An Interview With Professor John C. Longhurst: Cardiovascular Modulation by Electroacupuncture

John C. Longhurst is a Professor of Medicine, Physiology and Biophysics, Pharmacology and Center for Biomedical Engineering at the University of California, Irvine. He holds two endowed chairs: the Lawrence K. Dodge Endowed Chair in Integrative Biology and the Susan Samueli Chair in Integrative Medicine. He serves as the Director of the Susan Samueli Center for Integrative Medicine. He is also a practicing clinical cardiologist with interests in cardiovascular diseases, including hypertension. Professor Longhurst has published over 200 original articles, reviews and book chapters. During the last decade, Professor Longhurst's research team has been funded by two grants from the National Institutes of Health to study the mechanisms of action of acupuncture in regulating cardiovascular function. These studies explored the actions of acupuncture in lowering elevated blood pressure and reducing myocardial ischemia both in animal models and patients with mild to moderate hypertension. He evaluated important concepts in acupuncture including point specificity, appropriate controls for acupuncture studies, effective frequencies of electroacupuncture stimulation, responses to manual versus electroacupuncture and the central neural mechanisms underlying acupuncture's cardiovascular effect. In particular, he has suggested that the opioid (endorphins and enkephalins) and endocannabinoid systems, among all the neurotransmitters in the brain and the spinal cord, are involved in acupuncture's influence on elevated blood pressure.

He gave a presentation at the Symposium on Acupuncture and Meridian Studies 2009 in Seoul, Korea, with the title: Cardiovascular Modulation by Electroacupuncture. What follows below are excerpted from an interview with Professor Longhurst.

Question: What is cardiovascular modulation?

JCL: As opposed to many of the talks, mine will represent a lot of science, derived from a lot of experiments in our laboratory. Some areas I will touch upon really quickly, but I will present a few experiments in detail just to show how we do the studies. They are all serious studies, using the latest techniques in cardiovascular and neuroscience. Our studies are defining the brain's role, how it processes the information during acupuncture, and then how it affects the heart. Mainly we study how acupuncture regulates blood pressure, high blood pressure specifically. Our studies show that if your blood pressure is normal, acupuncture does not do too much, so we raise the blood pressure and we study the effect of acupuncture on elevated blood pressure or its influence on myocardial ischemia (a lack of adequate blood flow), which occurs when you have a heart attack. We have done studies in
humans as well as in animal models. Most of our data is from animal models since we can make many more measurements in these experimental investigations.

**Question: What is the role of electroacupuncture? (Why did you choose this method?)**

JCL: We have done studies comparing manual and electroacupuncture, but as I will discuss, you can standardize electroacupuncture much more accurately, from patient to patient. For example, if you want to apply the acupuncture at 2 Hz stimulation frequency (i.e. two cycles per second), you can flip a switch on the electrical stimulator and easily accomplish this with electroacupuncture. But, to do that with manual acupuncture we have found that it is hard to keep up the repetitive stimulation regularly at a 2 Hz frequency over a period of many minutes. We thus believe that electroacupuncture is better standardized. We have also performed many studies to look at various aspects of electroacupuncture and to show the best way of accomplishing this form of stimulation. We have done this to be able to use it in the most effective manner.

