



SESSION #2A

CHAIR: Dr. Kacey Ernst

Science, Technology and Health

Thursday, Oct. 24, 2019

1:15 – 2:45 pm

Papers:

1.) **Updating the Nuremberg Code: The Need for International Healthcare Collaborations in Artificial Intelligence and Robotics Ethics**

By Stephanie Zawada, University of Arizona and Jerzy Rozenblit, University of Arizona

2.) **Region-Based T1-Weighted MRI Morphometric Changes in High School Collision Sport Athletes**

By Pratik Kashyap, Purdue University

3.) **Building bridges: practical health-science diplomacy tools to link public groups and city decisionmakers**

By Ruth Larbey, University of the West of England

4.) **Antibacterial and antioxidant Xanthones and Benzophenones from *Garcinia smeathmannii***

By Hugues Fouotsa et al., University of Yaoundé, Cameroon

Updating the Nuremberg Code: The Need for International Healthcare Collaborations in Artificial Intelligence and Robotics Ethics

*By **Stephanie Zawada**, MS, University of Arizona; and **Jerzy Rozenblit**, PhD, University Distinguished Professor and Raymond J. Oglethorpe Endowed Chair, Department of Electrical and Computer Engineering, University of Arizona*

Abstract: The Nuremberg Code, one of the preeminent declarations of human rights, was created through the collaboration of international legal and healthcare professionals. Prior to the Code, the concept of informed consent was largely non-existent, and the rights of human research subjects varied by individual study. With the emergence of robotics and artificial intelligence (AI), ethical concerns surrounding the development of autonomous machines based on human behavior and neurocomputation have emerged. The potential for such machines to inflict harm on humans, particularly in a healthcare context, is also a concern. In the first section, modern ethical theories addressing AI and robotics in healthcare are discussed. The second section defines challenges for ensuring the development and use of ethical AI and robotics in healthcare. The third section outlines a framework, adapting the principles of the Nuremberg Code, for the ethical evaluation of AI and robotics in popular healthcare use cases. The last section includes current opportunities for international collaboration among scientists, engineers, healthcare professionals, and policymakers to promote a global framework for the design and utilization of ethical AI and robotics in healthcare.

Region-Based T1-Weighted MRI Morphometric Changes in High School Collision Sport Athletes

By *Pratik Kashyap*, PhD Candidate, School of Electrical and Computer Engineering, Purdue University

Abstract: Quantification of brain volume changes is a critical morphometric task when individuals may be at risk of longitudinal exposure to neurotrauma. We introduce a novel algorithm to characterize region-specific volume changes using existing atlases. The developed metric exhibited high sensitivity in detecting changes in athletes who experience repetitive subconcussive trauma coupled with a good replication of findings achieved with existing automated tools (e.g., SIENA-FSL). The tool also allows ready group-level comparisons for region-specific tissue volumes, allowing visualization of brain volume changes on a standard template/atlas. The algorithm's performance was assessed against SIENA-FSL on a pooled dataset of high school (ages 14-18) collision sport athletes (CSA: 19 female soccer; 38 male football) experiencing repeated subconcussive events, and age-matched non-collision sport athletes (NCA: 15 male; 14 female). CSA (soccer and football) underwent five MRI sessions keyed to onset of collision activities (Pre=before; In1=1-6 weeks; In2=5-9 weeks; Post1=15-20 weeks; Post2=26-29 weeks). NCA were imaged twice, 4-6 weeks apart, once before (Test) and once after (ReTest) training and competition onset. At each session, high-resolution anatomical imaging (1mm isotropic T1-weighted FSPGR with a 16-channel Nova Medical Inc. brain array) was performed on a General Electric 3T Signa HDx. Each anatomical scan was registered via affine and high-dimensional nonlinear transformations to the MNI152 standard space template and segmented into three tissue classes: gray matter (GM), white matter (WM) and cerebrospinal fluid (CSF). GM, WM volumes were sub-divided at each subject-session using parcellations of 278 and 20 regions-of-interest (ROIs), respectively. For both CSA genders, volumes of brain tissues (WM; GM; CSF) exhibited significant deviations during the season that largely recovered to pre-participation levels at Post2 (4-5 months post-season). Volumetric changes in brain tissues indicated a decrease in both GM and WM, with an increase in CSF. These changes varied longitudinally over the course of the continued participation in collision-based activities. All of these within-season changes are consistent with prior studies of acute dehydration, but are here observed in a more chronic form. Concern remains for the well-being of CSA given the relatively long duration of the observed changes in brain volume.

Building bridges: practical health-science diplomacy tools to link public groups and city decisionmakers

By **Ruth Larbey**, *Project Manager and Associate Lecturer, University of the West of England*

Keywords: Health, environment, cities, community-led, participatory development, policymaking

Abstract: The built environment has a large-scale impact on human health. Despite a growing interest in public involvement in health policy, a lack of evidence means it is difficult to draw firm conclusions about appropriate and effective public involvement activities that can inform healthy decisions in urban development.

This paper will explore the tensions between research-led and community-led involvement approaches. Drawing on recent experiences of running a city-wide engagement project, which included co-production, community-led development, capacity building, a web-based game and both community- and researcher-led artist collaborations, this paper will address the question: which tools serve to create the best conduits for information to flow – especially between marginalized or disadvantaged groups and city decision-makers?

Based on an associated research study working with the UK's major urban delivery agencies – landowners, developers, asset managers and local government – which quantified the real, external costs of health impacts in the urban environment, the project used the research findings to explore different scales of impact. Using results from the project's evaluation, this paper will consider practical implications for other cities wanting to implement science-policy engagements around health and the built environment, with the aim of strengthening local science diplomacy methods.

Antibacterial and antioxidant Xanthones and Benzophenones from *Garcinia smeathmannii*

By **Hugues Fouotsa**^{1,2}, **Alain Meli Lannang**^{2,3}, **Jean Paul Dzoyem**⁴, **Simplice J. N. Tatsimo**³, **Beate Neumann**², **Celine Djama Mbazoa**¹, **Andrianambinina Andriamarolahy Razakarivony**², **Augustin Ephrem Nkengfack**¹, **Jacobus N. Eloff**⁶, and **Norbert Sewald**²

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Keywords: *Garcinia smeathmannii*; Guttiferae; xanthone; benzophenone; antibacterial; antioxidant

Abstract: A new prenylated xanthone, 1,3,5,8-tetrahydroxy-2-(3-methylbut-2-enyl)-4-(3,7-dimethylocta2,6-dienyl) xanthone (**1**) and a new benzophenone (**2**), together with four known xanthenes derivatives, cheffouxanthone (**3**), smeathxanthone A (**4**), smeathxanthone B (**5**), ananixanthone (**6**), and two pentacyclic triterpenes, *epi*-friedelinol (**7**) and friedelin (**8**), were isolated from the stem bark of *Garcinia smeathmannii*. The structures of the compounds were elucidated on the basis of 1D and 2D NMR experiments and compound **2** was further characterized and confirmed by X-ray data. Compounds **1**, **2** and **3** exhibited the most prominent antibacterial activity against Gram positive *E. faecalis* with MIC values of 8 µg/mL, 8 µg/mL and 2 µg/mL, respectively, while compounds **1**, **3**, **4**, and **6** showed the capacity to scavenge free radicals.