945-60. PMCID:PMC6925072

18. Zid BM, **Kapahi P**. Exonuclease EXD2 in mitochondrial translation. Nat Cell Biol. 2018;20(2):120-2. PMID

19. Chaudhuri J, Bains Y, Guha S, Kahn A, Hall D, Bose N, **Kapahi P**, et al. The Role of Advanced Glycation End Products in Aging and Metabolic Diseases: Bridging Association and Causality. Cell Metab. 2018;28(3):337-52. PMCID:PMC6355252

20. Akagi K, Wilson KA, Katewa SD, Ortega M, Simons J, Hilsabeck TA, **Kapahi P**, et al. Dietary restriction improves intestinal cellular fitness to enhance gut barrier function and lifespan in D. melanogaster. PLoS Genet. 2018;14(11):e1007777. PMCID:PMC6233930

21. Kim H, Calatayud C, Guha S, Fernandez-Carasa I, Berkowitz L, Carballo-Carbajal I, **Kapahi P**, et al. Correction to: The Small GTPase RAC1/CED-10 Is Essential in Maintaining Dopaminergic Neuron Function and Survival Against alpha-Synuclein-Induced Toxicity. Mol Neurobiol. 2018;55(9):7553-4. PMCID:PMC6096954

22. Kim H, Calatayud C, Guha S, Fernandez-Carasa I, Berkowitz L, Carballo-Carbajal I, **Kapahi P**, et al. The Small GTPase RAC1/CED-10 Is Essential in Maintaining Dopaminergic Neuron Function and Survival Against alpha-Synuclein-Induced Toxicity. Mol Neurobiol. 2018;55(9):7533-52. PMCID:PMC6096980

23. **Kapahi P**, Kaeberlein M, Hansen M. Dietary restriction and lifespan: Lessons from invertebrate models. Ageing Res Rev. 2017;39:3-14. PMCID:PMC5476520

24. Bose N, Zee T, **Kapahi P**, Stoller ML. Mass Spectrometry-based in vitro Assay to Identify Drugs that Influence Cystine Solubility. Bio Protoc. 2017;7(14). PMCID:PMC5580967

25. Tomiyama AJ, Milush JM, Lin J, Flynn JM, **Kapahi P**, Verdin E, et al. Long-term calorie restriction in humans is not associated with indices of delayed immunologic aging: A descriptive study. Nutr Healthy Aging. 2017;4(2):147-56. PMCID:PMC5389018

26. Zee T, Bose N, Zee J, Beck JN, Yang S, Parihar J, **Kapahi P**, et al. alpha-Lipoic acid treatment prevents cystine urolithiasis in a mouse model of cystinuria. Nat Med. 2017;23(3):288-90. PMCID:PMC5656064

27. Nelson CS, Beck JN, Wilson KA, Pilcher ER, **Kapahi P**, Brem RB. Cross-phenotype association tests uncover genes mediating nutrient response in Drosophila. BMC Genomics. 2016;17(1):867. PMCID:PMC5095962

28. Kumar J, Barhydt T, Awasthi A, Lithgow GJ, Killilea DW, **Kapahi P**. Zinc Levels Modulate Lifespan through Multiple Longevity Pathways in Caenorhabditis elegans. PLoS One. 2016;11(4):e0153513. PMCID:PMC4831763

29. Luis NM, Wang L, Ortega M, Deng H, Katewa SD, Li PW, **Kapahi P**, et al. Intestinal IRE1 Is Required for Increased Triglyceride Metabolism and Longer Lifespan under Dietary Restriction. Cell Rep. 2016;17(5):1207-16. PMCID:PMC5089850

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32. Khanna A, Kumar J, Vargas MA, Barrett L, Katewa S, Li P, **Kapahi P**, et al. A genome-wide screen of bacterial mutants that enhance dauer formation in C. elegans. Sci Rep. 2016;6:38764. PMCID:PMC5153853

33. Zhang Q, Du G, John V, **Kapahi P**, Bredesen DE. Alzheimer's Model Develops Early ADHD Syndrome. J Neurol Neurophysiol. 2015;6(6):1-6. PMCID:PMC4704098

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35. Ramaswamy K, Killilea DW, **Kapahi P**, Kahn AJ, Chi T, Stoller ML. The elementome of calcium-based urinary stones and its role in urolithiasis. Nat Rev Urol. 2015;12(10):543-57. PMCID:PMC4875766

36. Liu S, Uppal H, Demaria M, Desprez PY, Campisi J, **Kapahi P**. Simvastatin suppresses breast cancer cell proliferation induced by senescent cells. Sci Rep. 2015;5:17895. PMID

