Preconception Care for Mothers:
A Functional Medicine Approach (Part 2): Thyroid Function

Attention: Young women, any women presently preparing for pregnancy, and all women who are planning on becoming mothers at some point! Here-ye, here-ye: Any women over 35 who are concerned with the possibility of preventing Down's syndrome in offspring. Any women who want to get their pre-pregnancy body and energy back? What about any women beginning or going through menopause? Then this article is a must read!

In the September 2007 newsletter, I reviewed the association of DNA oxidation with the development of Down's syndrome. In that issue, I also discussed a simple urine test for measurement of DNA oxidation, with a brief discussion of preventive measures for Down's syndrome (DS) in utero.

In this issue, I will review the association of maternal thyroid gland dysregulation with the in utero development of DS. I will conclude with practical steps for preventing maternal thyroid dysregulation resulting in possible prevention of DS.

WHAT ARE THE BASICS OF THYROID FUNCTION?

Having to tackle such a complex topic for the broad scope of readers of this newsletter and bring the concepts to a level understandable to the average health care consumer is no easy task. Because of this, I've tried to interject humor into the explanation whenever possible. Some of you will find this basic explanation of thyroid function as too detailed, while readers with endocrinology training may find this as juvenile. Nevertheless, please follow through with this brief, simplified explanation of thyroid function so as to understand the importance of proper maternal thyroid function on the developing child.

Pituitary Gland Control of the Thyroid

One of the many hormones released by the pituitary gland in your head is called Thyroid Stimulating Hormone (abbreviated TSH), also known as thyrotropin. TSH travels in the blood to the thyroid gland and stimulates the thyroid gland to release thyroid hormones.

Thyroid Hormones: A Numbers Game-T4, T3, T2, rT3

The thyroid gland is located in the neck under the Adam's apple. It produces the hormones thyroxin (also known as T4, or technically tetra-iodothyronine), T3 (technically called tri-iodothyronine) ,reverse-T3 (abbreviated rT3) and a tiny bit of T2. 90% of thyroid hormone made is T4. T4 is a prehormone and does little until it is activated within our body's cells. About 10% of thyroid hormone made is T3. T3 is the active form of thyroid hormone and is five times more powerful than T4. Most of the active thyroid hormone our body uses each day is from our body's cells converting T4 to T3.

Reverse-T3's function is analogous to the brakes on your car. If you are going too fast you want to step on the brakes before you crash. Analogously, rT3 puts the brakes on the conversion of T4 to T3 if too much T3 is made for the present conditions. In times of severe stress, rT3 is a protective mechanism which slows our metabolism so a person can survive longer

without food or water. With prolonged stress, maladaptation can occur with too much rT3 produced resulting in hypothyroidism. There are other mechanisms by which hypothyroidism can occur, but for the scope of this present discussion only a couple of mechanisms are mentioned.

"Finicky Receptors": Cell Receptivity to Thyroid Hormones and Genetic Expression

Every cell in the body has a cell nucleus. The nucleus contains the DNA of the cell. DNA is the key component in genetic functions of a cell. Receptors for thyroid hormones are on the cell nucleus. In simple terms, the nuclear receptors function is to allow the thyroid hormones to read the instructions to the DNA so the DNA will carry out the functions in the cell that the thyroid hormone tells it to. When the DNA has received the instructions and the thyroid hormones functions on the cell are manifested, then we say there is genetic "expression" of thyroid hormone function. There are various types of nuclear receptors to thyroid hormones, and the number of the receptors can vary. Under certain conditions, such as chronic stress, nuclear receptors can be resistant to thyroid hormones. With "unreceptive" receptors, even though the body may produce enough thyroid hormones low thyroid function can result. It's analogous to a finicky young woman who is not receptive to the advances of a young man...no matter how much he tries to gain the affection of the woman, if she isn't receptive to him, she won't "express" any interest.

When Thyroid Go's Wild! (...and its partner the Adrenal's too!)

