

discussing mechanisms underlying Glutathione deficiency and validation of a novel nutritional intervention based on supplementing glycine and N-acetylcysteine (GlyNAC) to correct Glutathione deficiency in older-humans. Dr. Sekhar will present the results of a pilot 16-week randomized, placebo-controlled, double-blind clinical trial in older humans investigating the effect of supplementing GlyNAC (vs. placebo) to improve Glutathione levels and oxidative-stress in 24 older-humans and 12 young-humans on impaired mitochondrial fuel-oxidation (MFO) and other defects. The trial met its primary objective that that GlyNAC supplementation (and not placebo) significantly improved Glutathione deficiency and corrected impaired MFO (and defects in its molecular regulation), and also significantly improved gait-speed (increased 19% increase to match young-humans), muscle-strength, exercise-capacity, and lowered oxidative-stress (80%) inflammation (IL-6 83%, TNF-alpha 58%), and insulin-resistance (68%). Dr. Taffet will discuss age-induced diastolic heart failure, and the effect of supplementing GlyNAC (vs. NAC alone) in aged 24-month old mice with diastolic heart-failure, impaired myocardial MFO and cardiac-inflammation. Collectively this symposium on Glutathione and Aging will highlight the discovery that supplementing GlyNAC to correct Glutathione deficiency in older-humans has significant health benefits, and could be a novel nutritional-intervention in aging.

#### GLUTATHIONE DEFICIENCY AND OXIDATIVE STRESS IN AGING: METABOLIC MECHANISM AND TARGETED INTERVENTION

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The free-radical theory of aging suggests that age-related functional decline is mediated by increases in free-radical induced oxidative-stress. Cells normally depend on antioxidants for protection against oxidative-stress. Glutathione is the most abundant endogenous intracellular antioxidant protein composed of 3 amino-acids, cysteine, glycine and glutamic-acid, and is known to be deficient in older-humans. We investigated Glutathione kinetics in older humans using a stable-isotope tracer-based approach, and found that compared to younger humans, older-humans had severe Glutathione deficiency as a result of decreased synthesis caused by limited availability of glycine and cysteine, and associated with elevated oxidative-stress. Orally supplementing glycine and cysteine (provided as N-acetylcysteine) at doses of 1.33mmol/kg/d and 0.81mmol/kg/d respectively for 2-weeks corrected their intracellular deficiency, normalized Glutathione synthesis rates and lowered oxidative-stress to levels in younger controls. These results suggest that short-term supplementation of GlyNAC at these doses can successfully correct intracellular Glutathione deficiency in older-humans.

#### CORRECTING GLUTATHIONE DEFICIENCY AND MITOCHONDRIAL DYSFUNCTION IN OLDER HUMANS: A RANDOMIZED CLINICAL TRIAL

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Aging is associated with impaired mitochondrial fatty-acid oxidation (MFO) due to unknown mechanisms, and interventions are lacking. We hypothesized that impaired MFO in aging occurs due to Glutathione-deficiency and tested this in a randomized, placebo-controlled double-blind clinical-trial in 24 older-humans (71.1y) and 12 young-controls (25.5y) using calorimetry, muscle-biopsy and tracer-protocols. Older-humans received either GlyNAC (Glycine 1.33mmol/kg/d and N-acetylcysteine 0.83mmol/kg/d as Glutathione precursors) or isonitrogenous-placebo for 16-weeks; young-controls received GlyNAC for 2-weeks. Compared to young-controls, older humans had significantly lower Glutathione, impaired MFO, lower gait-speed and physical-function, and higher oxidative-stress, inflammation and insulin-resistance. GlyNAC supplementation in older-humans significantly improved and restored MFO; increased gait-speed (19%), and physical-function; and decreased oxidative-stress (TBARS 80%), inflammation (IL-6 83%; TNF-alpha 58%), and insulin-resistance (HOMA-IR 68%), but young-controls were unaffected. These data provide proof-of-concept that GlyNAC supplementation could improve the health of older-humans by correcting Glutathione-deficiency and mitochondrial-defects to improve gait-speed, oxidative-stress, inflammation and insulin-resistance.

#### GLUTATHIONE, INFLAMMATION, MITOCHONDRIAL FAT OXIDATION AND DIASTOLIC HEART FUNCTION IN OLD MICE

George E. Taffet,<sup>1</sup> K A. Cieslik,<sup>1</sup> R V. Sekhar,<sup>1</sup> Celia A. Pena Heredia,<sup>2</sup> Dale J. Hamilton,<sup>2</sup> and Mark L. Entman<sup>1</sup>, 1. *Baylor College of Medicine, Houston, Texas, United States*, 2. *Houston Methodist Hospital, Houston, Texas, United States*

Impaired diastolic function is a risk factor for diastolic heart failure, may limit exercise performance, and is common in aging in both people and animals. This diastolic dysfunction seems to be associated with cardiac inflammation, fibrosis and impaired mitochondrial fatty acid metabolism. Old (24-28 m) mice fed a GlyNAC supplemented diet for 8 weeks were compared to those on control diet, and had dramatic improvement in all these parameters. For example, ATP generation from fatty acids with five-fold higher in the GlyNAC supplemented mice. In vitro studies compared NAC with GlyNAC and demonstrated the benefits only with supplementing both amino acids as compared to NAC alone. These data suggest that GlyNAC may have a role in improving cardiac function thus improving exercise tolerance and quality of life for older people.

