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Re: Testimonial

I have had the pleasure of working with the Center for Reproductive Medicine at the Cleveland Clinic since 2003—during several summer internships as an undergraduate student, in collaboration on many projects while studying abroad at medical school, and most recently, as a preceptor for the Summer 2010 student research internship program.

Few research programs provide students with the opportunity to immerse themselves into the inner workings of the house staff; however, from the beginning, this program made me feel that I was part of the team, with responsibilities and duties virtually indistinguishable from that of the research fellows. From my experience working at various hospitals and centers of excellence around the country, I have seen that it is very rare for students to become so involved and incorporated in a program's day-to-day activities. I was struck by the fact that even as an undergraduate student with no prior research experience, I was welcomed to be part of weekly meetings—not only observe, but share and participate in discussions and debates between the experts.

Internships were a rich and multi-faceted educational experience, where I received constant guidance and instruction. I was able to gain exposure to advanced Assisted Reproductive Technology laboratory techniques, participated in presentations and conferences, and authored several publications, and was always encouraged to learn and do more. Throughout my education with the program, I received an abundance of constructive feedback from Dr. Sajal Gupta and Dr. Ashok Agarwal. From my continued work with them, we developed a collaborative relationship. They gave me the tools and education to realize my potential, providing me with an endless number of amazing opportunities, both during and after my internships. Even outside of my time at the Cleveland Clinic, while completing my medical school degree, I was invited to work on journal reviews and book chapters that were later published. My time with the program taught me how to translate my academic knowledge into research projects in a meaningful and productive manner. As a result, I was able to significantly contribute to the following publications:

- 1) Gupta S, Agarwal A, **Sekhon L**, Krajcir N, Cocuzza M, and Falcone T. **Serum and peritoneal abnormalities in endometriosis: potential use as diagnostic markers.** *Minerva Ginecologica* 2006; 58(6):527-551.

This article reviews the literature regarding various immunological factors such as cytokines, growth factors, and adhesion molecules involved in the etiopathogenesis of endometriosis. Our review summarizes the literature regarding biomarkers, which may provide the means for reliable nonsurgical, non-invasive diagnosis.

A combination predictive model utilizing multiple biomarkers is proposed to assist in the early detection and monitoring of disease progression as well as its response to therapeutic treatments critical for its management.

- 2) Agarwal A, Gupta S, Sekhon L, and Shah R. **Redox considerations in female reproductive function and assisted reproduction: from molecular mechanisms to health implications.** Antioxidants and Redox Signalling 2008; 10(8): 1375-1403.

This literature review captures the role of reactive oxygen species in modulating a range of physiological functions and pathological processes affecting the female reproductive life span and menopause. Evidence suggests that oxidative stress plays a part in conditions such as polycystic ovarian disease, endometriosis, spontaneous abortions, preeclampsia, hydatidiform mole, embryopathies, preterm labor, and intrauterine growth retardation. As oxidative stress is deemed detrimental to both natural and assisted fertility, this article addresses many extrinsic and intrinsic conditions in assisted reproduction settings that can be tailored to reduce the toxic effects of reactive oxygen species.

- 3) Sajal Gupta, Lucky Sekhon, Nabil Aziz, Ashok Agarwal. **'The Impact of Oxidative Stress on Female Reproduction and ART: Evidence-based review'**. In: Antonis Makrigiannakis, Botros Rizk, Juan Garcia Velasco, Hassan Sallam, eds. Infertility and Assisted Reproduction. New York, NY: Cambridge UP, 2008; 178-186.

This book chapter discusses the interplay between reactive oxygen species and antioxidant molecules within the female reproductive tract. The physiological and pathological effects of oxidative stress in female reproduction and infertility are described and provide the rationale for the medical treatment of female infertility with antioxidant compounds.

- 4) Gupta S, Aziz N, Sekhon L, Agarwal R, Mansour G, Li J, Agarwal A. **Lipid peroxidation and antioxidant status in preeclampsia: a systematic review.** Obstetrics and Gynecology Survey 2009; 64(11):750-759.

Placental oxidative stress, resulting from ischemic reperfusion injury, is reported to be involved in the pathogenesis of preeclampsia, a complex multisystem disorder and leading cause maternal and fetal morbidity and mortality. There is a dearth of well-designed longitudinal studies investigating oxidative stress markers in preeclampsia. In this systematic review, we aim to establish whether there is evidence to link lipid peroxidation and antioxidant status with preeclampsia.

