

ALLERGIES AND HORMONES

According to some studies, allergies affect about one in five people worldwide, and affect up to 50% of people in developed nations. Allergies can manifest in many distinct forms—including contact dermatitis, allergic rhinitis, asthma, hay fever, and life-threatening anaphylaxis—but all allergies begin with the same underlying problem: an immune system that overreacts to a generally harmless threat, causing symptoms that range from mildly irritating to life-threatening. Many people don't realize that hormones can significantly impact the body's allergic response. Growing evidence suggests that hormones affect both the incidence and severity of many types of allergies.

Allergies cannot be cured, but they can be managed through a variety of different preventative and treatment methods. For the best treatment and management of allergies, it's important for patients and physicians to understand the role that hormones play in the development and symptoms of allergies.

How Allergies Work: The Allergic Response

The immune response is generally beneficial—for instance, when it defends the body against harmful bacteria. During an allergic reaction, however, the immune response is turned against a substance that is not actually dangerous through the following process:

1. First, the body is exposed to a protein (the allergen) found in something that seems harmless, such as pollen, animal dander, or food.
2. The body incorrectly identifies that protein as dangerous. This does not cause immediate symptoms, but the initial exposure to the allergen triggers the immune system to produce specific antibodies that will bind the protein if it shows up again, targeting it for attack.
3. The antibodies attach to special “defender” cells called mast cells. Mast cells are found in most body tissues, where they are prepared to respond if an allergen is detected.
4. During later exposures to the allergen, antibodies bind to it. This signals the attached mast cells to release an array of danger-fighting compounds, including histamine, a substance that causes inflammation in the surrounding tissue; leukotrienes, which also stimulate inflammation; and cytokines, chemical messengers that recruit other cells to help fight the invader.
5. The result? Specific symptoms depend on the severity and location of the immune response, but they can include redness, itchiness, a stuffy nose,

wheezing, coughing, sneezing, and swelling.

6. If this inflammatory response continues too long, it can damage the surrounding tissues and eventually lead to chronic diseases such as asthma.

Allergies can take many different forms, depending on the specific allergy symptoms and where the allergic response takes place. *Allergic rhinitis* (hay fever,) *allergic conjunctivitis* (an eye infection,) and *asthma* are all reactions to inhaled allergens such as pollens and animal dander. Allergic rhinitis refers to inflammation of the nasal passages; allergic conjunctivitis is inflammation of the eye; and asthma is the inflammation and constriction of airways.

Several types of *dermatitis* (skin rash) are caused by contact with allergens, such as animal dander and nickel. Other types of dermatitis can be caused by allergic reactions to foods such as wheat, soy, and dairy products. *Urticaria* (hives) are another form of allergy caused by contact with the allergen.

Systemic anaphylaxis, or allergic shock, is a whole-body allergic reaction that can be life-threatening. Anaphylaxis is a rare reaction, usually to foods, medications, or insect venom.

Allergies appear to have multiple different causes, including both a genetic component and something in the environment that triggers a response. For most of the different allergy types, connections between hormonal changes and allergy symptoms have been observed. Food allergies and anaphylactic shock are exceptions: for these allergic responses, the only way to avoid the reaction is to avoid the trigger.

Since hormones can have a significant impact on both the incidence of allergies and the severity of allergy symptoms, gaining a better understanding of how hormones affect the body is important for effective allergy management.

Hormones Impact Allergies

The body's hormonal system and immune system are intertwined like the strands of a complex web. They use many of the same chemical messengers, and changes in any of the individual components can affect the rest of the system. That means that anything that affects the balance of hormones in the body can impact the immune system as well—and anything that affects the immune system can also affect allergies, which are basically misfired immune responses.

Hormone level fluctuations and regulation can have a significant impact on both the incidence of allergies and the severity of allergy symptoms. Although the mechanisms are not always well understood, changes in hormone levels are frequently associated with the development of allergies or changes in allergy symptoms, particularly for hay fever, asthma, and dermatitis. Many factors can influence hormone levels, including natural physiological changes, some types of medications, and stress.