#### SESSION 2200 (SYMPOSIUM)

##### CREATIVITY IN LATER LIFE: PERSPECTIVES ON ITS FORMS AND MEANINGS

Chair: Carolyn E. Adams-Price, *Department of Psychology Mississippi State University, Starkville, Mississippi, United States*

Discussant: Danielle K. Nadorff, *Mississippi State University, Starkville, Mississippi, United States*

Over the past 15 years, gerontologists have become increasingly interested in identifying activities that increase

meaning and well-being in older adults' lives. One such activity is creative activity. New research suggests that creative activity can improve social connections, well-being and self-esteem, and sometimes cognitive processing. Yet some culturally-specific creative activities in which older people participate are not considered creative using standard psychological paradigms of creativity. This symposium will examine new perspectives on creativity in older adults with emphases on creative meaning across the life-span, and the benefits of new and long-term creative hobbies in healthy and frail older adults. Age differences in artists' perceptions of their creativity will also be discussed. The first presentation by Helen Kivnick will discuss the overall theme of vital involvement in late life from an Eriksonian perspective and its link to the benefits of creative activities. The second presentation by Kate de Medeiros will discuss the creative benefits of a poetry intervention for older adults with dementia. The third presentation by Monika Ardel will examine young and older nominated visual artists' perceptions of their own creativity and the creative process, in the context of creative careers. Finally, Carolyn Adams-Price will describe Glaveanu's sociocultural model of creativity, which can be used to explain the significance of different levels of creativity in a cultural context, from everyday creativity to genius creativity. Glaveanu's model has great promise for helping us understand the significance of various creative activities for older adults. Danielle Nadorff will be our discussant.

#### THE SOCIOCULTURAL MODEL OF CREATIVITY: HOW IT CAN EXPLAIN THE SIGNIFICANCE OF MULTIPLE FORMS OF LATE-LIFE CREATIVITY

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Creativity in later life comes in many forms, ranging from everyday creativity to genius-level creativity, and including both newly learned creative activities and life-long creative hobbies. Previous psychosocial models of creativity have had limited utility in explaining the significance of late life creativity. Glaveanu's sociocultural model has not been previously applied to older adults, but its inclusiveness makes it supremely useful for describing the range of creative activities and products in context. Creativity, according to Glaveanu, involves five interconnected components: actors, actions, artifacts, audiences, and affordances, which can be used to describe many different points along continuum of creative activities. The sociocultural model recognizes the value of different levels of creativity, including culturally-specific crafts, practice and learning new skills, the role of large and small audiences for creativity, and the connection of creativity and community. Glaveanu's model will be discussed in the context of Erikson's theory of late life development.

#### VITAL INVOLVEMENT: LINKING CREATIVITY TO LATER-LIFE WELL-BEING

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Erikson's principle of Vital Involvement (VI) holds that psychosocial health in older adulthood rests on elders' meaningful, reciprocal engagement with the world outside the self. Older adulthood's focal tension between Integrity

and Despair is fundamentally grounded in elders' "...vital involvement, with life's people, materials, activities, ideas, institutions, and so forth. [This engagement is] ... every bit as important as ...[the] reminiscence" (Kivnick & Wells, 2014) we have long identified as a path to wisdom. Through several empirical projects, our team has identified five dimensions of VI in older adulthood. Each is clearly invoked as an elder engages such arts media as clay, paint, paper, fiber, wood, words, music, movement, and more. These VI dimensions are also invoked in an elder's creative engagement with the people, materials, activities, and institutions of everyday life. This presentation illustrates ways that VI, through these dimensions, both facilitates and also expresses psychosocial well-being in older adults.

#### CREATIVITY, HOPE, AND EXPECTATION IN A POETRY PROGRAM: RETHINKING WHAT COUNTS AS SUCCESS IN DEMENTIA CARE

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Creativity offers liberation from the framework of decline in later life in general, and within the context of dementia specifically. Cohen described the synergy of hope and expectation as ways through which people access their creative potential, especially in the face of loss. This paper explores three case drawn from a qualitative study. Eight residents living in a secure dementia care facility participated in six 30-minute interactive poetry sessions using guidelines from the Alzheimer's Poetry Project (APP). Observations were conducted at baseline, during the intervention, and one week afterwards. All sessions were audio recorded, transcribed and analysed. Important findings included the positive potential of imagined futures, creative engagement as a tool for building social bonds, and the importance of language play. Overall, these findings point to new ways to consider success in dementia interventions by focusing on the potential to create meaningful and creative engagement opportunities.

#### DOES AGE AFFECT CREATIVE PROCESS AND STYLE? A COMPARISON OF OLDER AND YOUNGER VISUAL ARTISTS

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This study investigated differences in the creative process and style between 85 older (age 60-89 years, M=72.39) and 63 younger (age 27-58 years, M=41.95) visual artists who were nominated as artistically creative exemplars. Answers to open-ended survey questions were coded and compared by age group. Results of t-tests showed that the described creative process and style were similar for older and younger artists, with many being inspired by their environment or ideas and engaging in an intuitive and visual style. However, younger artists were more likely than older artists to be inspired by ideas, words, life, and the work process and to use an intuitive, expressionistic, eclectic, spiritual, and textured style. Interestingly, younger artists were more likely to believe that older artists have greater artistic experience, maturity, willingness to take risks, and understanding of the art world, whereas older artists tended to think that young artists are more original.