**Question: As a Western medicine practitioner, why are you interested in complementary and alternative medicine?**

JCL: This is a long story. I initially was not interested in performing studies in this area of research. We currently are fortunate to be well funded by our federal government. Our grants provide the fiscal resources that allow us to study acupuncture and its influence on the cardiovascular system. A lot of other people investigate the role of acupuncture in treating pain, but our studies focus on acupuncture’s cardiovascular effect and thus are very unique. My story of how I became interested in studying integrative medicine and specifically acupuncture is this. I went to China in the early 1990s. At that time I was invited by the Chinese government in 1992 to present a series of lectures around several cities in China. They asked me where I wanted to go to lecture. I said, “Shanghai!” since it sounded very exotic to me. Thus I went to Shanghai, then to Wuhan and Beijing. My host in Shanghai was Dr Peng Li. Dr Li was a wonderful host who introduced me to acupuncture. I went to a number of city clinics and visited traditional Chinese medicine (TCM) hospitals. They have a number of TCM hospitals there. They practice only TCM. I found that I was very interested in seeing for the first time acupuncture being practiced. Dr Li invited me back to Shanghai 2 years later to a conference like the SAMS 2009 conference and at that time he asked me if I would consider doing research with him. I initially said, “No!” I indicated that I still did not believe in it, but Dr Li was very smart. He gave his CV, which I read on the way home. I found that he was publishing in good Western scientific journals, strong well-respected journals, including neuroscience journals. I am a neuroscientist. Even though clinically I practice cardiovascular, I study autonomic neuroscience, which is how the cardiovascular system is regulated by the nervous system. After reading his CV, I said to myself, “Well, maybe I have to rethink the possibility of doing some collaborative research.” I therefore reconsidered my refusal to do acupuncture research with him. I subsequently invited Dr Li over to my laboratory at UC Davis. He stayed for 3 months and we completed whole study, which is very quick for the kind of studies we perform. Most of our studies take many many months to complete. We submitted the article, which was published in a journal called Circulation. Circulation is one of the top journals for cardiovascular disease. The article was published in 1998. We actually conducted the study in 1994. In this first study, we looked at the effects of acupuncture in a model of demand-induced myocardial ischemia that can occur when you partially narrow a coronary vessel and then you increase the heart’s demand for oxygen, in our case by increasing blood pressure. But the blood flow in demand-induced ischemia cannot meet the increase in oxygen requirements because the vessel’s lumen was narrowed, like the situation of an atherosclerotic plaque that occurs in patients with coronary artery disease. We were able to demonstrate that acupuncture reversed the ischemia almost completely. It was very interesting. Dr Li returned 2 years later in 1996 and we started to look at the mechanism of the electroacupuncture effect to examine how it works. We showed endorphins and enkephalins play a role in this process. We published that article in American Journal of Physiology. So over time I gradually began to conduct acupuncture studies in my own laboratory and I started to change my opinion about using it as a possible therapeutic intervention. But overall, my acceptance of acupuncture as an acceptable therapeutic intervention was a process. It was not something that happened immediately. It was not as if a light bulb came up all of a sudden, and I understood that this was an important area to investigate. I guess my belief started to change as I studied the
actions and mechanisms of acupuncture. I was able to replicate my findings in my own laboratory. Presently we have published over 20 papers in this area, which represents quite a large number of studies and papers in this area of science. I then transferred to UC Irvine (1998) where I am located now. Dr Li was retiring from his position as Chairman of Physiology at Shanghai Medical University, now called Shanghai Medical College of Fudan University. This is a very good university. It is one of the top two or three universities in all of China. I asked him if he wanted to work with me at UC Irvine full time. He said, “Yes!” and brought his whole family over to America. We have been together ever since. He now is a major part of my research program. After he arrived we started to apply for large NIH grants from our federal government to fund our acupuncture research because in the USA, you cannot do the research unless you have substantial funding. Currently I believe we have the only two grants from the National Heart, Lung and Blood Institute to study acupuncture’s influence on blood pressure and the mechanisms that underlie its influence.

Question: How about the education of integrative medicine in the USA?

JCL: First of all, integrative medicine is a very broad area. It is much bigger than just TCM. Integrative medicine occupies a very small part of our medical student’s education. Mostly, they receive lectures related to Western medicine since our medical school is a Western medical school. However, in the last few years we have been able to introduce a few lectures in integrative medicine. I gave, for example, a lecture to all of the first year medical students on acupuncture and its influence on the heart and some of its other actions, for example in pain. The lecture I give is a very general lecture. Also, this last summer two medical students took summer research rotations with me. They have some time to conduct research between their first and second years of medical study. We also have residents who rotate through our integrative medicine clinic. I have undergraduate students who have not yet been admitted into medical school who work in my laboratory. There are about 20 students at any given time in my laboratory.
John C. Longhurst, Shaista Malik. Chapter. Tjen-A-looi SC, Fu LW, Guo ZL, Longhurst JC (2018) Modulation of neurally mediated vasodepression and bradycardia by electroacupuncture through opioids in nucleus tractus solitarius. Sci Rep 8:1900 PubMed PubMed Central CrossRef Google Scholar. Vaseghi M, Shivkumar K (2008) The role of the autonomic nervous system in sudden cardiac death. Acupuncture is a therapeutic technique and part of traditional Chinese medicine (TCM). Acupuncture has clinical efficacy on various autonomic nerve-related disorders, such as cardiovascular diseases, epilepsy, anxiety and nervousness, circadian rhythm disorders, polycystic ovary syndrome (PCOS) and subfertility. The identified 44 publications in this search were related to acupuncture basic study and central autonomic regulation. Among these 44 articles which met the criteria, 35 articles are in English and 9 articles are in Chinese. In this review, the underlying central mechanism of acupuncture-induced autonomic modulation is discussed based on basic studies that have been published in the past 5 years. John C. Longhurst, Stephanie Tjen-A-Looi, in International Review of Neurobiology, 2013. 5 Physiological and Molecular Mechanisms Contributing to Acupuncture’s Cardiovascular Effects. Application of EA for 30 min typically impacts cardiovascular function for 1–1.5 h (Li, Tjen-A-Looi, & Longhurst, 2010a; Tjen-A-Looi, Li, & Longhurst, 2006; Tjen-A-Looi et al., 2004; Zhou, Tjen-A-Looi, et al., 2005) and in this manner can be differentiated from brief somatosensory stimulation whose blood pressure effects last no longer than the period of. Auricular electroacupuncture can be done with small standard needles (3–4 cm long), which can be connected to the electrostimulator (see Section 5.8.1.2.3) along with all the other needles inserted into corporal APs. John C. Longhurst (UCI: University of California, Irvine) H-Index: 48. view all 3 authors... Modulation of Neurally Mediated Vasodepression and Bradycardia by Electroacupuncture through Opioids in Nucleus Tractus Solitarius. Jan 30, 2018 - Scientific Reports. 4.00. Electroacupuncture (EA) stimulation of somatosensory nerves underneath acupoints P5, ST36, ST37, LI16 or G37 selectively but differentially modulates sympathoexcitatory responses. We therefore hypothesized that EA-stimulation at P5 or ST more.