



# The PMI Times

Department of Pathology, Microbiology & Immunology  
University of South Carolina ~ School of Medicine  
The Communication Source for PMI Faculty, Staff & Students  
Department Chair: Dr. Mitzi Nagarkatti, PhD  
Editors: Dr. Angela Murphy, PhD & Nicki Holt

May - August 2020

## *P* Honors & Awards

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Congratulations to Bryan L Holloman, a doctoral student in the Nagarkatti lab, who was a recipient of the 2020 Alumni and Dean's Distinguished Service Awards announced on 8/21/2020. Bryan was awarded the Community Service Award by Dr. Les Hall, Dean UofSC School of the Medicine (SOM) at a virtual celebration held on October 8, 2020. Bryan was one of only eighteen individuals to be recognized for their contributions to the health care field and their service to the SOM at the annual Alumni and Dean's Awards Ceremony. Bryan was chosen for this award as he is a decorated Army veteran and entrepreneur, his research in the Nagarkatti lab, and his involvement in social justice initiatives and societal needs.

Michal Claire Williams, an undergraduate in the laboratory of Dr. Philip Brandon Busbee, was awarded a South Carolina Honors College SURF Grant. Her grant application proposes to investigate the role of the aryl hydrocarbon receptor in different cell types during Indole-3-Carbinol (I3C)-mediated attenuation of colitis disease severity and microbial dysbiosis.

Graduating Class of 2020 medical student John Plante was the recipient of the Stefan Mironescu Memorial Award for Excellence in Pathology, which each year is given to the graduating student who had the highest-grade average in the second year Medical Pathology course.

Graduating Class of 2020 medical student Kristen Logan attained a residency position in the Department of Pathology of Duke University Medical Center in the 2020 National Residency Matching Program (NRMP).

Dr. Ioulia Chatzistamou will serve as a Co-I for the 1R21CA252360-01 NCI/NIH grant awarded to Dr. Hexin Chen in biological sciences. The title of the two-year award is "Nanoparticle-delivered miR-489 rejuvenates anthracycline-based chemotherapy".

Dr. Ioulia Chatzistamou will serve as a Co-I on an award from the South Carolina Research Authority (SCRA) received on June 24<sup>th</sup>, 2020 (PI: Kiaris, H). The title of the award is "Further Development of CCL8 Antibodies for the treatment of cancer, COVID19 and immune related pathologies. Maturation & Prototyping Matching Grant". Period of Support: 2020-21.

Dr. Ioulia Chatzistamou is an inventor of two patents awarded to UofSC. The titles of the inventions are:  
-Anti-CCL8 Antibodies and Uses Thereof. Kiaris H, Farmaki E, Chatzistamou I, Kaza V. U.S. Patent and Trademark Office. Issued 07/28/2020 Patent no. 10,723,794,  
-Peromyscus Animal Model for Cancer. Kaza V, Farmaki E, Chatzistamou I, Kiaris H. U.S. Patent and Trademark Office. Issued 07/15/2020. Patent no. 10,709,120.

Dr. Ioulia Chatzistamou was invited to serve on the Editorial Board of the journal, Translational Oncology.

Dr. Kandy Velázquez and Dr. Brandon VanderVeen received an R43 from the National Center for Integrative and Complementary Health (NCCIH) entitled: Development of Quercetin to Treat Muscle Wasting Disorders (1R43AT011171-01). This is a 1-year grant in the amount of \$299,998.

Matthew Noneman (Velázquez Lab) was awarded a Science Undergraduate Research Fellowship (SURF) from the Honors College. The award is entitled: Characterization of spontaneous pain in colorectal cancer.

Dr. Carole Oskeritzian received an R21 grant from the NIH National Cancer Institute in the amount of \$400K on the “Development of a noninvasive, rapid and affordable method for early detection of colorectal cancer”.

Dr. Carole Oskeritzian was nominated to serve as a South Carolina Academy of Science Councilor.

Narendra P Singh, PhD, received a Laboratory Travel Award from the American Association of Immunologists (AAI) to attend the AAI Meeting in Hawaii from May 8-12, 2020 in Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Alkeiver Cannon, a graduate student from Nagarkatti lab, submitted an abstract which was selected as third place winner (\$150) of the student competition by Drug Discovery Toxicology Specialty Section at the Society of Toxicology Annual Meeting, Anaheim, CA, March 15-19, 2020. The meeting was cancelled due to COVID-19.