Naturally-Occurring Changes in Hormones

Puberty, a young person's physical transition from child to adult, is one of the points when body hormones naturally change. It begins when a portion of the brain triggers the release of hormones from the pituitary gland and the adrenal glands. In females, levels of progesterone and estrogen increase; males begin testosterone production. Although scientists do not yet understand how these and other hormonal changes affect allergies, puberty has been observed to trigger the onset of allergies in some individuals. In others, it can worsen or improve allergy symptoms.

Another naturally-occurring influence on the body's hormone levels is the female menstrual cycle. Levels of the hormone progesterone increase immediately prior to the start of menstruation and remain high until it ends. Up to 40% of women find that their asthma symptoms worsen during this timeframe. One study also found a connection between the development of allergies and irregular menstrual cycles. In this study, women who had irregular menstrual cycles were 29% more likely to develop hay fever and 54% more likely to develop asthma.

Progesterone and estrogen levels also change during pregnancy—another time when allergy symptoms have been observed to change. About one-third of pregnant women with asthma experience no change in their symptoms, about one-third experience an improvement in their symptoms, and about one-third experience worsening of their symptoms.

During menopause, a woman's ovaries decrease production of estrogen and progesterone. Just as changes in the levels of these hormones during puberty, menstruation, and pregnancy can affect allergies, their decrease during menopause can also cause allergy changes. Again, the mechanism is not well understood. Since different women appear to have different sensitivities to estrogen and progesterone, different women experience different effects on their allergies.

Another observation that supports the connection between hormone changes and allergies is in the incidence of autoimmune diseases. Autoimmune diseases, which are essentially an allergy to one's own cells or tissues, are three times more common in premenopausal women than in the rest of the population. This suggests the allergy/hormone connection, but again, does not explain how it works.

Stress-Induced Hormone Changes

Another significant influence on hormone balance is the body's reaction to stress. The stress response is an automatic, physical response to something an individual perceives as threatening, such as a speeding car, an upcoming math exam, or an

overdue bill.

The stress response originated as a way to prepare the body to respond physically to danger, either by fighting or fleeing; it is also known as the *fight-or-flight* response. Modern-day threats are more likely to be psychological than physical, but both types of threats trigger the same stress response.

In the short term, this physical response to stress is a natural and beneficial reaction. It primes the body to escape an immediate physical threat, possibly saving the person's life. However, the benefit is lost when an individual is exposed to chronically high stress levels. The physical changes that can improve performance in the short term have negative effects on health and mental processes in the long term. Numerous studies have shown that stress impacts the body's allergic response. Stress can trigger flare-ups of eczema, asthma, and atopic dermatitis. It can also worsen allergy symptoms and trigger or worsen autoimmune diseases.

Cortisol

The hormone cortisol is one of the key players in the body's response to stress. In the short term, it triggers a quick energy increase by releasing sugar into the bloodstream. It also causes a burst of immune system function. However, when cortisol levels remain high, as they can during chronic stress, it instead decreases mental performance, suppresses function of the thyroid gland, decreases immunity, decreases bone density, decreases muscle tissue, and increases blood pressure and abdominal fat.

Cortisol has so many functions, it can be difficult to tease out exactly how this hormone affects allergies. However, its roles in glucose metabolism, blood pressure regulation, blood sugar regulation, immune function, and the inflammatory response give it multiple routes by which it can impact allergic responses.

Prolonged periods of stress can cause cortisol levels remain elevated, so that some aspects of immune system function continue to be suppressed. This makes the person more susceptible to infections and illness. At the same time, other aspects of the immune system may become unbalanced, which can increase the risk of developing an autoimmune disease, in which the immune system attacks the body's own cells.

Cortisol's connections to other body systems mean that it can influence allergies through other routes as well. One of these routes is through the hormone progesterone, which is used to make cortisol. When high levels of cortisol are produced, progesterone is depleted. This disrupts progesterone's balance with estrogen, which can lead to changes in allergies.

