

## Applications for the E.A.Dickson Emeriti Professorship Award 2020-2021

	Last name	First name	e-mail	Title of Proposal	Budget Requested	Notes	Result
1	Joseph	Suad	<a href="mailto:sjoseph@ucdavis.edu">sjoseph@ucdavis.edu</a>	Gendered and Cultural Framework for Refugee Mental Health: the Arab Crisis	\$ 20,000		
2	Rucker	Robert	<a href="mailto:rbrucker@ucdavis.edu">rbrucker@ucdavis.edu</a>	Pyrrroloquinoline quinone: Additional studies related to its physiological importance	\$5,000 to 7,500.00		
3							
4							
5							
6							
					\$ 27,500		



**Title: GENDERED AND CULTURAL FRAMEWORK FOR REFUGEE MENTAL HEALTH: THE ARAB CRISIS**

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**Submitted to:**

**Edward A. Dickson Emeriti Professorship Award 2020-2021**

**Abstract**

This project develops a gendered and cultural conceptual framework for assessing the mental health of Arab (Arab-GCCF) and other vulnerable populations (refugees, displaced persons) in Lebanon, West Bank/Palestine, and Egypt to reduce mental health disparities. Research on mental health assessment in the Arab Region has focused largely on the application of standard Western diagnostic tools and has ignored the gendered hierarchies inscribed in local patriarchal structures, the local notions of personhood nested in family and community, and the histories of rapid economic/political transformations, social upheaval, wars, displacement, and violence which have up-ended whole nations. This study will develop the Arab GCCF for mental health assessments of refugees and vulnerable populations exposed to violence. We will work with colleagues from University of Davis Arab Region Consortium (UCDAR) and engage scholars, students and the wider community of UC Davis through workshops, seminars, webinars, and webpage. We will use the development of this framework to apply to NIH and other agencies to test the framework in Lebanon, West Bank/Palestine, and Egypt. The project could set a template for gendered and cultural conceptual frameworks to be developed for other regions of the world, including among refugees, vulnerable and minority populations of the United States.

**Introduction:**

The Arab GCCF study hypothesizes that Arab vulnerable populations who have a great need for psychosocial care as a result of war traumas and mental distress may be more open to engage in service utilization if assessments and interventions are gendered and culturally adapted. If these assumptions are confirmed, gendered and culturally adapted mental assessments and interventions could be considered a promising strategy for reducing mental health disparity rates for vulnerable refugees in other regions of the world. The Carnegie Endowment reports that "Of the 60 million displaced persons worldwide, close to 40 percent originate from the Arab region, mainly Syria and Palestine" (Carnegie 2018).

The Syrian civil war, one of the worst humanitarian crises since the Second World War, has affected millions of people in Syria and neighboring countries in the Arab Region and displaced millions internally and externally. The war on Iraq from 2003 to the present has created additional millions of refugees and displaced persons. The civil war in Libya disrupted another Arab nation, displacing its people. The protests in Sudan over the decade leading to the creation of two separate states have expanded the refugee and displaced populations of neighboring countries. Palestinian refugees have been displaced numerous times, in their own country as well as from Syria and Lebanon. Lebanon is hosting over one million registered Syrian refugees equaling over one fourth of its population. This is in addition to Palestinian refugees from the 1948 Arab-Israeli war, estimated to be around half a million people (Chaaban et al, 2010) and in addition to Iraqi refugees in Lebanon. The occupied Palestinian territory continues to suffer the consequences of occupation with about 30% of the population of 2.8 million having become refugees of the 1948 and 1967 Arab Israeli wars. (BADIL Resource Center, 2015). The conditions are much worse in the Gaza Strip. Egypt, a country under the Regional Refugee and Resilience Plan (3RP, 2018) a coordination effort between countries neighboring Syria (Jordan, Lebanon, Turkey, and Iraq), Egypt, and UN agencies, including UNHCR, has become another destination for Syrian refugees since 2012. Covering an area of 5.25 million square miles the Arab Region is home to 423 million Arabs living in 22 countries. This region has one of the world's highest growth rates not only at home but also in United States, Canada, Australia, France, United Kingdom, and a number of other host countries. The consequences of many years of wars, armed conflicts, occupation, persecution, suppression, and human rights violations in Iraq, Lebanon, Palestine, Libya, Yemen, and Syria have resulted in skyrocketing rates of mental problems, and deficiencies in mental health services.

When designing and implementing mental health interventions and utilizing mental health concepts and theories and when attempting to redefining conceptual framework for mental health and illness, we cannot ignore the region's sociocultural, religious, and political contexts. Informed by notions of Cartesian dualism of body and mind, positivism, and reductionism, much of the theory and practice of mental health,

including psychiatry and mainstream psychology, have emerged from a Western cultural value-orientation and a Western understanding of the human condition. While such monocultural conceptual framework for mental health have informed adequate tools to alleviate mental distress in the West, it has also proven to be very challenging when applied in the context of non-Western cultures. Tribe (2005, p. 8) has already pointed out that Western cultural approaches to mental health tend to be “predicated on a model that focuses on individual intrapsychic experience or individual pathology, while other traditions may be based more on community or family processes.” Consequently, while a substantial amount of research on the consequences of refugee traumas on mental health is available, most of this research has focused on the individual rather than the community, and on a culturally inappropriate notion of gender (Gopalkrishnan, N., 2018). Collective trauma has broader meanings that are reflected in social processes, and understanding these is essential to make accurate clinical formulations and to intervene effectively (Kirmayer 2007). Arabs whose lives have been diminished and damaged by military or political violence on a large social scale often do not see themselves as mentally ill individually. In such traumatic contexts medicalization would effectively depoliticize and delegitimize people’s suffering, reduce them from victims to patients, and, as a result, negatively affect their agency and capacity to cope with trauma. Even worse, this may in fact blunt the demand for change and even stifle individual and community recovery. The medicalization of Arab social suffering carries the risk of ignoring and marginalizing the socio, political, and economic contexts of the problem. If suffering is seen as an individual phenomenon, then individualized medical interventions will follow as logically consistent responses to individual “symptoms”. By over focusing all effort on “diagnosing” the “patient”, and finding medical solutions, well intended but uninformed providers may not only miss the underlying causes of distress but even violate the first Hippocratic tenet: *primum non nocere*. A reflexive use in the Arab Region of Western diagnostic instruments and scales without incorporating culturally and gender-congruent social representations, norms, and local idioms of distress may result in what Kleinman has described as “category fallacy” (Nichter, 1981). Ignoring professional and cultural biases and trying to explain suffering in entirely psychiatric terms is a reductionist and sanitized view of terrible human adversities; therefore incorporating social, political, cultural and gender factors as important dimensions in formulating and understanding mental distress is not only a medical but also a social and moral imperative. Most of the research focuses on disorders, the end stage of the continuum from ease to disease (Canetti et al, 2010; Alpak et al 2015; Kazour et al, 2017). However along the mental continuum, suffering can progress to its end stage, disease. The aim of this project is to prevent this from happening using a public health approach to addressing the traumas of wars and conflicts, and if it does to address it properly through a gendered and culturally appropriate framework.

More problematically, the diagnoses of such disorders, for example PTSD and depression, are derived from the Diagnostic Statistical Manual (DSM). The DSM was developed by the U.S.A Veteran Administration to meet the reimbursement coding requirements of insurance companies for traumatized Vietnam veterans. Through five subsequent iterations by the American Psychiatric Association and American Psychological Association jointly, it became an unquestioned bible of mental disorders. Despite efforts to address cultural appropriateness the fundamental paradigm of DSM 5 remains a reductionist Newtonian biomedical paradigm based on Western notions of the individual, gender, and mental health. This project raises questions concerning the cultural appropriateness and transferability of the DSM to the Arab regional (and other) contexts especially that increasingly, there is a recognition that mental health symptoms can vary in different contexts and cultures, and even in the same culture given a changed context (Pedersen, 2002; Kohrt and Hruschka, 2010; Yeomans and Forman, 2009).

