CHEM-4703(3) ñTopics in Chemistryò

COURSE DESCRIPTION

Title: **E 9AE 9 C 9C9 D 9C C**

[This course addresses ñUNIQUE CHEMICAL SPECIES as commonalities in health, pathogenesis of neurodegenerative and other degenerative, chronic and infectious diseases (including COVID-19), oxidative stress, inflammation, chemical toxicity, cancers, host-pathogen interactions, and therapy and immunology. It seeks to explain the rationale for consumption of fresh foods and vegetables for optimal healthò]

Instructor: Dr. Michael O. Eze

Rationale:

There exists a dire need to approach research on neurodegenerative, and other degenerative, chronic and infectious, diseases (including COVID-19), inflammation, cancer, chemical toxicity, and host-pathogen interactions in much more incisive ways. This calls for the design of courses incorporating novel approaches that would target specific aspects of these health conditions from interdisciplinary vantage points. Thus, traditional thinking should be blended with more radical approaches. For instance, the student deserves a deeper insight into the chemistry and pathophysiological implications of free radicals, reactive oxygen species (ROS), and nitric oxide (NO) as these rather unique chemical species are involved in pathogenesis, etiology and therapy (immunotherapy and chemotherapy) of cancers, and other diseases, as well as in vaccinology. At rather low levels, ROS and NO play subtle but vital regulatory roles in gene expression, cardiovascular and neuronal events for instance. They also play critical roles in cellular oxidative stress, pathogenesis of aging, and many other degenerative and chronic diseases including Alzheimer's, Lou Gehrig's (Amyotrophic lateral sclerosis, ALS), Huntington's and Parkinson's diseases, Multiple sclerosis, Cataracts, and complications of Diabetes, etc. The special and confounding pathology of COVID-19 involves hyper-inflammation, the cytokine storm, oxidative stress and other associated/allied phenomena.

The other relevant species are 1) potentially reactive chemical intermediates like Michael reaction acceptors, and cellular Maillard reaction products. 2) advanced glycation end products (AGEs). 3) sphingomyelinases and ceramide. This course, therefore, arms the students with the proper contexts (apart from traditional immunological concepts, for instance) within which to base interpretations of results of appropriately designed experiments. **The rationale for consumption of fresh foods and vegetables for optimal health is implicated.**

Texts & Resources:

pathogens: HIV/AIDS and other viral pathogens (including corona viruses); *Plasmodium* spp., *Leishmania, Brucella, Mycobacteria*, etc]. Detoxification mechanisms (Induction of phase 2 enzymes). The special and confounding pathology of COVID-19 (and other coronavirus infections): hyper-inflammation, the cytokine storm, oxidative stress and other associated/allied phenomena; potential remediation strategies.

Antioxidants and Nutraceuticals (Health foods and eating healthy; e.g., sulforaphane and others).

Therapeutic and host toxicity mechanisms of antimalarials.
Immunogenicity/vaccinology [Receptor-ligation → Signal Transduction (ROS, NO, guanylate cyclase)]

Toxicity Perspectives and Disease: Cancer (Mechanisms of carcinogenesis); Pathogenesis of aging, and other degenerative diseases studied to date, including, Alzheimer's, Lou Gehrig's (ALS), Huntington's and Parkinson's diseases, Multiple Sclerosis, Cataracts, and complications of Diabetes, and others.

Thiol antagonists as Fatty acid synthesis inhibitors, and potential sources of candidates for broad spectrum antibiotics against bacteria and apicomplexan protozoan pathogens;

Protein disulfide isomerase in health and disease;

Advanced Glycation End Products (AGEs): sources and potential implications

Sphingomyelinases, Sphingolipids and ceramide in health and disease.

Weeks 10 ï 11: Specific issues arising from the literature: critical review, and interpretation of research findings in recent relevant publications.

[***NOTE: Because very numerous issues are involved, the main topics to be treated will be selected in class [by the students and the Instructor] on first day of lectures to satisfy the special interests, desires and aspirations of the students enrolled in the course. Items are covered to the extent that time permits***].

Research Paper:

Consistent with the intent to sharpen the student's inquisitive mind, each student writes **one major** research paper (due week 9 of the course). This paper is on a topical issue within the theme. The student chooses a topic, and gets it approved by the Instructor, **before proceeding** to write.

Grading:

Mid-Term Test (*Based on material covered in lectures*):	**25%**
One major Research Paper on a relevant topical issue within the general theme:	**40%**
Final Exam (*Based on material covered in lectures*):	**35%**
	100%

If a student does better on the final exam than on the midterm test, the midterm test will be worth 12.5% (not 25%) of the final grade, and the final exam will be worth an extra 12.5% of the final grade.

NOTE: Even though this is a 4000-level course (3-credits), it will accept students at any other level who have the relevant background (Permission of the Instructor). It may be taken by graduate students; in which case greater emphasis is placed on mechanistic aspects of reactions, as well as on the depth and breadth of the research paper.

Prerequisites: CHEM-3502(3) or -