37. Killilea DW, Westropp JL, Shiraki R, Mellema M, Larsen J, Kahn AJ, **Kapahi P**, et al. Elemental Content of Calcium Oxalate Stones from a Canine Model of Urinary Stone Disease. PLoS One. 2015;10(6):e0128374. PMCID:PMC4466234

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39. Chi T, Kim MS, Lang S, Bose N, Kahn A, Flechner L, **Kapahi P**, et al. A Drosophila model identifies a critical role for zinc in mineralization for kidney stone disease. PLoS One. 2015;10(5):e0124150. PMCID:PMC4430225

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41. Katewa SD, Khanna A, **Kapahi P**. Mitobolites: the elixir of life. Cell Metab. 2014;20(1):8-9. PMCID:PMC4103626

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## REVIEWS AND CHAPTERS

1. Durai Sellegounder, Parisa Zafari, Misagh Rajabinejad, Mahdi Taghadosi**, Pankaj Kapahi** (2021) Advanced glycation end products (AGEs) and its receptor, RAGE, modulate age-dependent COVID-19 morbidity and mortality. A review and hypothesis International Immunopharmacology, 2021 page 107806

2. Ramaswamy K, Killilea DW, **Kapahi P**, Kahn AJ, Chi T, Stoller ML. (2015) The elementome of calcium-based urinary stones and its role in urolithiasis. *Nat Rev Urol.* PMID:26334088

3. SD Katewa, A Khanna, **P Kapahi**. (2014) Mitobolites: The Elixir of Life. Cell metabolism 20 (1), 8-9

4. Miller J, Chi T, **Kapahi P**, Kahn AJ, Kim MS, Hirata T, Romero MF, Dow JA, Stoller ML. (2013) Drosophila melanogaster as an emerging translational model of human nephrolithiasis. *J Urol* 190:1648-56. PMC3842186

5. Khanna A, **Kapahi P**. Rapamycin: killing two birds with one stone. (2011) *Aging* (Albany NY). 2011 Nov;3(11):1043-4. PMID: 22170738 PMCID: PMC3249449

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7. Katewa SD, **Kapahi P**. (2011) Role of TOR signaling in aging and related biological processes in *Drosophila melanogaster*. *Exp Gerontol.* 2011 May 46(5)**:** 382-390 PMID: 21130151 PMCID: PMC3058120

8. Evans DS, **Kapahi P**, Hsueh WC, Kockel L. (2011) TOR signaling never gets old: aging, longevity and TORC1 activity. *Aging Res Rev.* 2011 Apr; 10(2)**:** 225-237 PMID: 20385253 PMCID: PMC2943975

9. Giebultowicz J, **Kapahi P**. (2010) Circadian Clocks and Metabolism: The Nutrient-Sensing AKT and TOR Pathways Make the Link. *Curr Biol.* 20(14):R608-R609. PMID: 20656206
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11. **Kapahi P**. A conserved role for the TOR pathway in aging. In *Handbook on biology of aging*.
12. **Kapahi P,** Chen D, Rogers AN, Katewa SD, Li PW, Thomas EL, Kockel L. (2010) With TOR, less is more: a key role for the conserved nutrient-sensing TOR pathway in aging. *Cell Metab.* 11(6):453-65. PMID: 20519118 PMCID: PMC2885591.
13. Katewa SD, **Kapahi P**. Dietary restriction and aging. (2010) *Aging Cell.* 9(2):105-12. PMID: 20096035, PMCID: PMC2958258
14. **Kapahi P**, Vijg J. (2009) Aging--lost in translation? *N Engl J Med.* 361(27), 2669-2670. PMID: 20042759
15. Kaeberlein M, **Kapahi P**. (2009) Cell signaling. Aging is RSKy business. *Science*. 326(5949):55-6. PMID: 19797648
16. Lucanic M, **Kapahi P**. (2009) Ubiquitin ligases join the field of dietary restriction in *C. elegans*. *Aging*. (Albany NY). 1(9):751-2. PMID: 20157562, PMCID: PMC2815732.
17. Kaeberlein M, **Kapahi P**. (2009) The hypoxic response and aging. *Cell Cycle*. **8**(15):2324. PMID: 19633411
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19. **Kapahi P**, Zid B. (2004) TOR pathway: linking nutrient sensing to life span. *Sci Aging Knowledge Environ.* (36):PE34. PMID: 15356349, PMCID: PMC2754831.
20. Karin M, Takahashi T, **Kapahi P**, Delhase M, Chen Y, Makris C (2001) Oxidative stress and gene expression: the AP-1 and NF-kappaB connections. *Biofactors*. 15(2-4):87-9. PMID: 12016332
21. Kirkwood TL, **Kapahi P**, Shanley DP. (2000) Evolution, stress, and longevity. *J Anat.* 197 (4):587-90. PMID: 1197532 PMCID: PMC1468174.
22. Kirkwood TL, Adams C, Gibbons L, Hewitt CD, **Kapahi P**, Kowald A, Leeming G, Lithgow GJ, Martin K, Potten CS, Shanley DP. (1996) Cell maintenance and stress responses in aging and longevity. In *molecular gerontology research structure and strategy*. Plenum Press New York and London. Edited by Rattan SI and Toussaint O.
23. Haskard DO, **Kapahi P**, Mason JC, Wellicome SM. (1994) Leukocyte adhesion molecules in clinical medicine. In *Leukocyte Adhesion Molecules: Basic and clinical aspects*. Elsevier Science Publishers. Edited by Gahmberg CG, Mandrup Poulsen T, Wogensen Bach L and Hokfelt B.