Congratulation to the Nagarkatti lab! The American Association of Immunologists – AAI cited their article “AhR Activation Leads to Massive Mobilization of Myeloid-Derived Suppressor Cells with Immunosuppressive Activity through Regulation of CXCR2 and MicroRNA miR-150-5p and miR-543-3p That Target Anti-Inflammatory Genes” by Neamah Wurood, Narendra Singh, Hasan Alghetaa, Osama Abdulla, Saurabh Chatterjee, Brandon Busbee, Mitzi Nagarkatti and Prakash Nagarkatti as the #12 most-read article in the Journal of Immunology in May 2020. You may view the full list of most-read article at [www.jimmunol.org/MostRead](http://www.jimmunol.org/MostRead) August 1, 2020.

Juhua Zhou, PhD received a Laboratory Travel Award (\$1500) to attend the American Association of Immunologist (AAI) meeting in Honolulu, HI, scheduled to take place on May 8-12, 2020. The meeting was cancelled due to COVID-19.

Dr. Culpepper (Nagarkatti lab) was awarded the American Association of Immunologist (AAI) Trainee Abstract Award for her abstract: Culpepper CD, Wilson MK, Nagarkatti PS, Nagarkatti, M. Epigenetic regulation of C-Kit1<sup>+</sup> FcER1a<sup>+</sup> mast cells by cannabidiol during staphylococcal enterotoxin B--induced liver injury. The meeting scheduled to take place in Honolulu, HI, on May 8-12, 2020 was cancelled due to COVID-19.

Congratulations to our newest PMI graduates completing their dissertation defenses:

- Alexander Sougiannis, Ph.D., Murphy lab
- Amira Mohammed, Ph.D., Nagakatti lab
- Rasha Abdulhamza, Ph.D., Testerman lab

Congratulations to the following students who received NIH Diversity Supplement Awards on R01 grants to Drs. Mitzi Nagarkatti, Prakash Nagarkatti and Angela Murphy:

- Alkeiver Cannon, Nagarkatti lab, - AhR Ligands in Epigenetic Dysregulation of T cells
- Bryan Holloman, Nagarkatti lab, -AhR Ligands in Epigenetic Dysregulation of T cells
- Sierra McDonald, Murphy lab, - Emodin as a chemopreventive agent for breast cancer

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## **News & Updates**

Prakash Nagarkatti, PhD, was featured in Newsweek titled: “Scientists Say Dengue Unlikely to Protect Against Coronavirus After Study Claims Link” by Kashmiri Gander on 9/23/20. <https://www.newsweek.com/scientists-dengue-coronavirus-protection-mosquitos-1533735>

USA Today featured Prakash Nagarkatti, PhD in an article titled: “Data, data and more data is what will make a coronavirus vaccine safe, says USA TODAY's vaccine panel”. USA TODAY's expert panel sees steady progress toward a safe and effective COVID vaccine, urge public's patience as trials proceed and data comes in, by Elizabeth Weise, and Karen Weintraub, 9/17/2020. <https://www.usatoday.com/in-depth/news/health/2020/09/17/covid-vaccine-update-experts-say-were-over-halfway-there-need-data/5805725002/>

Drs. Mitzi and Prakash Nagarkatti were featured by The State Newspaper, “Key cannabis chemical may help prevent colon cancer, per top USC researchers” by Lucas Daprile, Sept. 16, 2020.  
<https://www.thestate.com/news/local/education/article245772375.html>

Drs. Mitzi and Prakash Nagarkatti received recognition in EurekAlert! news release Sept 15, 2020. “University of South Carolina study reveals how cannabinoids may be useful to prevent colon cancer”.  
[https://www.eurekalert.org/pub\\_releases/2020-09/uosc-usr091520.php](https://www.eurekalert.org/pub_releases/2020-09/uosc-usr091520.php)

“When a COVID Vaccine is Developed, Will People Take It?” was the title of the NPR, South Carolina Public Radio broadcast with Tut Underwood, interviewing Dr. Prakash Nagarkatti, September 2, 2020.  
<https://www.southcarolinapublicradio.org/post/when-covid-vaccine-developed-will-people-take-it>