Thyroid dysfunctions are related not only to the thyroid gland itself, but also to a range of secondary metabolic factors associated with poor nutritional status and unhealthy aging. A common association is adrenal gland dysfunction altering thyroid gland function. This is often seen in women having difficulty becoming pregnant, pregnant women over 35, in new mothers and in the elderly.

Many times what goes wacky first are the adrenal glands, then the thyroid. Adrenal gland function is most accurately evaluated with samples of adrenal hormones taken from a person's saliva. This is termed "salivary hormone testing", or as I tell my patients the "spit tests". Conventionally, blood cortisol levels are used to test adrenal gland function. If that test shows a low or high normal or is slightly out of normal range, the ACTH stimulation test (via blood testing) is used to check the pituitary glands effect on adrenal function. The problem is that test is often normal until the adrenal glands are almost non-functional. Therefore a person's adrenal function is often declared "normal" even when it's not functioning well.

Salivary adrenal testing gives more accurate information of the adrenal's function because it measures the more normal day to day function of the adrenal glands.

"Testing, Testing, One-Two-Three"

As opposed to "spit tests" for adrenal gland hormones, all of the hormones associated with thyroid function can be accurately measured in the blood. Most of these blood hormone levels are relatively constant during the day, but there are fluctuations based on the time of day blood is taken: With TSH a peak occurs during the night and the low occurs between 10 am to 4pm.[1] Because of this, to get a relatively stable baseline measurement it is best to measure thyroid-associated hormone levels in the middle of the day. If you are unable to measure mid-day, at least have the blood levels measured at the same time of day for comparison testing.

Often, many doctors screen for thyroid problems with TSH only. Also, measuring a full functional thyroid panel (TSH, total T3, free T3, free T4, and reverse T3) is often expensive. However, misdiagnosis is more expensive in terms of the effect on a person's life than inadequate testing. In the case of mothers-to be, misdiagnosis is also very "expensive" for the developing child. As you will soon see, we sure better check more than TSH though because many problems will be missed, possibly effecting the entire life of a child!

Summary of Thyroid Function

In summary, the basic function of the thyroid gland is that of a thermostat for our metabolism. Of great importance, the thyroid hormones particularly T3 influences proper function of the "cells power plants", the mitochondria. Without good mitochondrial function the cells will not have energy to carry out their functions. Thus all cells in the body are affected by the thyroid gland's effects on metabolism.

WHAT ARE THE EFFECTS OF MATERNAL THYROID DYSFUNCTION?

Fetal Brain Development

Thyroid hormones are intricately involved in the development of the nervous system in the fetus, in neonates (newborns) and children. (Authors note: I prefer to use the term "developing child" rather than "fetus" since I hold to the fact that life begins at the moment of conception. However I use the term fetus for clarity). Hypothyroidism in pregnant women and neonates has potential lifetime impacts on the child's cognitive function, speech, hearing, coordination and behavior.[2] Also, T3 stimulates genes that regulate processes of growth of the brain's physical structures.[3]

IS THERE A CONNECTION WITH MATERNAL GLUTEN SENSITIVITY AND DOWN SYNDROME (DS)?

Down Syndrome and Thyroid Auto-antibodies

First let me define a key term: "Thyroid Auto-antibodies". These are antibodies that attack a persons own thyroid gland. These are *not* antibodies made against your 1998 Honda!

Down syndrome children have a congenital gut (gastrointestinal tract or GI tract) abnormality called Celiac disease which results in food intolerances to gluten containing grains. There are many people who have gluten sensitivities, but Celiac disease is the most severe manifestation at the end of the continuum from sensitivities to intolerances. The congenital gluten intolerances in DS suggest a potential connection between gluten sensitivity and thyroid auto-antibodies. Auto-antibodies to the thyroid gland are one of many results of gluten sensitivities or intolerances. A 2001 study suggests that the effect of dietary antigens, such as those produced by gluten sensitivity or intolerance may be the stimulus for altered immune responses resulting in impaired brain development and cognitive performance in DS.[4]