A Western medicalization of war trauma may result in stigmatization, a damaging consequence most Arabs will try hard to avoid. Arabs have a shared set of values, beliefs, and traditions that are in key ways different from those of Westerners. According to Fakhr El-Islam’s (2008) review of literature on the influence of Arab culture on mental illness, Arab cultural beliefs and practices can be decisive in shaping Arabs’ perceptions and management of psychiatric disorders. The stigma attached to mental illness is one of the main factors that negatively influences Arab persons with mental illness accessing mental health services (Gearing et al., 2014). Addressing the stigma of mental illness is of special importance in the Arab region, where formal mental health resources are scarce and people with mental illness experience the compounded disadvantages of poverty and illness stigma (Al-Krenawi, 2005). In Arabic “stigma” is derived from the word ‘*Alwasm*’, which means the process of attaching signs to things or places so they can be easily identified – though the term, at times, has locally different interpretations (Dardas, LA, Simmons, LA, 2005). This sociological concept attributes social disgrace and shame to people due to their socially contravening behaviors. Arab patients often somatize their mental distress to avoid the social stigma (Al-Krenawi, 2005). Given that accessing mental health services is a critical step towards reducing the burden of mental illness, considering stigma as one of the factors that may disrupt seeking mental health care in Arab communities is an important goal for healthcare providers and policymakers. However, most of the approaches to mental health assessments and interventions

were originally developed and adapted for Western populations. Since what may be considered acceptable in one society may be considered unacceptable and open to stigmatization in other societies, an attempt to apply a Western conceptual framework for mental health and illness poses a particular risk in the Arab region.

If the frameworks used to assess and treat mental health problems do not take in consideration variations in how various cultures understand their realities, including the use of particular concepts/ words, and if the wrong concepts are used, the validity of measurements and practices becomes questionable (Lewis-Fernández, R., & Kirmayer, L. J., 2019). The risk therefore lies in a social disapproval of individual characteristics, beliefs, or behaviors that are against sociocultural norms (Lauber & Rossler, 2007). As the social shame associated with a family member's psychiatric diagnosis extends to the entire family (El-Islam, 2008), associative stigma (Major & O'Brien 2005), a social stigma by being in a relationship with someone who has mental illness, is unfortunately common in Arab countries. This associative stigma is itself a manifestation that, in the Arab region, the person is always understood in their familial and community contexts. Kadri et al. (2004) found that 86.7% of family members reported psychological suffering and poor quality of life due to the presence of a member with mental illness. Arab families would tend to discuss such sensitive issues within the family rather than involving outsiders, including psychiatrists or psychotherapists. As a result, Arab patients who face social stigma often experience a complicated mental illness trajectory and are at risk for poor quality of life, social isolation, low self-esteem, and little confidence in future success (Azar & Kurdahi Badr 2006, Endrawes et al. 2007). This project hypothesizes that an Arab Gendered and Cultural Conceptual Framework for mental health assessments is a necessary logical and destigmatizing first step for the Arab Region in establishing effective and accessible psychiatric services and developing mental health policies that encourage both those who experience mental illnesses and the community to accept psychiatric diagnoses and treatments.

The research team is well positioned to carry the proposed project, as it will build on a solid foundation of twenty years of inter-institutional collaboration. The UC Davis Arab Region (UCDAR) Consortium is a partnership between UC Davis and five international universities in the Arab region: American University of Beirut, the American University in Cairo, the American University of Sharjah, Birzeit University, and Lebanese American University. The Consortium was founded in 2001 and is chaired by its founder Dr. Suad Joseph, Distinguished Research Professor of Anthropology and Gender, Sexuality & Women's Studies, at UC Davis. Dr. Suad Joseph is the PI of this application (<http://sjoseph.ucdavis.edu/ucdar>).

## **Background on Mental Health in Lebanon**

Mental health has been a growing public health concern in Lebanon. Nearly 4.6% of the Lebanese have experienced a severe mental disorder; around 25.8% meet the criteria for at least one mental disorder and 10.5% experience more than one disorder in their lifetime (Karam EG, Mneimneh ZN, Dimassi H, et al., 2018). The most prevalent disorder is depression, followed by anxiety and mood disorders. Professional treatment is sought by only a small number of individuals who experience any type of mental disorder, with a substantial delay in treatment-seeking behavior ranging from 6 years to 28 years after onset of the disorder (Karam EG, Mneimneh ZN, Dimassi H, et al, 2008). The main barrier is the taboo nature of mental health problems (Karam EG, Mneimneh ZN, Dimassi H, et al., 2018). Moreover, 70% of the Lebanese population have been exposed to war events, with a cumulative effect due to the continuous political unrest and intermittent conflicts in the country (Farhood L, Dimassi H, Strauss NL., 2013). Lebanon has been experiencing the effects of the humanitarian crisis resulting from the war in Syria. As of 2018, the country hosts 1.5 million Syrians who fled the war in neighboring Syria (including 950,334 registered as refugees with UNHCR), along with 28,800 Palestinian refugees from Syria and a preexisting 180,000 Palestinian refugees from Lebanon, all living in 156 gatherings and 12 camps (Government of Lebanon and the United Nations, 2017). This influx has overstretched public services and exacerbated social tensions in areas with a high density of vulnerable Lebanese. While 2.5% of displaced Syrians reported needing mental healthcare in the last six months, 62% did not receive such care (World Food Programme, UN Children's Fund, UN High Commissioner for Refugees, 2018). One of the main reasons for the lack of access was that mental health remained much stigmatized in Syrian and Lebanese communities alike (World Food Programme, UN Children's Fund, UN High Commissioner for Refugees, 2017).

## **Background on Mental Health in West Bank/Palestine**

Palestinians have lived through conflict and have been exposed to violence for decades, with the conflict intensifying during the First and Second Intifada's (1987-1991; 2000-2004) and the Israeli attacks on Gaza (2008-2009; 2012, 2014), among other exposures to violence. Such exposures have become a major cause of social suffering and general ill-health, including poor mental health outcomes, for civilians. Studies found that the prevalence of anxiety and depression in the Palestinian Territories are high and that such mental health problems impair the populations' current social functioning and wellbeing (Fassin & Rechtman, 2009; Giacaman, Husseini, Gordon, & Awartani, 2004). Among adolescents a study found that after the Second Intifada approximately 76.5%

of the injured victims qualified as suffering PTSD like symptoms and that the problem had a heterogeneous course, with excess risk for chronic symptoms and comorbidity with other psychiatric disorders such as anxiety and depression. Among all the predictors in the PTSD like group, anxiety and depression models, only geographical location, fatalism, and negative coping were significant predictors (Khamis, 2008). Other studies demonstrated the impact of humiliation on youth living in the West Bank (Giacaman, Abu-Rmeileh, Hussein, Saab, & Boyce, 2007); and quality of life, human insecurity and distress among Palestinian youth in the Gaza Strip (Hammoudeh, Hogan, & Giacaman, 2013). The results also demonstrate that the average quality of life of Palestinian youth on the WHO physical, psychological, and environmental domains is low (among the lowest of any population in the world); that exposure to violence, trauma, and insecurity is significantly associated with increased subjective health complaints; that there are gender differences in exposure and outcomes as girls have higher prevalence of depressive like symptoms; and that youth living in refugee camps have higher depressive like symptoms compared to those living in cities or villages.