WCOS interviewed Dr. Prakash Nagarkatti, Sept 3, 2020. Glenn Counts from WCOS-TV spoke with Dr. Nagarkatti concerning “USC researchers think THC may be able to treat COVID-19 patients”.  
<https://www.wsocvtv.com/news/local/usc-researchers-think-thc-may-be-able-to-treat-covid-19-patients/W3YI4EMNFZEH5II3F46MHLQEZE/>

USA TODAY featured Dr. Prakash Nagarkatti along with USA TODAY’s expert panelist in the article “Experts see progress on a COVID-19 vaccine, but worry about who gets it first and how it gets to them”. Public confidence in effectiveness and delivery of COVID-19 vaccines must be established for battle against the pandemic to succeed. The article was featured 8/26/20 by Elizabeth Weise and Karen Weintraub. <https://www.usatoday.com/in-depth/news/health/2020/08/25/covid-vaccine-race-experts-steady-progress-worry-logistics-distribution/3389988001/>

Dr. Prakash Nagarkatti was featured by the State’s reporter Lucas Daprile, titled “USC researchers think THC in marijuana may be able to treat deadly COVID complication” August 28, 2020. The article discussed was published in Frontiers in Pharmacology, the British Journal of Pharmacology and the International Journal of Molecular Sciences.  
<https://www.thestate.com/news/coronavirus/article245321785.html>

South Carolina’s Premier Magazine, Columbia Metropolitan, featured Dr. Prakash Nagarkatti in the article “From Fabric to Pharmaceuticals, Hemp farming in SC” by Reba H Campbell, Aug 2020 edition.  
<https://columbiametro.com/article/from-fabric-to-pharmaceuticals/>

Newsweek Magazine featured Dr. Prakash Nagarkatti in the article “Anti-Vaxxers Could Get Boost from FDA If Coronavirus Vaccine Authorized Prematurely”, September 2, 2020 by Kashmira Gander.  
<https://www.newsweek.com/anti-vaxxers-fauci-fda-1529092>

Alzforum, networking for a cure, highlighted the publication of Drs. Mitzi and Prakash Nagarkatti in “Liver Enzyme Levitates with Exercise, Spurs Learning in Old Mice” 10 July 2020. The primary paper cited: Mondal A, Bose D, Saha P, Sarkar S, Seth R, Kimono D, Albadrani M, Nagarkatti M, Nagarkatti P, Chatterjee S. Lipocalin 2 induces neuroinflammation and blood-brain barrier dysfunction through liver-brain axis in murine model of nonalcoholic steatohepatitis. J Neuroinflammation. 2020 Jul 4;17(1):201.

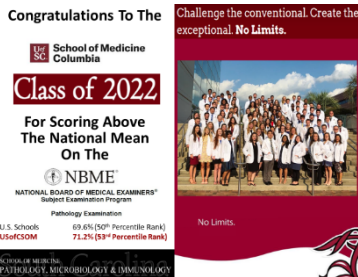
Other paper cited: Alhasson F, Das S, Seth R, Dattaroy D, Chandrashekar V, Ryan CN, Chan LS, Testerman T, Burch J, Hofseth LJ, Horner R, Nagarkatti M, Nagarkatti P, Lasley SM, Chatterjee S. Altered gut microbiome in a mouse model of Gulf War Illness causes neuroinflammation and intestinal injury via leaky gut and TLR4 activation. PLoS One. 2017;12(3):e0172914. Epub 2017 Mar 22. <https://www.alzforum.org/news/research-news/liver-enzyme-levitates-exercise-spurs-learning-old-mice>

Dr. Mitzi Nagarkatti reviewed grants for the NIH Systemic Injury by Environmental Exposure (SIEE) Study Section as a standing member from June 30 – July 1, 2020.

In June of 2020, we welcomed new Business Manager, Elizabeth Caulder who joined us from the Department of Environmental Health Sciences, located at the Arnold School of Public Health. Elizabeth brought with her over five years of experience navigating and managing the administrative procedures necessary for the successful operation of an applied research department at the University of South Carolina.