Cortisol's role in blood sugar regulation might also indirectly affect allergy symptoms. Increased cortisol levels cause an increase in blood sugar. Increased blood

sugar causes increased production of insulin, the hormone responsible for moving sugar out of the blood and back into cells. However, often the overly-high blood sugar triggers over-production of insulin, which in turn causes blood sugar to plummet—triggering release of more cortisol.

Cortisol has another important role: regulation of the inflammatory response. It decreases inflammation, and so keeps the immune system from over-responding to a perceived threat. However, some patients with atopic dermatitis have decreased cortisol levels after stress. If stress makes less cortisol available to turn *off* the allergic response, these individuals will have worsened allergic responses when stressed.

Allergies and Stress Reduction

The good news for allergy patients is that stress-reduction techniques don't just help them to "feel" less stressed. They actually affect the underlying hormone changes associated with stress, and so help in the management of allergies and allergy symptoms that are worsened by stress. In order to maintain healthy levels of cortisol, it is important to activate the body's "relaxation response" after the fight-or-flight response has been activated.

Many stress reduction techniques activate this relaxation response, helping people to maintain healthy levels of cortisol. Stress reduction can take the form of lifestyle changes to reduce overall stress and improve nutrition. It can also take the form of stress management, through activities such as exercise, yoga, meditation, breathing exercises, journaling, and guided imagery. In fact, one study showed that laughter—from watching a funny movie—counteracted some of the allergy-related effects of stress!

Hormones and Allergy Treatment

Since hormones play such an important role in regulating the incidence and severity of allergies, it's not surprising that they also play a role in allergy treatment. Synthetic hormones are used to treat many types of allergies.

Corticosteroids are a group of hormones that are produced by the outer layer of the adrenal gland. This group includes cortisol, and all its members have broad anti-inflammatory effects. Inhaled synthetic corticosteroids are the primary maintenance medication used for asthma prevention. Corticosteroids can be injected for the systemic treatment of inflammation associated with allergies or asthma, or applied topically to treat localized inflammation.

Adrenaline, also known as epinephrine, is a naturally occurring hormone released by the adrenal glands in response to stress. It triggers an increase in heart rate

and increased blood flow to muscles and the brain, activities which counter some of the symptoms of anaphylaxis, also known as allergic shock. Synthetic adrenaline, or epinephrine, is used to treat anaphylaxis; for this reason, people with severe allergies will often carry self-administered epinephrine (such as an EpiPen) in case of exposure to a life-threatening allergen.

Hormone Allergies

Recent research suggests a more direct connection between hormones and allergies in certain individuals: they become allergic to their own hormones, so changes in those hormones trigger allergic reactions. When the body develops an allergic response to its own naturally-occurring hormones, a variety of allergic symptoms can occur.

In some women, the hormones progesterone and/or estrogen can cause an allergic response. In some, the allergy manifests with skin symptoms such as acne and eczema, a condition called estrogen dermatitis. Symptoms of estrogen dermatitis occur during the two weeks after ovulation or when women are undergoing estrogen replacement therapy. Sensitivity to estrogen can usually be detected by a simple skin test. Treatment depends upon the severity of the symptoms. Some women find that taking an antihistamine during the problem timeframe provides enough relief; others may need to discontinue estrogen therapy. More severe cases are treated with anti-estrogen medication or even by removal of the ovaries, which produce estrogen.

Other studies have found that many women with menstrual symptoms such as acne, asthma, migraine headaches and allergic rhinitis have antibodies to the hormones progesterone and estrogen in their blood. This suggests that the symptoms might be caused by an allergy to their own hormones.

Some patients have also been observed with allergies to synthetic hormones used for the treatment of allergies. One study found that when allergic dermatitis patients did not respond to treatment with topical hydrocortisone, the cause was often an allergy to hydrocortisone. Since hydrocortisone and other corticosteroids are used in the treatment of many different types of allergies, allergies to these hormones undoubtedly interfere with other allergy treatments as well.