## **Background on Mental Health in Egypt**

In just the first two years following the 2011 Egyptian revolution, 4,648 people lost their lives to acts of political violence – likely an underestimate given that this number includes only officially documented deaths by the Egyptian Ministry of the Interior (Tadros, 2014). Beyond this, there have been dramatic increases in other types of violence, including an almost 900% increase in armed robberies from 2010 (prior to the revolution) to 2012 (Tadros, 2014). In a population survey, 61.5% of respondents reported that they had experienced violence since January 2011, including political violence, religiously motivated violence, sexual assaults, or theft/attack (Tadros, 2014). In addition to the experience of direct and witnessed forms of violence, many Egyptians experience ongoing fears and uncertainties that have affected the social and political landscape, increasing polarization and restricting the exchange of information across sociopolitical perspectives (Lynch, Freelon, & Aday, 2017). Egyptian youth and young adults were highly involved in the Arab Spring protests (Haas & Lesch, 2012), and Cairenes, not surprisingly report the highest rates of exposure to political violence (Papanikolaou, et al., 2013; Tadros, 2014). Although relatively little data on the mental health effects of the violence in post-revolution Egypt are available, it is evident from psychological research in other contexts that chronic exposure to violence dramatically increases risk for general psychological distress, as well as specific mental health problems, such as anxiety, depression, and posttraumatic stress (Breire & Spizzanola, 2005; Cannetti, et al., 2017; Cummings, Merrilees, Taylor & Mond, 2017). In one post-revolution study of Egyptian adolescents, 69% reported symptoms of anxiety, 82.9% reported subsyndromal symptoms of PTSD (16.3% meeting full diagnostic criteria), and 33.3% qualifying for a diagnosis of major depressive disorder (Rabie, et al., 2015).

## **A Gendered and Cultural Conceptual Framework**

To what extent are war traumas defined as disease in the Arab Region? We hypothesize that defining war traumas as disease, pathologizes a natural consequence of war, suffering, and invests treatment of traumatized persons primarily through medications and therapies (Horwitz and Wakefield, 2007). We suggest socio-political causes of trauma require socio-political, rather than biomedical, resolutions. Those who have suffered trauma as a result of wars have lost country, culture, language, identity, employment, property, relationships, family, social capital – and they have lost them violently. These losses can create profound suffering. That suffering is a normal and legitimate human response to extreme duress. It is a robbing of a person's dignity to pathologize and medicalize their suffering (Koga & Pirzada, 2015); it is a violation of their humanity. Moreover, a Western medicalization of war trauma may result in stigmatization, a damaging consequence most Arabs will shun. We propose to develop a culturally appropriate model to evaluate trauma in situations of war and conflict.

To what extent is the Western notion of the individual used in defining mental health in the Arab region? Critical research documents that the notion of the individual is historically and culturally based on Western frameworks. In reviewing the wide range of kinship forms that are culturally known, anthropologist Marshall Sahlins (2013) defines kinship as “mutuality of being” suggesting that kin are “people who are intrinsic to one another's existence – thus ‘mutual person(s)’, ‘life itself’, ‘intersubjective belonging’, ‘transbodily beings’, and the like” (Sahlins, 2013, p. 2). He also points out the distinction that has been made in anthropology between “the individual”—a Western construct relating to unitary social identity and the autonomous self—and the “dividual,” a term applicable to partible and recombinable formations of the person in interpersonal or intergenerational relationship. Transporting the classical Western notion of the individual embedded in psychodynamic frameworks to non-Western societies presents problems for diagnostic and therapeutic practices. “Personhood” in the Arab region is informed by a relational notion of selfhood, a self that is situated in the context of family and community (Joseph 1999). Based on extensive literature reviews and empirical research, we hypothesize that a culturally appropriate epistemological concept of personhood may better inform culturally congruent frameworks for diagnosis and treatment (Joseph 2018).

To what extent does the Western notion of gender underlie the diagnostic and treatment frameworks used in the Arab region? While much of the literature on refugee mental health focuses on women, our research indicates that both men and women suffer the effects of war. Men can suffer the traumas of war as much or more than women (Giacaman et al, 2007) do — something that we call the paradoxical protective effects of patriarchy. Patriarchy in the Arab region is gender and age hierarchical, organized around kinship and based on a relational notion of self (Joseph, S. 1994). We hypothesize that men or women declare as health issues and responses to them are highly gendered phenomenon. Idioms of distress, health-seeking behaviors, receiving mental and psychological help are highly gendered and socially normed in the Arab region. Gender is socially normed in health behavior. This proposal will bring a gendered and culturally appropriate framework to develop diagnoses and increase acceptability of health treatments.

### **Method**

**Aim:** Develop an Arab gendered and cultural conceptual framework for mental health assessments of war refugees and other vulnerable populations exposed to violence.

The current biomedical framework for health suggests that health and disease are on a single continuum with health at one end and problems/disease on the other. In this view, the absence of health problems is synonymous with good health and poor health is not distinct from higher levels of health problems. However, this single continuum model of mental health and mental disease is inconsistent with the WHO definition of health, which states that health is more than the absence of disease. Keyes (Keyes, C.L., 1988) argues that it is important to also study the optimal social functioning of individuals in terms of their social engagement and societal embeddedness. Keyes' dual continua model (Westerhof, G. J., & Keyes, C. L., 2010) indicates that social well-being consists of five dimensions describing a person who is functioning optimally in society: (1) social coherence: being able to make meaning of what is happening in society; (2) social acceptance: a positive attitude toward others while acknowledging their difficulties; (3) social actualization: the belief that the community has potential and can evolve positively; (4) social contribution: the feeling that one's activities contribute to and are valued by society; and (5) social integration: a sense of belonging to a community. A dual continua model in which a mental health continuum and a mental disease continuum are viewed as coexisting and independent from each other is consistent with what is often seen in practice—someone with a mental problem/disease can still have a high level of positive mental health. For example, someone with a diagnosable mental disorder like depression or PTSD may still range broadly from high to low levels of emotional, psychological, or social wellbeing. This represents a way of thinking about the relationship between mental health problems and positive mental health that is more consistent with the complexity of functioning actually observed in people. There is abundant literature on logical guidelines for qualitatively deriving theories from text and data (Harris, 2003; Miles & Huberman, 1994; Leech & Onwuegbuzie, 2007; Myers, 2009), and on qualitative tools for investigating these complex phenomena of transcultural mental health. However, in the multidisciplinary literature there is a paucity of studies looking into qualitative systematic methods for building conceptual frameworks. At times, multidisciplinary phenomena are presented without even a scaffold of characteristics identified from previous inquiry that provide an internal structure and a starting point for observations, interview questions, further development building on structures or categories, and for analysis. We posit that such is the case with the current Western "framework" for Arab mental health and illness. To address this gap, this study will examine the underlying philosophy of the term "conceptual framework" and will propose a new analytical process for reconstructing a unified theoretical framework for Arab mental health from the multidisciplinary literature. The study will then apply the proposed method in constructing a conceptual framework for the multidisciplinary phenomenon of gendered and cultural conceptual framework for mental health for refugees and vulnerable populations in the Arab region.