Dr. James Catroppo attended the following UofSC Center for Teaching Excellence (CTE) workshops:

- Hands-On Blackboard Collaborate Small Group Session
- Classroom Behavior in the COVID-19 Environment: A Practical Guide
- Digital Accessibility Open Forum: Ask The Experts. Committing To A More Inclusive Digital Campus
- 3D's of Virtual Course Development
  - Preparing For Virtual Instruction: What's Next
  - Virtual Teaching Best Practices
  - Deliver: Teaching a Virtual Course
  - Develop: Building a Virtual Course
  - Design: Planning a Virtual Course
- Blackboard Collaborate Ultra
- Developing Your Fall Syllabus. Part 1: Review, Revise, Realign
- Developing Your Fall Syllabus. Part 2: Planning, Particulars, Production
- Teaching Online Best Practices
- Remote Teaching: Best Practices for Improving Live Class Meetings
- Tea and Empathy
- Small Changes, High Impacts in Integrative and Experiential Learning
- Tips for Teaching an Asynchronous Online Course



Dr. James Catroppo attended the following International Association of Medical Science Educators (IAMSE) webinars:

- The Disappearing Pathology Instructor
- Partnering with Medical Students to Discover Educational Solutions for On-Line Learning
- The Future of MedEd Conferences

Dr. James Catroppo attended the International Association of Medical Science Educators (IAMSE) 24th Annual Meeting/#IAMSE20 Virtual Conference “Envisioning the Future of Health Sciences Education”.

Dr. Traci Testerman will serve as Associate Editor for the journal BMC Gastroenterology.

Dr. Traci Testerman was interviewed by WIS TV for a story entitled “How effective are masks? A simple test offers some answers” <https://www.wistv.com/2020/08/27/how-effective-are-masks-simple-test-offers-some-answers/>

Dr. Ioulia Chatzistamou was invited as a reviewer for the NIH Study Section: Rapid Investigation of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) and Coronavirus disease 2019 (COVID-19) PAR-20-177, PAR-20-178, June 30<sup>th</sup> and August 14<sup>th</sup>, 2020.

Patrice Cunningham, a Postbaccalaureate Research Education Program (PREP) Student, joined the lab of Dr. Velázquez in August 2020. Patrice's research will be investigating the role of macrophages on cancer cachexia. She is one of eight students accepted this year at USC PREP (NIH-R25).

Aman Sumal, M2 Medical Student, joined the lab of Dr. Velázquez in August 2020. Aman's research will be investigating the antinociceptive mechanism of Ojeok-san in dorsal root ganglia.

Dr. Carole Oskeritzian attended the two-part American Association for Cancer Research Virtual Annual Meeting in April 27-28 and June 22-24, 2020.

Dr. Carole Oskeritzian attended the 2020 Society of Investigative Dermatology Annual Meeting Virtual Conference in May 13-16, 2020.

Together with over 60 colleagues from around the world, Dr. Carole Oskeritzian was invited to participate in the Allergy Chat in Lockdown Virtual Meeting, organized by Dr. Toshi Kawakami, MD, PhD, La Jolla Institute for Immunology, CA, on May 18, 20 and 22, and designed to provide an international platform to exchange ideas and spark future collaborations.

Dr. Carole Oskeritzian served as a grant reviewer for the Development Research Project program of the South Carolina IDEa Network of Biomedical Research Excellence (SC INBRE) last June.

Dr. Angela Murphy served as a reviewer for NIH/NCI Transition to Independence awards on June 10<sup>th</sup> and 11<sup>th</sup>, 2020.

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## **Publications**

Alrafas HR, Busbee PB, Chitrala KN, Nagarkatti M, Nagarkatti P. Alterations in the gut microbiome and suppression of histone deacetylases by resveratrol are associated with attenuation of colonic inflammation and protection against colorectal cancer. *J Clin Med*. 2020 Jun 9;9(6):1796.

Farmaki E, Kaza V, Chatzistamou I, Kiaris H. CCL8 promotes postpartum breast cancer by recruiting M2 macrophages. *iScience*. 2020 Jun 26;23(6):101217.

Chavez B, Farmaki E, Zhang Y, Altomare D, Hao J, Soltnamohammadi E, Shtutman M, Chatzistamou I, Kiaris H. A strategy for the identification of paracrine regulators of cancer cell migration. *Clin Exp Pharmacol Physiol*. 2020 Oct;47(10):1758-1763.