## INVITED LECTURES

1. Columbia University, Dec., 2019
2. NIA IRP Baltimore May, 2019
3. UC Davis, April, 2018
4. University of Wisconsin, *C. elegans* Stress and Aging, June, 2018
5. Bethesda, MD, NIH Stress and Aging, July, 2018
6. University of Texas, Oct 2017
7. Hillblom Foundation Meeting, Jan 2017
8. University of Virginia, Oct 2016

9. Sanford-Burnham Institute, San Diego, August 2016
10. Mount Desert Island Biological Laboratories, Aging Course lecture, June 2016
11. American Aging Association Meeting, Seattle, June 2016
12. Joslin Diabetes Center, May 2016
13. University of Pennsylvania, Philadelphia, March 2016
14. National Institute of Immunology, New Delhi November 2015
15. The University of California, Davis, October 2015
16. The University of Michigan, Ann Arbor, September 2015
17. Calico, San Francisco, July 2015
18. NIA Aging course, Buck Institute June 2015
19. American Aging Association meeting, Marina Del Rey, May 2015
20. Yale University, Endocrine Grand Rounds. April 2015
21. The University of Texas, San Antonio, Microbiome and aging conference. October 2014
22. University of California, San Francisco, Department of Hematology. July 2013
23. Children's Hospital Oakland Research Institute. August 2013
24. Sanford-Burnham Institute. April 2013
25. NIH Bethesda, Workshop on Circadian clocks. February 2013
26. Caloric Restriction Society, San Francisco. June 2012
27. Scripps Institute, Florida. December 2012
28. CSHL, Genetics of Aging meeting. October 2012
29. Stanford University, 'Frontiers in aging seminar series'. September 2012
30. University of California, San Francisco, CVRI. April 2012
31. University of Southern California, Andrus Gerontology Center. October 2011
32. The University of California, San Francisco, Department of Urology. July 2011
33. University of California, San Francisco, Endocrine Grand Rounds. May 2011
34. University of California, San Francisco, Department of Endocrinology. December 2010
35. University of Basel, Switzerland. December 2010
36. The University of Rochester, Department of Aging. December 2010
37. Cornell University, Department of Nutrition. December 2010
38. Gerontological Society of America, New Orleans, LA. November 2010
39. Nathan Shock Aging Center 2010 Conference on Aging, San Antonio, TX. October 2010.
40. National Institute of Aging workshop, Circadian Clocks and Their Role in Aging: Molecular Mechanisms, Bethesda, MD. June 2010.
41. University of Michigan, Ann Arbor, MI, Nathan Shock: Aging and TOR Signaling Conference. May 2010.
42. Keystone Symposium on aging, Tahoe, CA. March 2010.
43. University of California, Berkeley, Nutrition department. October 2009.
44. University of California, San Francisco, Neurosciences department. October 2009.
45. Buck Institute symposium on systems biology of aging. Buck Institute for Age Research. November 2009.
46. Ellison Foundation Colloquium on the Biology of Aging, Ellison Medical Foundation. 2009; Colloquium, Woods Hole, MA. August 2009.
47. NIA Summer Training Course in Experimental Aging Research. Buck Institute for Research on Aging. June 14-18 2009.
48. American Geriatric Society Symposium, American Aging Association 38th Annual Conference, Scottsdale, AZ. May 2009.
49. IPSEN Foundation conference, Salk Institute. January 2009.
50. The National Institute on Aging IRP Distinguished Lecturer in Neuroscience and Aging (Series). Baltimore, MD. December 16, 2008.
51. Sonoma State University Lifelong Education Class "21st Century Genetics," Buck Institute for Research on Aging. November 20, 2008.