Grounded theory, one of the most widely used qualitative interpretive frameworks in the social science, is a specific paradigm of inquiry that is adequate for conceptual framework building because a) it uses methods that conform to the "good science" model (Denzin & Lincoln, 1994; Charmaz & Belgrave, 2019) and b) it includes a number of distinct features and involves the use of coding paradigms to ensure a sound conceptual development (Strauss, & Corbin, 1990). It is also a research method aimed at the discovery of theory from systematically obtained data and an inductive, "theory discovery methodology" (Martin & Turner, 1986), which facilitates the generation of theories of process, sequence, and change pertaining to organizations, positions, and social interaction. Being contextual, procedural, and inductive, the grounded theory builds a "context-based, process-oriented description and explanation of the phenomenon, rather than an objective, static description expressed strictly in terms of causality" (Andersson, Hallberg, & Timpka, 2003, p. 50). This study will employ a grounded theory strategy to generate, identify, and trace the Arab mental health phenomenon's major concepts, which together constitute its theoretical framework. We aim to develop concept, each with their own distinct attributes, characteristics, assumptions, limitations, perspectives, and specific function within the conceptual framework (Morse & Mitcham, 2002; Austin, Z., & Sutton, J. 2014). The study's novel analytical method for building the Arab

conceptual framework for mental health will integrate a causal setting approach with a flexible interpretative approach. It will first redefine concepts and conceptual framework. Concepts are defined by components and are characterized by a number of features. A conceptual framework is defined as a network of interlinked concepts that provide a panoptic understanding of a phenomenon. Each concept plays an ontological or epistemological role in the framework. Consequently, conceptual frameworks are not mere aggregates of concepts but, rather, constructs in which each concept plays an integral role. This study's Arab Gendered and Cultural Conceptual Framework for Mental Health could provide a template for other world regions.

### **The Research Team:**

The UCDAR team includes scholars: UC Davis -- Suad Joseph (Anthropology) and Patrick Marius Koga (School of Medicine), Raquel Aldana (School of Law); American University in Cairo -- Kate Ellis (Psychology); Birzeit University – Rita Giacaman (Community and Public Health); Lebanese American University -- Carmel Bouclaus (School of Medicine). Three more team members from the American University of Beirut will join the project in the testing phase after the development of the GCCF. Koga heads a center for refugee mental health; Aldana has run legal clinics for refugees. The PI, Joseph, has carried out research and published extensively on gendered and cultural approaches to family and community in the Arab region. Giacaman is widely published and recognized for her mental health work with Palestinian refugees. Ellis has a practice and runs a clinic for refugees in Cairo. Bouclaus works with refugees in Lebanon. We will invite the UCDAR partners to UCD for two in-person workshops to work with the UCD community. Two of our UCD team members have already worked with the Global Migration Center (Koga, Aldana). They won a small grant to do two workshops at UCD on trauma that emerges from legal conditions of refugees. The rest of the work of the team will be done through ZOOMs, webinars etc. The team has been working together since 2017.

### **Research Search Method Steps Towards Arab GCCF**

**Aim: Develop an Arab gendered and cultural conceptual framework for mental health assessments of war refugees and other vulnerable populations exposed to violence.** The aim focuses on conceptual development. The project will carry out a thorough review of the published and grey literature, reviews of our own long-standing research, knowledge and lived experience, as well as semi structured interviews and focus groups. It will explore and rethink key concepts such as “personhood”, “patriarchy”, “gender formulations” “idioms of distress”, “help-seeking behaviors”, social stigma”, and “cultural congruence”. From this critical engagement with the literature and cultural experts, we will develop an Arab gendered and cultural conceptual framework (Arab GCCF) to be subsequently tested and validated through other grants in the future.

#### **1. *Mapping of selected data sources indirectly from the spectrum of multidisciplinary literature on Arab mental health as well as directly from practitioners and scholars.***

Conduct an extensive review of the multidisciplinary texts to identify text types and existing empirical data and practices.

Undertake workshops with practitioners, specialists, and scholars from various disciplines at UC Davis, in conjunction with UCD and UCDAR partners whose work focuses on cross cultural mental health. Data collection will be a comprehensive and complete scoping for a comprehensive mapping and complete data collection to ensure validity (Morse & Mitcham, 2002).

The two in-person workshops will create public events to engage the UCD community.

There will be by invitation seminars for UCD scholars and students to engage in discussions to map the literature and to move towards development of the GCCF.

Following the in-person workshops, the Core Team will conduct monthly ZOOM seminars.

During the course of the year, webinars and other forms of outreach to the campus and larger communities of the five universities. This will include two ZOOM seminars with the UCDAR Core team and UCD scholars and students to continue the work of the in-person seminar.

The project will hire an undergraduate student assistant to work with the PI on logistics and on gathering background data for the project and the webpage. The student will be mentored in research and critical reading as well as research planning and organization. The webpage will offer products of the project for the public.

#### **2. *Extensive reading and categorizing of the selected data***

Read the selected data and categorize it both by discipline and by a scale of importance and representative power within each discipline (e.g. cultural and medical anthropology; psychiatry; psychology; sociology, public health, etc.) This process will maximize the effectiveness of our inquiry and will ensure effective representation of each discipline.

**3: Identifying and naming concepts**

Review the selected data to identify concepts (Strauss & Corbin. 1990) as this allows them to emerge from the literature. We expect that the result will be a list of numerous competing and sometimes contradictory concepts. We are well aware that “qualitative inquiry that commences with the concept, rather than the phenomenon itself, is subject to violating the tenet of induction, thus is exposed to particular threats of invalidity” (Morse, Hupcey, et al. 2002, p. 68). The ontological concept of dual mental health continua will serve as a fulcrum to guide a comparison of how mental health is constructed in the Western biomedical model versus how the Arab region is conceptualizing mental health in war.

**4: Deconstructing and categorizing the concepts**

Deconstruct each concept, identify its main attributes, characteristics, assumptions, and role, to subsequently organize and categorize the concepts according to their features and ontological, epistemological, and methodological role.

**5. Integrating concepts**

Group together and integrate concepts that have similarities to one new concept. This activity will substantially reduce the count number allowing us to manipulate to a reasonable number of concepts.

**6. Synthesize** concepts into a gendered and cultural Arab conceptual framework for Mental Health

This iterative activity will include repetitive synthesis until we recognize a framework that makes sense. We will reduce the number of concepts and establish the presumed relationship among the concepts.

**Results and Benefits**

At the conclusion of this project, we expect to have developed the Arab Gendered and Cultural Conceptual Framework (Arab GCCF). The next step will be to develop a novel Arab mental health assessment instrument thoroughly informed by our Arab GCCF. We will seek NIH and other funding to conduct a randomized trial in the Arab Region in which we will compare the assessment outcomes of the novel Arab instruments versus established Western mental health instruments. We will recruit a heterogeneous sample of Public Health Clinics in Lebanon, West Bank/Palestine, and Egypt that serve large numbers of refugees and vulnerable populations. The larger-scale test would also provide more detailed information about the costs of scaling up and sustaining the Arab GCF adapted approach to mental assessments of Arab refugees and other vulnerable populations not only in the Arab region but also in the Arab refugee diasporas in the United States. The project will benefit the UCD community through the inclusion of three UCD faculty in the Core Research Team; through workshops open to the UCD scholarly, student and broader community; through by invitation seminars for UCD scholars and students; through public outreach by way of the website to be developed for this project. Should the Arab GCCF prove to be viable and productive in helping to ease mental health disparities, the process and template for its development could be used by scholars, students and practitioners at UCD for other refugee, vulnerable, and minority communities.