--Figure of the article is featured on the cover of *CEPP*; Volume 47, October 2020

Zhang Y, Chatzistamou I, Kiaris H. Coordination of the unfolded protein response during hepatic steatosis identifies CHOP as a specific regulator of hepatocyte ballooning. *Cell Stress Chaperones*. 2020 Nov;25(6):969-978.

Milovic A, Bassam K, Shao H, Chatzistamou I, Tufts DM, Diuk-Wasser M, Barbour AG. Lactobacilli and other gastrointestinal microbiota of *Peromyscus leucopus*, reservoir host for agents of Lyme disease and other zoonoses in North America. *PLoS One*. 2020 Aug 20;15(8):e0231801.

Becker W, Alrafas HR, Wilson K, Miranda K, Culpepper C, Chatzistamou I, Cai G, Nagarkatti M, Nagarkatti PS. Activation of cannabinoid receptor 2 prevents colitis-associated colon cancer through myeloid cell de-activation upstream of IL-22 production. *iScience*. 2020 Aug 27;23(9):101504.

Samantaray S, Knaryan VH, Del Re AM, Woodward JJ, Shields DC, Azuma M, Inoue J, Ray SK, Banik NL. Cell-permeable calpain inhibitor SJA6017 provides functional protection to spinal motoneurons exposed to MPP+. *Neurotox Res*. 2020 Oct;38(3):640-649.

Alkarkoushi RR, Hui Y, Tavakoli AS, Singh U, Nagarkatti P, Nagarkatti M, Chatzistamou I, Bam M, Testerman TL. Immune and microRNA responses to *Helicobacter muridarum* infection and indole-3-carbinol during colitis. *World J Gastroenterol*. 2020 Aug 28;26(32):4763-4785.

Tashkandi H, Chaparala A, Peng S, Nagarkatti M, Nagarkatti P, Chumanevich AA, Hofseth LJ. Pharmacokinetics of Panaxynol in Mice. *J Cancer Sci Clin Ther*. 2020;4(2):133-143.

Mohammed A, Alghetaa HFK, Miranda K, Wilson K, P Singh N, Cai G, Putluri N, Nagarkatti P, Nagarkatti M.  $\Delta^9$ -Tetrahydrocannabinol prevents mortality from acute respiratory distress syndrome through the induction of apoptosis in immune cells, leading to cytokine storm suppression. *Int J Mol Sci*. 2020 Aug 28;21(17):6244.

Bose D, Mondal A, Saha P, Kimono D, Sarkar S, Seth RK, Janulewicz P, Sullivan K, Horner R, Klimas N, Nagarkatti M, Nagarkatti P, Chatterjee S. TLR antagonism by Sparstolonin B alters microbial signature and modulates gastrointestinal and neuronal inflammation in gulf war illness preclinical model. *Brain Sci*. 2020 Aug 8;10(8):532.

Atwany NZ, Hashemi SK, Jayakumar MN, Nagarkatti M, Nagarkatti P, Hassuneh MR. Induction of CD4<sup>+</sup>CD25<sup>+</sup> regulatory T cells from in vitro grown human mononuclear cells by sparteine sulfate and harpagoside. *Biology (Basel)*. 2020 Aug 6;9(8):211.