52. Keystone Symposia on Molecular and Cellular Biology, Pathways of Longevity, Copper Mountain Resort, Copper Mountain, CO. March 3 – April 4, 2008.
53. Brain Diseases and Molecular Machines: Spotlights from Evolution, Development and Network Biology, Paris, France. March 25–28, 2008
54. Cold Spring Harbor Meeting on Genetics of Aging, Cold Spring Harbor. 2008.
55. The Gerontological Society of America, 60th Annual Scientific Meeting, The Era of Global Aging: Challenges and Opportunities. November 2007.
56. Nathan Shock Center Conference on Aging, Nutrients and Aging. San Antonio, TX. October, 2006.
57. NIA Summer Training Course in Experimental Aging Research. June 2006.
58. The University of Washington, Seattle, The Basic Biology of Aging Series. June 6, 2006.
59. 47th Drosophila Meeting, 2005.
60. 44th Drosophila Meeting, 2003.
61. Cold Spring Harbor Meeting on Genetics of Aging, Cold Spring Harbor. 2002.
62. 43rd Drosophila Meeting, 2002.
63. Gordon Research Conference on Free Radicals in Disease. Ventura, CA. February 2001.
64. Gordon Conference on Biology of Aging, Ventura, CA. February 2000. (awarded the poster prize)
65. Cold Spring Harbor Meeting on Genetics of Aging, Cold Spring Harbor. April 1998
66. Gordon Conference on Biology of Aging, Italy. May, 1998.
67. 4th Biomed Conference on Molecular Gerontology, Paris. November, 1997.

## PATENTS

1.Podocarpic acid and derivatives thereof for treatment of diabetic complications (2016) (pending)
J. Chaudhuri, N Bose, P Kapahi
2.Lipoic acid and derivatives thereof for treatment of Cystinuria (2018)
*Patent #:10052305*
T Zee, M Stoller, P Kapahi
3.Modulators of Alpha-Dicarbonyl Detoxification and their use for the treatment of diabetic pathologies (2018 pending)
P. Kapahi, N. Bose, J. Chaudhuri
4.Methods for identifying and using IKK inhibitors (2008 pending)
M Karin, P Kapahi
5.Methods for identifying IKB Kinase (IKK) inhibitors (2008)
*Patent # 7399606*
M Karin, P Kapahi
6.Methods for identifying and using IKK inhibitors (2003)
*Patent # 6649654; Type: Grant*
M Karin, P Kapahi

## TRAINEES

| Training Period | Trainee Name | Current Position of Past Trainees |
|---|---|---|
| 2000-2005 | Brian Zid | Assistant Professor, UCSD (Ph.D. student) |
| 2004 –2006 | Kally Pan | Ph.D., Columbia University (Research Assistant) |
| 2005-2012 | Di Chen | Assistant Professor, Nanjing University (Postdoc) |
| 2005-06 | Atsushi Yamaguchi | Assistant Professor, Chiba U, Japan (Postdoc) |
| 2005-2011 | Aric Rogers | Assistant Professor, MDI Biological Laboratory (Postdoc) |