**Budget**

<b>Travel &amp; workshops &amp; catering:</b>	<b>12,000</b>
<b>Student Assistant &amp; Web assistant</b>	<b>7,000</b>
<b>Supplies</b>	<b>1,000</b>
<b>Total:</b>	<b>\$20,000</b>

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1966-67 U. of Pittsburgh, Anthropology: one year graduate work  
1962-66 State U. of New York at Cortland, B.A. in Social Science; Magna Cum Laude

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1999-01 Director, Education Abroad Program, U. of California / American U. in Cairo  
1998-99 Chair, Faculty Resident Seminar Group, U. of California, Irvine  
1997-98 Director, Women's Studies Program  
1993-12 Professor of Anthropology and Women and Gender Studies  
1982-93 Associate Professor of Anthropology  
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**HONORS**

- 2019 Middle East Studies Association. Jere L. Bacharach Life-Time Service Award  
2019 Lebanese American University Named Lecture Series: Dr. Suad Joseph Distinguished Lecture Series  
2016 Association for Middle East Women's Studies Life Time Achievement Award  
2016 Middle East Section of the American Anthropological Association Life Time Achievement Award  
2014 UC Davis Prize for Undergraduate Teaching and Research (\$45,000).  
2014 Arab American Studies Association Life Time Service Award.  
2012 Chancellor's Achievement Award for Diversity and Community. UC Davis.  
2012 Alumni Hall of Fame. State University of New York, Cortland.  
2010 Journal of Middle East Women's Studies Distinguished Lecturer. UCLA. May.  
2010 Fully Engaged. Selected as one of UOIP's Top 100 most internationally effective UC Davis faculty/staff. University Outreach and International Programs.  
2009-12 Named Lecture Series: Suad Joseph Lecture Series in Iranian Studies. UCD.  
2009-12 President-Elect/President/Past President. Middle East Studies Association of North America.  
2009 State U. of New York, Cortland. Distinguished Faculty in Residence. Oct.  
2008 Cortland Senior High School. Alumni Wall of Fame.  
2008 MillerCom Lecturer. University of Illinois, Urbana-Champaign.  
2004 Distinguished Scholarly Public Service Award. U. California, Davis.  
2004 Sabbagh Distinguished Lecturer. U. of Arizona.  
2003 Lyceum Distinguished Scholar Award. Wichita State U.  
2002 Nominated President-Elect. Middle East Studies Association.  
2001 Equal Opportunity and Affirmative Action Award. American U. in Cairo.  
1999 Distinguished Scholars Lecture. State U. of New York, Cortland.  
1997 Pro Femina Research Consortium, Outstanding Mentor Award.  
1994 Distinguished Alumnus Award. Cortland College Alumni Association. State U. of New York,

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#### PUBLICATIONS

- General Editor Encyclopedia of Women and Islamic Cultures (EWIC). Leiden: Brill  
2020 In Press: EWIC Print II Volumes 1-8.  
2010-2019 Online Supplements I-XX.  
2007 EWIC Print I. Volume VI. Supplement & Index. Leiden: Brill.  
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2005 Volume II. Family, Law and Politics.  
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#### EDITED BOOKS

- 2018 Arab Family Studies: Critical Reviews. Syracuse: Syracuse University Press.  
2013 Women and Islamic Cultures. Disciplinary Paradigms and Approaches: 2003-2013. Leiden: Brill.  
2000 Gender and Citizenship in the Middle East. Syracuse: Syracuse U. Press.  
1999 Intimate Selving in Arab Families: Gender, Self and Identity. Syracuse: Syracuse U. Press.

#### CO-EDITED BOOKS

- 2020 In Press: Arab American Women: Representation and Refusal. Eds. Michael Suleiman, Suad Joseph, Louise Cainkar. Syracuse U. Press.  
2001 Women and Power in the Middle East. Eds. Suad Joseph and Susan Slyomovics. U. of Pennsylvania Press.  
1999 Gender and Citizenship in Lebanon. Eds. Najla Hamadeh, Jean Said Makdisi, Suad Joseph. Beirut: Dar al Jadid Press. (In Arabic).  
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1978 Muslim-Christian Conflicts: Economic, Political and Social Origins. Eds. Suad Joseph and Barbara L.K. Pillsbury. Westview Press.

#### SELECTED ARTICLES AND BOOK CHAPTER

- Submitted "Dreaming with Fatima: Trespassing and Other Inspirations." In Fatima Mernissi For Our Time. Edited by Minoo Moallem and Paola Bacchetta. Syracuse University Press.  
In Press "Tribute to Michael Suleiman" in Arab American Women: Representation and Refusal. Edited by Michael W. Suleiman, Suad Joseph and Louise Cainkar. Syracuse: Syracuse University Press.  
In Press Arab American women: Intersectional Genealogies and Trajectories. in Arab American Women: Representation and Refusal. Edited by Michael W. Suleiman, Suad Joseph and Louise Cainkar. Syracuse: Syracuse University Press.  
In Press "Arab American Gender Representations in the New York Times: 1851 Through 1919." in Arab American Women: Representation and Refusal. Edited By Michael W. Suleiman, Suad Joseph and Louise Cainkar. Syracuse: Syracuse University Press.  
In Press "Brothers and Sisters, Husbands and Wives: Love/Power/In-Law. In Brothers and Sisters: Sibling Relationships Over the Life Course. Edited by Anna Buchanan and Anna Rotkirch. London: Palgrave Macmillan  
2020 Foreword. In Women Rising: Resistance, Revolution, and Reform in the Arab Spring and Beyond. Edited by Mounira Charrad and Rita Stephan. New York: New York University Press.  
2018 "Introduction: Family in the Arab Region: State of Scholarship." In Ed. Suad Joseph. Arab Family Studies: Critical Reviews. Syracuse U. Press.

## Pyrroloquinoline quinone: Additional studies related to its physiological importance

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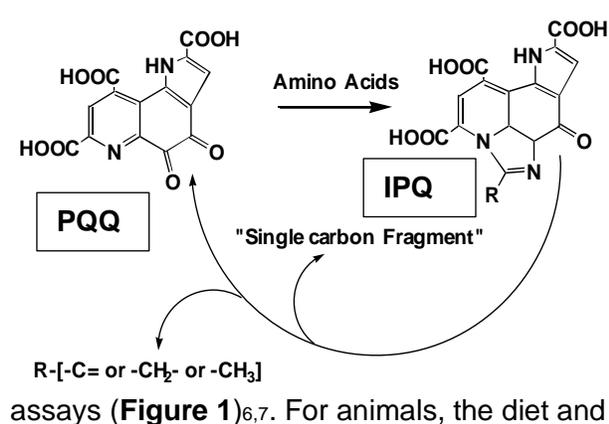
<https://nutrition.ucdavis.edu/people/robert-rucker>

**Abstract.** Pyrroloquinoline quinone (PQQ) acts as an accessory factor for certain NAD (nicotinamide adenine dinucleotide)-requiring dehydrogenases. PQQ aids in sustaining high cellular levels of oxidized NAD (NAD<sup>+</sup>). NAD<sup>+</sup> is an activator of enzymes, such as the sirtuins, which play a direct role in the regulation of mitochondrial function. Because of the connection between PQQ, NAD<sup>+</sup>, the sirtuins, and mitochondrial functions, PQQ attributes have been described that range from neonatal survival benefits to anti-aging-related effects. For the proposed work, the distribution and relationships between the two principal forms of PQQ will be examined (PQQ and imidazolopyrroloquinoline, IPQ). A working hypothesis is that most of the PQQ in tissues is in the form of IPQ. An important outcome will be an assessment of IPQ's potential to serve as a tissue source for PQQ.

**Goals, Purpose, and Hypotheses.** The goals for the proposed Edward A Dickson Award are to 1) sustain my current research and publication efforts and 2) continue collaborations that link my activities within the Nutrition Department to those associated with Food Science, the Western Human Nutrition Research Center at UC Davis, the Oklahoma Medical Center, and Oklahoma State University. The proposed project focuses on pyrroloquinoline quinone (PQQ) and its principle derivative, imidazolopyrroloquinoline quinone (IPQ). The hypotheses are that:

1. PQQ and/or its derivatives, such as IPQ, are nutritionally important/essential and when converted to PQQ and act either as a "vitamin" or a vitamin accessory factor.
2. IPQ deserves more attention as a potential source of PQQ.