- Sarkar S, Saha P, Seth RK, Mondal A, Bose D, Kimono D, Albadrani M, Mukherjee A, Porter DE, Scott GI, Xiao S, Brooks B, Ferry J, Nagarkatti M, Nagarkatti P, Chatterjee S. Higher intestinal and circulatory lactate associated NOX2 activation leads to an ectopic fibrotic pathology following microcystin co- exposure in murine fatty liver disease. *Comp Biochem Physiol C Toxicol Pharmacol*. 2020 Dec;238:108854.
- Mohammed A, Alghetaa HK, Zhou J, Chatterjee S, Nagarkatti P, Nagarkatti M. Protective effects of  $\Delta^9$  - tetrahydrocannabinol against enterotoxin- induced acute respiratory distress syndrome are mediated by modulation of microbiota. *Br J Pharmacol*. 2020 Aug 4;177(22):5078–95.
- Yang X, Bam M, Becker W, Nagarkatti PS, Nagarkatti M. Long noncoding RNA AW112010 promotes the differentiation of inflammatory T cells by suppressing IL-10 expression through histone demethylation. *J Immunol*. 2020 Aug 15;205(4):987-993.
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- Mondal A, Bose D, Saha P, Sarkar S, Seth R, Kimono D, Albadrani M, Nagarkatti M, Nagarkatti P, Chatterjee S. Lipocalin 2 induces neuroinflammation and blood-brain barrier dysfunction through liver-brain axis in murine model of nonalcoholic steatohepatitis. *J Neuroinflammation*. 2020 Jul 4;17(1):201.
- Mohammed A, Alghetaa H, Sultan M, Singh NP, Nagarkatti P, Nagarkatti M. Administration of  $\Delta^9$ -Tetrahydrocannabinol (THC) post-staphylococcal enterotoxin B exposure protects mice from acute respiratory distress syndrome and toxicity. *Front Pharmacol*. 2020 Jun 16;11:893.
- Ginwala R, Bhavsar R, Moore P, Bernui M, Singh N, Bearoff F, Nagarkatti M, Khan ZK, Jain P. Apigenin modulates dendritic cell activities and curbs inflammation via RelB inhibition in the context of neuroinflammatory diseases. *J Neuroimmune Pharmacol*. 2020 Jun 30. Epub ahead of print.
- Chaparala A, Tashkandi H, Chumanevich AA, Witalison EE, Windust A, Cui T, Nagarkatti M, Nagarkatti P, Hofseth LJ. Molecules from American Ginseng suppress colitis through nuclear factor erythroid-2-related factor 2. *Nutrients*. 2020 Jun 21;12(6):1850.
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- Alrafas HR, Busbee PB, Chitralla KN, Nagarkatti M, Nagarkatti P. Alterations in the gut microbiome and suppression of histone deacetylases by resveratrol are associated with attenuation of colonic inflammation and protection against colorectal cancer. *J Clin Med*. 2020 Jun 9;9(6):1796.
- Wu W, Wang C, Zang H, Qi L, Azhar M, Nagarkatti M, Nagarkatti P, Cai G, Weiser-Evans MCM, Cui T. Mature vascular smooth muscle cells, but not endothelial cells, serve as the major cellular source of intimal hyperplasia in vein grafts. *Arterioscler Thromb Vasc Biol*. 2020 Aug;40(8):1870-1890.
- Rahman MA, Jui MS, Bam M, Cha Y, Luat E, Alabresm A, Nagarkatti M, Decho AW, Tang C. Facial Amphiphilicity-Induced Polymer Nanostructures for Antimicrobial Applications. *ACS Appl Mater Interfaces*. 2020 May 13;12(19):21221-21230.
- Chaparala A, Poudyal D, Tashkandi H, Witalison EE, Chumanevich AA, Hofseth JL, Nguyen I, Hardy O, Pittman DL, Wyatt MD, Windust A, Murphy EA, Nagarkatti M, Nagarkatti P, Hofseth LJ. Panaxynol, a bioactive component of American ginseng, targets macrophages and suppresses colitis in mice. *Oncotarget*. 2020 Jun 2;11(22):2026-2036.
- Tobiansky DL, Kachkovski GV, Enos RT, Schmidt KL, Murphy EA, Soma KK. Sucrose consumption negatively impacts metabolism, and alters neurosteroids and the brain of rat dams. *Journal of Endocrinology*. 2020 May;245(2):231-246.



Sougiannis AT, VanderVeen BN, Cranford TL, Enos RT, Velazquez KT, McDonald S, Bader JE, Chatzistamou I, Fan D, Murphy EA. Impact of weight loss and partial weight regain on immune cell and inflammatory markers in adipose tissue in male mice. *J Appl Physiol*. 2020 Oct 1;129(4):909-919.

Hofseth LJ, Hebert JR, Chanda A, Chen H, Love BL, Pena MM, Murphy EA, Sajish M, Berger FG. Mechanisms of Early Onset Colorectal Cancer: Early Clues and Current Views. *Nature Reviews Gastroenterology & Hepatology*. 2020 Jun;17(6):352-364.