| Training Period | Trainee Name | Current Position of Past Trainees |
|---|---|---|
| 2006-2006 | Julia Palter | Ph.D., UCSB (Research Assistant) |
| 2007-2009 | Ursula Edman | Scientist, Biotech Industry (Postdoc) |
| 2007-2009 | Ninguang Luo | MD (Postdoc) |
| 2008-2011 | Patrick Li | Scientist, Sangamo Biosciences (Postdoc) |
| 2008-2010 | Tom McCloskey | Scientist, U California-Berkeley (Postdoc) |
| 2008-2012 | Miguel Vargas | Scientist, Biotech industry (Ph.D. student) |
| 2009-2017 | Subhash Katewa | Research Assistant Professor, Buck Institute (Postdoc) |
| 2009-2011 | Tom Chi | Assistant Professor, UCSF (Postdoc) |
| 2009-2013 | Man Su Kim | Assistant Professor, College of Pharmacy, Inje University, Gimhae, Republic of Korea (Postdoc) |
| 2009 -2014 | Timothy Camarella | Scientist, Biotech industry (Masters student) |
| 2010-present | Su Liu | Scientist Biomarin (post-doc) |
| 2011 -2013 | Nicole Naude | Clinical Laboratory Scientologist, Univ. Penn. (Masters student) |
| 2011-2015 | Matt Laye | Assistant Professor, College of Idaho (Postdoc) |
| 2011-12 | Marysia Kolipinski | Nurse Practitioner (Masters student) |
| 2011 - 2013 | Jennika Krisa | Sales Manager, Sepax Technologies (Masters student) |
| 2011-2016 | Kazutaka Akagi | Assistant Professor, National center for geriatrics and gerontology, Japan (Postdoc) |
| 2011-2013 | Nichole Bond | High school Teacher (Postdoc) |
| 2011-2016 | Guiping Du | Scientist, biotech (Postdoc) |
| 2011-2015 | Jitendra Kumar | Assistant Professor, (DBT-IPLS program) Patna University (Postdoc) |
| 2012-2014 | Sharon Epstein | Patent office lawyer, Buck Institute (Postdoc) |
| 2012-2014 | Hai Lu | Scientist, Biotech Industry (Masters student) |
| 2012-2016 | Sven Lang | Assistant Professor, Saarland University Faculty of Medicine Germany (postdoc) |
| 2012-2016 | Nuno Luis | Postdoc, Germany,(postdoc) |
| 2012-2017 | Amit Khanna | Scientist, Centrillion, (postdoc) |
| 2012- 2015 | Catherine Le | Scientist, Roche, (postdoc) |
| 2012-2015 | Gulnur Muteliefu | Scientist, Ultragenyx (Postdoc) |
| 2013-2014 | Sruthi Damodar | Scientist, Biotech Industry (Masters student) |
| 2014-2016 | Mauricio Ortega | Pharmacy student (Masters student) |
| 2014-2016 | Alex Rifkind | Started own company; law school |
| 2014- 2017 | Mark Watson | Postdoc, Brand Lab (postdoc) |
| 2015-2017 | Jesse Simons | Research associate, Ellerby lab (Masters student) |
| 2015-2017 | Sana Khateeb | Research associate, Benz lab (Masters student) |
| 2015-2017 | See Yang | Scientist, Biotech industry |

| Training Period | Trainee Name | Current Position of Past Trainees |
|---|---|---|
| 2015-present | Tanuja H. Peiris | Current Postdoc |
| 2016- 2018 | Sanjib Guha | Postdoc, Rutgers University |
| 2014-2018 | Jyotiska Chaudhari | Quality Operations, Baxter Int'l Inc. |
| 2014-2018 | Neelanjan Bose | Emery Pharma |
| 2013- 2017 | Tiffany Zee | Regeneron |
| 2012-2019 | Amit Sharma | Principal Investigator, SENS Foundtaion |
| 2012-present | Kenneth Wilson | Current Graduate student |
| 2017-present | Tyler Hilsabeck | Current Graduate student |
| 2016-2018 | Jessica Ramirez | Pharmacy school |
| 2016-2018 | Austin Lim | Research Associate, Buck Institute |
| 2016-2018 | Blaine Pattavina | Scientist, Biotech |
| 2016-present | Brian Hodge | Current postdoc |
| 2017-2019 | Geoffrey Meyerhof | Graduate student, UC Santa Barbara |
| 2018-present | Sudipta Bar | Current postdoc |
| 2018- 2020 | Lukas Fluitt | Current Graduate student |
| 2018- 2020 | Lauren Winer | Current Graduate student |
| 2018- 2020 | George Brownbridge | Current Graduate student |
| 2018-present | Kristeen Pareja | Current postdoc |
| 2019-present | Muniesh Muthaiyan Shanmugam | Current postdoc |
| 2019 | Pinky Kain | Visiting Scientist |

**Mentoring under privileged students**

In addition to mentoring scientists I am also passionate about mentoring underprivileged students to narrow the economic gap in the world. Simply learning English and life skills that we take for granted can more than doubles their income opportunities. However, these kids do not have mentors to guide them. With the support of mentors around the world we are creating a network for these students to help them realize their dreams. With the help of postdocs at the Buck I initiated a mentorship program which has now grown to over 400 mentors worldwide https://www.buckinstitute.org/news/kapahi-mentoring/.

## REFERENCES


1. Dr. Judith Campisi, Buck Institute for Aging Research.
   Jcampisi@buckinstitute.org

2. Dr. Marshall Stoller, UCSF
   Marshall.stoller@ucsf.edu

3. Dr. Anne Brunet, Stanford University.
   Abrunet1@stanford.edu

4. Dr. Gordon Lithgow, Buck Institute for Aging Research.
   Glithgow@buckinstitute.org

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