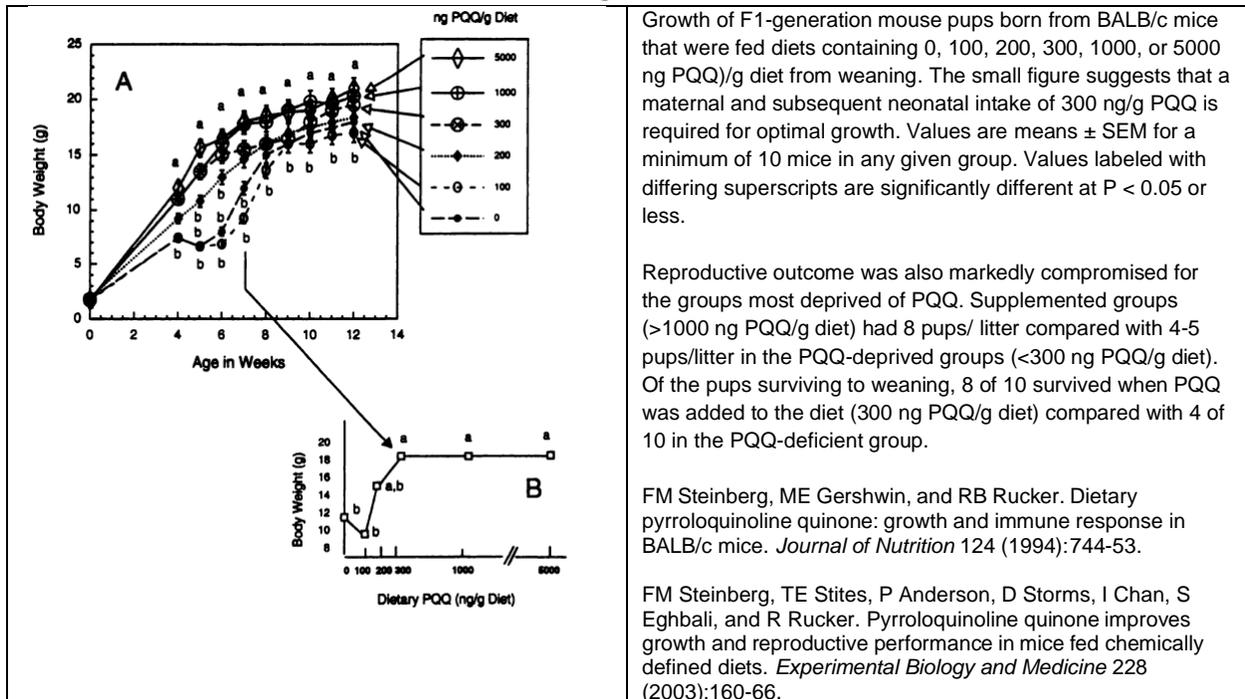
**Introduction and Rationale.** The first suggestion that PQQ was biologically relevant evolved from observations that some bacterial dehydrogenases utilized PQQ as redox catalysts (i.e., in addition to those derived from pyridine or flavin derivatives; for examples, catalysts/cofactors derived from the vitamins, such as niacin and riboflavin)<sup>1</sup>. Subsequent work confirmed observations<sup>1</sup> and led to the elucidation of the chemical structures for PQQ and derivatives, such as IPQ<sup>9,10-12</sup>.



PQQ and IPQ are present in eukaryote tissues and biological fluids at concentrations ranging from nanomolar to micromolar. Exposure to PQQ elicits physiological responses in experimental animal models when present in nanomolar concentrations in diets<sup>1</sup>. A dietary deficiency of PQQ can also be demonstrated in rodent<sup>1</sup>, pig<sup>2</sup>, and chicken<sup>3-5</sup> animal models. Further, dietary requirements have been determined using nutritional 'dose-response' assays (Figure 1)<sup>6,7</sup>. For animals, the diet and the potential for microbiome synthesis are the

only known sources of PQQ. Of potential importance, PQQ is found in human and rodent breast milk at concentrations that correspond to the amounts estimated to meet dietary requirements and attenuate signs of deficiency<sup>8,9</sup>.

**Figure 1**



Growth of F1-generation mouse pups born from BALB/c mice that were fed diets containing 0, 100, 200, 300, 1000, or 5000 ng PQQ/g diet from weaning. The small figure suggests that a maternal and subsequent neonatal intake of 300 ng/g PQQ is required for optimal growth. Values are means  $\pm$  SEM for a minimum of 10 mice in any given group. Values labeled with differing superscripts are significantly different at  $P < 0.05$  or less.

Reproductive outcome was also markedly compromised for the groups most deprived of PQQ. Supplemented groups ( $>1000$  ng PQQ/g diet) had 8 pups/litter compared with 4-5 pups/litter in the PQQ-deprived groups ( $<300$  ng PQQ/g diet). Of the pups surviving to weaning, 8 of 10 survived when PQQ was added to the diet (300 ng PQQ/g diet) compared with 4 of 10 in the PQQ-deficient group.

FM Steinberg, ME Gershwin, and RB Rucker. Dietary pyrroloquinoline quinone: growth and immune response in BALB/c mice. *Journal of Nutrition* 124 (1994):744-53.

FM Steinberg, TE Stites, P Anderson, D Storms, I Chan, S Eghbali, and R Rucker. Pyrroloquinoline quinone improves growth and reproductive performance in mice fed chemically defined diets. *Experimental Biology and Medicine* 228 (2003):160-66.

The primary sources of PQQ in food stuffs evolves from plant and animal exposure to methylotrophic bacteria, rhizobium (common soil bacteria), and acetobacters<sup>1</sup>. It is also important to note that the PQQ-like compounds in soil initially came from interstellar dust<sup>13</sup>. Accordingly, it may be inferred that plants and animals have been exposed to PQQ throughout evolution. PQQ is found in plant tissues at levels about ten times those found in animal tissue.

In animals, PQQ participates in a range of biological functions with apparent survival benefits (e.g., optimization of neonatal growth, reproductive performance, hepatic and muscular functions, and mitochondriogenesis), as well as benefits to neuroprotection and improved cognitive, immune, and antioxidant functions<sup>1</sup>. Further, of the known biofactors in foods, PQQ is the only biofactor for which the effects of a dietary deficiency have been demonstrated<sup>1</sup>. Although PQQ is not currently viewed as a vitamin, we and others have demonstrated that it is a critical accessory factor important in modulating the activity of NAD-requiring dehydrogenases<sup>1,14-20</sup>. In brief, Akagawa et al.<sup>19,20</sup> demonstrated that when a PQQ-bound dehydrogenase oxidizes NADH, higher concentrations of NAD(+) are generated. In cells, PQQ also attenuates cellular lactate release and increases intracellular ATP levels. Of critical importance, NAD<sup>+</sup> is utilized by enzymes in the sirtuin family (**cf. Figure 2**). Sirtuins are a family of signaling proteins involved in metabolic regulation and events necessary for mitochondriogenesis. We described a PQQ sirtuin-directed pathway connection and its importance to mitochondriogenesis<sup>14</sup>. All of the pleiotropic actions described for PQQ to date are related mitochondriogenesis and optimized when PQQ is optimal.