Li Y, Hodge J, Liu Q, Wang J, Wang Y, Evans TD, Altomare D, Yao Y, Murphy EA, Razani B, Fan D. TFEB is a master regulator of tumor-associated macrophages in breast cancer. *Journal of Immunotherapy for Cancer*. 2020 Jun;8(1):e000543.

Iwanowycz S, Saaoud F, Fan D, Wang J, Wang Y, Altomare D, Liu J, Blackshear P, Shao Y, Lessner S, Murphy EA, Wang H, Yang X. Bone marrow deficiency of mRNA decaying protein Tristetraprolin increases inflammation and mitochondrial ROS but reduces hepatic lipoprotein production in LDLR knockout mice. *Redox Biology*. 2020 Jun 17;101609.

Liu Q, Hodge J, Wang J, Wang Y, Wang L, Singh U, Li Y, Yao Y, Wang D, Ai W, Nagarkatti P, Chen H, Xu P, Murphy EA, Fan D. Emodin reduces breast cancer lung metastasis by suppressing macrophage-induced breast cancer cell epithelial mesenchymal transition and cancer stem cell formation. *Theranostics*. 2020 Jul 9;10(18):8365-8381.

VanderVeen BN, Murphy EA, Carson JA. The Impact of immune cells on the skeletal muscle microenvironment during cancer cachexia. *Frontiers in Physiology*. 2020 Aug 31;11:1037.

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## **Presentations**

Khathayer F, Kathrein K, Nagarkatti M, Ray SK. Evaluation of therapeutic efficacy of 4HPR and SAHA for inhibition of human glioblastoma T98G xenografts in zebrafish. Proceedings of the 2020 Annual Meeting of the American Association for Cancer Research; Philadelphia (PA): AACR Virtual Annual Meeting II, June 22 – 24, 2020. Poster Number 6128.

Singh NP, Chandler Z, Ezeanya N, Nagarkatti P, Nagarkatti M. Resveratrol mediates regulation of genes through microRNAs in the gut epithelial cells that may play a role in the gut health and amelioration of EAE in mice. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Zhou J, Ma X, Li Y, Zhong Y, Nagarkatti P, Nagarkatti M. Functions and mechanisms of chondroitin disaccharide-induced miRNAs in the regulation of CD44 expression involved in the development of experimental autoimmune encephalomyelitis. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Culpepper, C.D., Miranda, K., Wilson, K., Nagarkatti, P.S., and Nagarkatti, M. Epigenetic regulation of C-Kit<sup>1°</sup> FcER1a+ mast cells by cannabidiol during staphylococcal enterotoxin B--induced liver injury. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. This abstract was accepted for an oral presentation. The meeting was cancelled due to COVID-19.

Sultan, M., Nagarkatti, P. and Nagarkatti, M. Anandamide impaired the pro-inflammatory T cells and promoted the induction of MDSCs and T regulatory cells in Staphylococcus Enterotoxin B (SEB)-induced acute lung injury. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Miranda, K., Culpepper, C., Wilson, K., Nagarkatti, P. S. and Nagarkatti, M. Cannabidiol alters macrophage differentiation resulting in accumulation of immunosuppressive myeloid cells and dendritic cells. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Holloman, B., Nagarkatti, P., and Nagarkatti, M. Treatment with natural AhR ligand leads to amelioration of LPS-induced acute lung injury by decreasing microRNA 29B-2-5p expression targeting increased IL-22 production. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Dopkins, N., Wilson, K., Miranda, K., Nagarkatti, P. and Nagarkatti, M. Efficacy of cannabidiol treatment in experimental MS is due to immunosuppressive activity of myeloid cells in CNS downregulating recruitment of CD4+T cells, proinflammatory chemokines and gasdermin D expression. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Abdulla, O., Nagarkatti, P. and Nagarkatti, M. Regulation of macrophages in tumor microenvironment by microRNA in T cell lymphoma-bearing mice. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.

Wilson, K., Miranda, K., Holloman, b., Kaul, M., Nagarkatti, P.S. and Nagarkatti, M. Single cell profiling illustrates down-regulation of lncRNA, GM42031 in macrophages and microglia as a potential mechanism of neuroinflammation in transgenic GFAP-gp120 mice. Annual Meeting of American Association of Immunologists (AAI) Meeting, May 8-12, 2020, Honolulu, Hawaii. The meeting was cancelled due to COVID-19.