Maternal thyroid auto-antibodies could be a trigger for the genetic chromosomal abnormality in the fetus manifesting as DS. It is established that thyroid hormones are intricately involved in the development of the nervous system of the fetus. Thyroid disorders from auto-antibodies to the thyroid are prevalent in adults with celiac disease. A 2001 study in The American

Journal of Gastroenterology reports there is a high prevalence of thyroid disorders in untreated adult celiac disease patients and that gluten withdrawal may single-handedly reverse the disease[5]. Additionally a 1999 article describes a woman with reversal of Hashimoto's thyroiditis when gluten was withdrawn from the diet.[6] Therefore pre-pregnancy gluten withdrawal in those women with either gluten sensitivities or celiac disease may prevent the chromosomal abnormality resulting in DS.

Down Syndrome Children Have High Thyroid Auto-antibody Levels

Even though DS is a genetic disorder, there is further evidence supporting the possibility of prevention of DS by pre-pregnancy maternal gluten withdrawal in women with gluten sensitivities. Throughout the clinical literature it is well established that DS children commonly have high levels of thyroid auto-antibodies.[7],[8] Could this be the result of in-utero DNA damage as a result of maternal gluten sensitivity from thyroid auto-antibodies?

IS IMPAIRED XENOESTROGEN DETOXIFICATION ASSOCIATED WITH THYROID DYSFUNCTION?

Almost everyone has Toxic Xenoestrogens

In the June 2007 issue of this newsletter, we discussed the effect xenoestrogens have on breast cancer development. Xenoestrogens (pronounced "zee"-"no"-"estrogens") are defined as synthetic substances commonly found in the environment of modern society that differ from those produced by living organisms that have estrogen-like effects. According to government sanctioned research, as reviewed in the June 2007 issue, almost 100% of the U.S. population has at least five of these xenoestrogens in their tissues.

Xenoestrogens Impair Thyroid Function

Many xenoestrogens induce increased phase I detoxification activity. For a layman's explanation of phase I detoxification, I refer you to my June 2007 breast cancer prevention article. Studies suggest that the toxins dioxin, PBDE's and other xenoestrogens contribute to faster rate of clearance of thyroid hormone from the body, increasing the need for the thyroid gland to produce more to maintain normal tissue levels.[9] As more thyroid hormone is cleared faster than it can be made by the thyroid, blood T4 and T3 levels will decrease.[10] The bottom line is with imbalanced detoxification the cells have less available thyroid hormone.

Impaired Thyroid Function and Down Syndrome

As previously confirmed, thyroid hormones are intricately involved in the development of the fetal nervous system. With less maternal thyroid hormone available this too could be a mechanism resulting in chromosomal abnormalities underlying DS.

"WHAT STEPS CAN I TAKE TO PREVENT MATERNAL THYROID DYSFUNCTION?"

Every woman, particularly those trying to get pregnant who are over 35 years-old, should consider taking the following steps to prior to becoming pregnant to prevent thyroid dysfunction during pregnancy:

1. *Improve xenoestrogen detoxification.* A detoxification program focused on improving balanced phase I and phase II detoxification has a profound effect on not only thyroid dysfunction, but also gut dysfunction, loss of excess fat, and helps balance multiple hormones. I have many of my patients start on a 1 week detoxification program because most people feel significant improvement in most symptoms, greatly increased energy and almost everyone has a permanent loss of 6 to 8 pounds of mostly fat, much of that in their waist in that short period of time. This helps "jump start" the healing responses and motivates people to continue from these fast initial improvements.

2. *Get adequate nutrient precursors for T4 formation.* Iodide is a limiting nutrient in the production of T4. Sea vegetables, for example seaweed, have organic iodide.

3. *Decrease thyroid auto-antibodies.* As previously discussed, gluten containing grains are associated with autoimmune hypothyroidism. Elimination of foods containing gluten and also dairy proteins that contain casein decrease the potential for maternal thyroid dysfunction.
4. *Improve conversion of T4 to T3.* Selenium in the form of selenium methionine is essential to this conversion. 200 mcg is advisable for most people. One big handful of raw brazil nuts has about this much selenium. For people with severe thyroid problems, supplementing with selenium is often necessary.