**Figure 2**

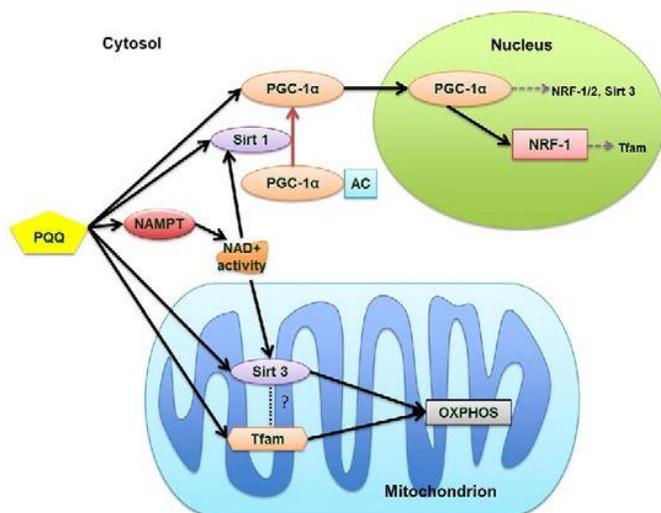


Figure 2 - Nuclear gene-encoded regulatory factors are essential for mitochondrial biogenesis and function. The nuclear factors that regulate the expression of nuclear DNA-encoded genes that regulate mitochondrial assembly are SIRT1 and peroxisome proliferator-activated receptor  $\gamma$  coactivator-1 $\alpha$  (PGC-1 $\alpha$ ). PGC-1 $\alpha$  serves as a central component of the transcriptional regulatory circuitry that coordinately controls the energy-generating functions. Other detail may be found in:

- Tchapanian E, Marshal L, Cutler G, Bauerly K, Chohanadisai W, Satre M, Harris C, Rucker RB. Identification of transcriptional networks responding to pyrroloquinoline quinone dietary supplementation and their influence on thioredoxin expression, and the JAK/STAT and MAPK pathways. *Biochem J.* 2010;429(3):515-26. doi: 10.1042/BJ20091649.
- Chohanadisai W, Bauerly KA, Tchapanian E, Wong A, Cortopassi GA, Rucker RB. Pyrroloquinoline quinone stimulates mitochondrial biogenesis through cAMP response element-binding protein phosphorylation and increased PGC-1 $\alpha$  expression. *J Biol Chem.* 2010;285:142-52.
- Zhang J, Meruvu S, Bedi YS, Chau J, Arguelles A, Rucker R, Choudhury M. Pyrroloquinoline quinone increases the expression and activity of Sirt1 and -3 genes in HepG2 cells. *Nutr Res.* 2015; 35:844-9.

**Proposed Work.** There are only a few reports related to the estimation for IPQ in biological fluids or tissues. Although there are estimates for PQQ in many foods (Note: there are several high throughput chemical assays available for PQQ), their validity and precision can often be questioned. For example, PQQ readily forms adducts with nucleophilic reagents such as methanol, aldehydes, ketones, urea, ammonia, amines simple amino acids<sup>21</sup>. These adducts are currently only best measured using mass spectrometric (MS) approaches or uv-spectrophotometric methods coupled with high performance liquid chromatographic techniques<sup>22,23</sup>. There are no simple chemical assays that are currently available for PQQ derivatives, such as IPQ. When MS is utilized, amino acid-derived condensation products are observed and may be quantified. Of these, the most predominant is imidazolopyrroloquinoline (IPQ) or imidazolopyrroloquinoline with an attached amino acid side chain or R-group.

Why is this important? We have emphasized that PQQ added to diets is rapidly converted to derivatives when such diets are suspended in aqueous solution. We have also shown that human<sup>9</sup> and rodent (unpublished data) milks contain 8-15 times the amounts of IPQ as PQQ. Accordingly, It is easily argued that IPQ may be a potential source of PQQ. For example, the dissociation of IPQ at neutral pH is  $\sim 10^{-4}$ . This value takes on relevance, when one considers that at neutral pH using chemical assays based on redox cycling (used to indirectly measure antioxidant potential) or assays in vivo based on the rate of cell proliferation or growth, exposure

to IPQ causes the same level of stimulation/response as PQQ if added at ~100-1000 times the concentration of PQQ needed to observe the response. Although there is no doubt that the active form of PQQ is the quinone form, particular as it relates NAD<sup>+</sup> formation. Measurements of only this underivative form of PQQ in fluids and tissue do not reflect total tissue pools of PQQ derivatives, which in turn may prove to elicit other potential functions.

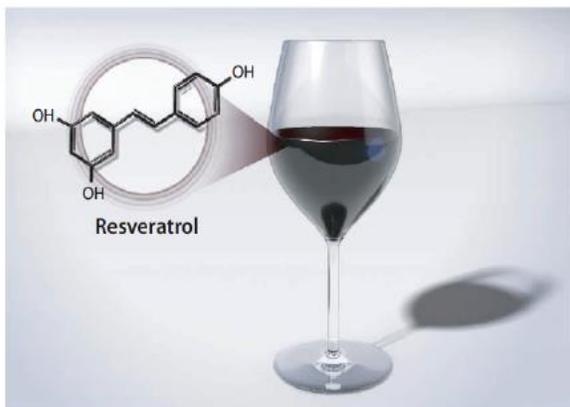
What has been discussed with the proposed collaborators is to 1) assess the total PQQ in selected food sources and 2) tissues from animals exposed to a PQQ source at differing levels. A consideration is what can be done at a nominal cost and yet have an impact. For example, rats or mice exposed to 5, 10, or 20 times the requirement estimated for PQQ could be used as the tissue source. The requirement for animals (observed so far in mice, rats, pigs, and chickens) appears to be ~500 micrograms/Kg dry food or ~150 micrograms/1000 Kcal or 4.2 MJ of feed; also cf. Figure 1. Based on our human data<sup>15</sup>, a week of exposure should be sufficient to reach a tissue equilibrium between PQQ and IPQ formation. Tissues (liver, muscle, and adipose) will be examined, because of their importance to mitochondrial-related oxidative metabolism. Already in place are extraction protocols for PQQ and its derivatives<sup>9,22,23</sup>. Moreover, the analytical protocols are available but may need refinement. For example, Dr. Alyson Mitchell (FST at UCD) as a post-doc in my laboratory developed MS protocols for IPQ & PQQ and polyphenolic compounds<sup>8,9</sup>. The proposed collaborators (Drs. Mitchell, Jonscher, and Newman) are directors or have been directors of mass spectrophotometry facilities. I will be responsible for refining equilibrium and kinetic information related to rates of IPQ formation and equilibrium parameters and their pH dependence.

For the current proposal, a goal would be to show that IPQ makes an important and potentially functional contribution to the total PQQ in a given biological tissue or fluid. To give the work more visibility and potential impact, wine would be chosen as one of the food-related samples along with cocoa samples. These choices are based on observations that both PQQ and resveratrol (the putative active agent in red wine and basis for the so-called French paradox phenomenon) promote mitochondriogenesis and can be linked to antioxidant and anti-aging effects.

There is a conundrum, however, that exists for resveratrol, as well as other bioflavonoids, that does not exist for PQQ<sup>24-28</sup>. Using chemical assays, we and others have estimated that many red wines contain 0.05 to 0.1 mg PQQ per 100 mL (unpublished data). Although the estimates for resveratrol is 2-3 times that amount, for equivalent biological effects in animal studies, such as the promotion of mitochondriogenesis, 300-400 mg of resveratrol/Kg of dry diet (3000-4000 Kcals) are required, compared to only 2-5 mg PQQ/kg of dry diet. In humans, from 50 to 250 mg per day of supplemental resveratrol are often recommended (e.g. the equivalent of 2 or more cases of red wine per day) vs 2-3 bottles with regard to PQQ; or perhaps ~5-10-fold less, if the IPQ content were known. A simple PubMed search using just resveratrol and red wine as key words results in over 1000 citations. The effects that have been ascribed to resveratrol may be due to other factors, such as PQQ (**Figure 3**).

### Figure 3

## Comparisons Between PQQ and Resveratrol



Cheers. Resveratrol, the natural compound in red wine, and other small molecules are allosteric activators of SIRT1, an enzyme with roles in many biological processes (including DNA repair, metabolism, programmed cell death, and inflammation) that affect human life span.