- 5) Sekhon L, Gupta S, Kim Y, Agarwal A. **Female infertility and antioxidants.** Current Women's Health Reviews 2010; 6.

Many studies have implicated oxidative stress in the pathogenesis of infertility causing diseases of the female reproductive tract. The aim of this study was to review the current literature on the effects of antioxidant therapy and to elucidate whether antioxidant supplementation is useful to prevent and treat infertility and poor pregnancy outcomes related to various obstetric and gynecologic conditions.

- 6) Gupta S, Sekhon LH, Agarwal A. **'Sperm banking: When, how and why?'**. In: Edmund Sabanegh. Male Infertility: Problems and Solutions (In press).

This book chapter provides a comprehensive and up-to-date review of the various indications for semen cryopreservation and an outline of the different patient groups for whom this therapy is most efficacious. Specific techniques of semen cryopreservation and their associated fertility success rates are discussed, alongside ethical considerations and possible reasons as to why this fertility preservation method remains underutilized.

- 7) Agarwal A, Sekhon L. **Oxidative stress and antioxidants for idiopathic oligoasthenoteratozoospermia: is it justified?** Indian Journal of Urology (In press).

This article reviews the current literature on the effects of antioxidant supplementation in subfertile males with idiopathic oligoasthenoteratozoospermia to improve fertilization and pregnancy rates. We examine various

antioxidant compounds, such as carnitine and vitamins C & E, as part of a strategy to modulate the level of oxidative stress in the male reproductive tract, which is implicated in impaired spermatogenesis leading to poor semen parameters and increased DNA damage and apoptosis.

- 8) Gupta S, Sekhon L, Kim Y, Agarwal A. **The role of oxidative stress and antioxidants in assisted reproduction.** Current Women's Health Reviews (In press).

Oxidative stress contributes to the high rate of failure seen in assisted reproductive techniques in achieving fertilization and pregnancy. This article explores the utility of metabolomics as a novel, non-invasive method of accurately and efficiently quantifying oxidative stress. This study reviews the current literature on the effects of antioxidant supplementation of IVF culture media and in patients to improve fertilization and pregnancy rates in patients undergoing assisted reproduction.

- 9) Agarwal A, Sekhon L. **The role of antioxidants in treating male infertility.** Human Fertility (In press).


This article is a review of the current literature on the effects of various antioxidants to improve fertilization and pregnancy rates in couples with male-factor infertility. The evidence outlined by this review is compelling and serves as a rationale for randomized control trials to confirm the efficacy and safety of antioxidant supplementation in the medical treatment of idiopathic male infertility.

- 10) Gupta S, Sekhon L, Surti N, Aziz N, Chandra A, Agarwal A. **Menopause: the role of oxidative stress and antioxidants in menopause-related health conditions.** Obstetrics and Gynecology Survey (Submitted).

This review provides information regarding the role of oxidative stress in menopause. The benefits of hormone replacement therapy in alleviating menopause-associated symptoms are assessed. Estrogen's dual role as both a prooxidant and antioxidant is explored. The current literature on the role of various dietary supplements and selective estrogen receptor modulating drugs is assessed as a means of reducing oxidative stress in postmenopausal women.

In summary, this program is ideal for motivated students that desire the opportunity to work with and learn alongside leaders in research and the field of reproductive medicine. I am extremely grateful for the guidance and help I have received from Dr. Gupta and Dr. Agarwal. I strongly feel that my time with the Center for Reproductive Medicine was the most valuable of all my educational experiences as an undergraduate and medical student. In addition to providing me with an initial chance to become involved in research and make a real contribution—it gave me the skills and confidence to pursue a career in academic medicine.

The Center for Reproductive Medicine has helped hundreds of students achieve their dreams. This has become increasingly apparent, through witnessing the immense advantage of being published on my applications to match into a competitive Ob/Gyn residency, and in seeing the high level of productivity of new students entering the program. Joining this program is a definitely a step in the right direction for any student completing a basic science undergraduate and/or medical degree with a view to excel in their career.

  
Dr. Lucky H. Sekhon

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Class of 2010

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