5. *Enhance T3 influence on mitochondrial energetics.* Selenium in the form of selenium methionine improves the production of T3 and lowers thyroid auto-antibodies.

6. *Improve T3 receptor binding.* The cell nuclear receptors interact with vitamin A, conjugated linoleic acid (CLA), and the omega-3 fats EPA and DHA. Rosemary extract has found to potentiate the effects on vitamin D. Zinc in the form of zinc glycinate promotes proper thyroid function through its role as a cofactor for the thyroid receptor of the cell nucleus. Grass-fed free-range beef is a good food source of CLA. Krill oil or fish oils are high in EPA and DHA. Fatty fish like salmon have significant EPA and DHA.

7. *Influence all of the above functions with a consistent combination of resistance and aerobic exercise!*

References

[1] Brabant G, Prank K, Hoang-Vu C and von zur Muhlen A. Hypothalamic regulation of pulsatile thyrotropin secretion. J Clin Endocrinol Metab 1991;72:145-50.
[2] Chan S, Kilby M. Thyroid hormone and central nervous system development. J Endocrinol. 2000;165:1-8.

[3] Strait K, Carlson D, Schwartz H, et al. Transient stimulation of myelin basic protein gene expression in differentiating cultured oligodendrocytes: a model for 3,5,3'-triiodothyronine-induced brain development. Endocrinology. 1997;138:635-41. (http://endo.endojournals.org/cgi/content/full/138/2/635)

[4] Licastro F, Mariani R, Faldella G, et.al. Immune-endocrine status and coeliac disease in children with Down's syndrome: relationships with zinc and cognitive efficiency. Brain Res Bull. 2001;55:313-17.

[5] Sategna-Guidetti C, Volta U, Ciacci C, et al. Prevelance of thyroid disorders in untreated adult celiac disease patients and effect of gluten withdrawal: an Italian multicenter study. Am J Gastroenterol. 2001;96:751-57.

[6] Valentino R, Savastano S, Tommaselli A, et al. Unusual association of thyroiditis, Addison's disease, ovarian failure and celiac disease in a young woman. J Endocrinol Invest. 1999;22:390-94.

[7] Rooney S, Walsh E. Prevalence of abnormal thyroid function tests in a Down's syndrome population. Ir J Med Sci. 1997:166:80-82.

[8] Kanavin O, Aaseth J, Birketvedt G, Thyroid hypofunction in Down's syndrome: is it related to oxidative stress? Biol Trace Elem Res. 2000;78:35-42.

[9] Fletcher N, Geise N, Schmidt C, et al. Altered retenoid metabolism in female Long-Evans and Han/Wistar rats following long-term 2,3,7,8-tetracholorodibenzo-p-dioxin (TCDD)-treatment. Toxicol Sci. 2005;86:264-272.

[10] Van Birgelen A, Van der Kolk J, Fase K, et al. Subchronic dose-response study of 2,3,7,8-tetracholorodibenzo-p-dioxin in female Sprague-Dawley rats. Toxicol Appl Pharmacol. 1995;132:1-13.

About the Author: Dr. Douglas Husbands graduated from San Francisco State University with a Bachelor of Science degree in Biology/Human Physiology in 1983. He later graduated from Cleveland Chiropractic College of Los Angeles in 1991. In 1996 he earned his post-graduate board certification as a Certified Clinical Nutritionist with the International and American Associations of Clinical Nutritionists, and in 2000 as a board certified Anti-Aging Health Care Practitioner with the American Board of Anti-Aging Health Practitioners. In 2003, he completed training in Functional Medicine with the Institute for Functional Medicine. Dr. Husbands has been sought for expert opinion by national health magazines and been published in peer-reviewed journals. He has taught many classes and lectured extensively to a wide variety of audiences on natural health topics and functional medicine. Dr. Husbands returned to his birthplace, the San Francisco Bay Area in 2004 and practices natural health care in San Carlos, CA.