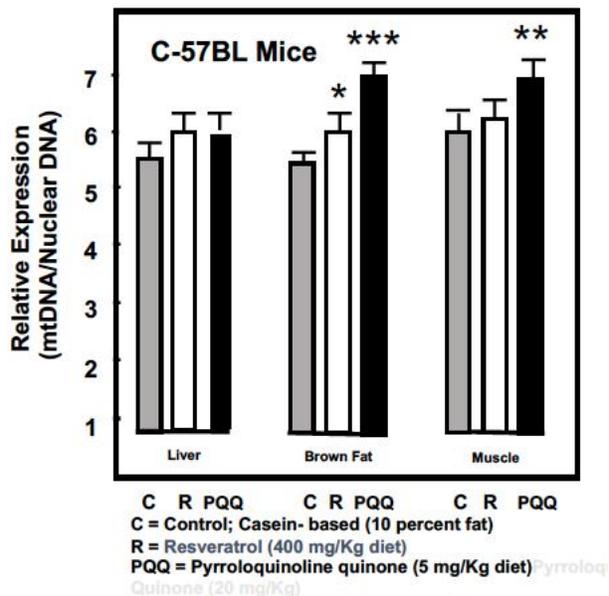


Figure 3 - Comparison of concentrations of dietary resveratrol or PQQ needed to stimulate mitochondrial production in three different tissues.

**Importance and Significance.** Demonstrating that IPQ is a functional precursor to PQQ adds another dimension to PQQ's importance as a potentially new nutrient with 'essential' properties. Since my retirement, I have been involved in collaborations that have resulted in over 30 papers and reviews. Fortunately, I was able to sustain my laboratory for another 7-8 years following my retirement. Data remain for an additional 2-3 papers. The data evolved from studies that underscore:

1. The novel chemical features of PQQ, which are analogous to combining the functional properties of riboflavin, ascorbic acid, and pyridoxal cofactors into one molecule. The data include some basic information on the rates of IPQ formation, UV and NMR spectral data, comparisons of PQQ's ability to carry redox cycling relative to other compounds.
2. The uptake of IPQ into tissues and data on our inability to demonstrate that mammalian tissues make PQQ. Although no longer available, at one-point, radioactive PQQ and IPQ were available and were utilized in such studies.
3. Data on comparisons of PQQ ability to stimulate mitochondriogenesis relative to compounds, such as those in the flavonoid family and polyphenolics, such as resveratrol.

What is missing are reasonable estimates for the ratio of PQQ to IPQ in tissues and fluids. It is also anticipated that additional compositional data that focus on IPQ to PQQ ratios in tissues and foods should cause others to pay more attention to derivatives when measuring the PQQ content in biological samples.

At this point, I have access to departmental resources (analytical equipment and animal resources). Consequently, I will be involved in activities to define pH-dependent kinetic parameters and eventual publication(s) of the research product.

**Budget.** I have been supporting this work currently with residual unrestricted gift monies (currently ~\$6000.00) and personal funds. I anticipate that an additional \$5000.00 to \$7,500.00 would be sufficient to underwrite the mass spectrometric, animal facility, chemical/reagent costs based on typical campus rates.

#### **Budget**

1. Mass spectral costs and assay development - **\$8000.00**. (Up to \$5000.00 from the proposed award plus \$3000 from existing funds). This amount would underwrite 5-6 weeks of technical lab support and about 50 hours of MS running time. The estimate is based on current campus rates of ~\$50/hour and includes lab and actual MS machine running time. A part of the cost relates to IPQ preparation and tissue and fluid extractions.
2. Animal costs - **\$200.00** An estimate for 10 mice or rats per day for 10 days. (I hope to negotiate with the Department to see if these costs might be waived in return for the annual lectures that I give).
3. PQQ and reagent costs – **\$500** I am hoping to acquire 5-10 grams of PQQ as a gift from Mitsubishi Gas and Chemical Co., the current major supplier of PQQ. The pure compound is easy to isolate from 1 gram or more of the dietary supplement source offered by Life Extension® for ~\$100.00. This is in to the prices at chemical supply houses (e.g., the product from Sigma/Aldrich is ~\$6000.00 for 0.1 grams of PQQ!) For sales to supplement companies, MGC's retail price is ~\$10000/Kg or \$10 per gram. If not from the proposed grant, these costs could come from existing gift funds.
4. Publication Costs – **Variable** If funded to \$7500, I would use ~\$2500 for page charges or publication costs. I anticipate two to three papers coming from this effort.

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**Proposed Collaborators:**

1. John Newman, Ph.D. WHNRC - <https://www.ars.usda.gov/pacific-west-area/davis-ca/whnrc/omu/people/john-newman/>
2. Winyoo Chowanadisai, Ph.D. Oklahoma State University - <https://humansciences.okstate.edu/nsci/directory/winyoo-chowanadisai.html>
3. Karen Jonscher, Ph.D. Harold Hamm Diabetes Center, Department of Biochemistry and Molecular Biology, OU Health Sciences Center - <https://hammdiabetescenter.org/Research/Members/bio/karen-jonscher-phd>
4. Alyson Mitchell Ph.D. FST at UC Davis - <https://foodscience.ucdavis.edu/people/alyson-mitchell#/>

## Biographical Summary

Robert B Rucker, Professor Emeritus

**Education:**

Institution	Degree	Date	Field of Study
University of Missouri	NIH Post-Doc	1970	Nutritional Biochemistry
Purdue University, Lafayette, IN	PhD	1968	Biochemistry
Purdue University, Lafayette, IN	MS	1965	Biochemistry
Oklahoma City University, Oklahoma City, OK	BA	1963	Chemistry/Humanities

**Selected Positions and Honors:**

<p><b>Positions:</b>            2008-Present: Emeritus Professor, Department of Nutrition            1999-2007: Vice Chair, Department of Nutrition (2007-2008 Acting Chair)            1989-2008: Professor, Department of Nutrition and Internal Medicine            1981-1988: Professor and Chair, Department of Nutrition            1975-1979: Associate Professor            1970-1975: Assistant Professor</p>
<p><b>Honors:</b>            1986 UC Davis Medical School Oettinger Research Award            1993 Borden Research Award, American Society for Nutritional Sciences (ASNS)            2004 Fellow AAAS &amp; 2006 Fellow American Society for Nutrition (formally ASNS)            2006 Distinguished Professor – UC Davis            2013 Edward A. Dickson Emeriti Professorship            2013 Alumni Award – Department of Nutrition – Purdue University, Lafayette, IN</p>

**Selected Service Activities:**

President: 1997 American Society Nutrition Society; Membership Committee Chair: Soc. Expl. Biol. Med. (1992-1997)

Editorial Boards: Past Senior Associate Editor, American Journal Clinical Nutrition; Past service on the editorial boards for the Journal of Nutrition, Nutrition Research, Annual Reviews of Nutrition; J of Nutr and Metabolism

Council member or participant: American Society Nutrition Society (1991-94, 1996-1999) and Soc. Expl. Biol. Med. (1992-1997); Other activities: ASN Publication Management Committees - J of Nutrition and Am J of Clin Nutrition (2009-2011), ASN – Awards Committee (2011-2013), ASN – Fellow's Committee (Current)

Chaired: Gordon Research Conference-1983 (Elastin); NIH Workshop: Nutrition and Lung Disease (1985), FASEB Summer Research Conference on Trace Elements(1999)

Participated: Program Committees for ASNS, FASEB, TEMA, e.g., planning committees for the 1993-1996 Experimental Biology meetings; planning committee for the Trace Element in Man and Animal Meetings for 1987 and 2002

Plenary Speaker: 1992 International Nutrition Congress in Adelaide, 1995 20th Nutrition Congress, Republic of China; various Gordon Conferences (most recent 2005); Meeting of the Am. Association Veterinary Nutrition (2006); International Conference on Vitamins, Coenzymes, and Biofactors and International Symposium on Vitamin B6, PQQ, Carbonyl Catalysis and Quinoproteins (2011); Japan Society for Bioscience, Biotechnology, and Agro-chemistry in Sundai, Japan (2013)

**Publications:** (~300 total: Research papers, Chapters, Reviews and Editorials) The following are Post-retirement (Chapters, Monographs, Research Papers)

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