Allergies and the Human Immune System: A Complex Relationship

Given the complexity of the human immune system, it will be years before a complete understanding of the allergy-hormone connection emerges. However, a clear link between the two exists, making it critical to consider possible hormone complications when planning allergy treatments.

Resources

The Mayo Clinic.com (www.MayoClinic.com): This web site contains a searchable database of different diseases and conditions, which provides detailed information on different types of allergies.

All Allergy Net (www.allallergy.net): This web site provides a well-organized gateway to a wide variety of allergy web sites.

National Institute of Allergy and Infectious Diseases (www.niaid.nih.gov): This site collects information, resources, and news about asthma and allergies.

Roby Institute (<http://www.onlineallergycenter.com/>): This web site describes some of the latest information, theories, and treatment for hormone imbalances and hormone allergies.

References

1. "Puberty: Physiology." Geneva Foundation for Medical Education and Research.
<http://www.gfmer.ch/Endo/Lectures_10/Puberty_%20Physiology.htm#Adrenal%20Steroids> (Accessed October 31, 2007.)
2. Shiel, William C., Jr., MD FACP FACR. "Cortisone Injection (Corticosteroid Injection) of Soft Tissues & Joints"
<http://www.medicinenet.com/cortisone_injection/article.htm>
(Accessed November 1, 2007.)
3. "Endocrinology Health Guide: The Adrenal Glands"
<<http://www.umm.edu/endocrin/adrengl.htm>> (Accessed November 1, 2007.)
4. "Anaphylaxis."
<<http://www.mayoclinic.com/health/anaphylaxis/DS00009/DSECTION=6>>
> (Accessed November 1, 2007.)
5. University of Texas at Austin. "Evidence Of Estrogen And Progesterone Hormone Allergy Discovered." *ScienceDaily* 30 March 2006. 5 November 2007
<<http://www.sciencedaily.com/releases/2006/03/060330182210.htm>>
(Accessed November 4, 2007.)
6. Roby, Russell, M.D., J.D. "Hormone Imbalance – Hormone Allergy."
<http://www.onlineallergycenter.com/treatments/hormone_imbalance.htm> (Accessed November 4, 2007.)
7. Wurtzman, Mitchell. "New clues to premenstrual skin flare-ups." *Total Health* 17 n.6:16, 1995.
8. Bell, John R. "Some women may be allergic to hormones." *OB GYN News* 41.9:19, 2006.
9. Association of Operating Room Nurses, Inc. "Allergy research findings reported in 2004." *AORN Journal* 81.1:14, 2005.
10. Wilkinson, S.M., P.H. Cartwright, and J.S.C. English. "Hydrocortisone: an important cutaneous allergen." *The Lancet* 337:761, March 1991.
11. Tweed, Vera. "Women's health handbook take charge of your hormones: are your hormones wreaking havoc with your health?" *Better Nutrition* 68: 44, 2006.
12. "Prevalence and Incidence of Allergies." Wrong Diagnosis
<www.wrongdiagnosis.com/a/allergies/prevalence.htm> (Accessed

October 31, 2007.)

13. Warner, John O., *et al.* "Allergy Practice Worldwide: A Report by the World Allergy Organization Specialty and Training Council." *International Archives of Allergy and Immunology* 139:166-174, 2006.
<<http://content.karger.com/ProdukteDB/produkte.asp?Aktion=ShowFulltext&ArtikelNr=90502&Ausgabe=231588&ProduktNr=224161>> (Accessed October 31, 2007.)
14. Bouchez, Colette. "Can Stress Cause Weight Gain?" MedicineNet.com
<<http://www.medicinenet.com/script/main/art.asp?articlekey=56459>>
(Accessed October 31, 2007.)
15. "Stress: Unhealthy response to the pressures of life." Mayo Clinic.
<<http://www.mayoclinic.com/print/stress/SR00001/METHOD=print>>
(Accessed October 31, 2007.)
16. Starnbach, Michael N. "The Truth About Your Immune System (Harvard Special Health Report)." Harvard Health Publications, 2004.
17. "Understanding the stress response." In *Stress Control (Harvard Special Health Report)*. Harvard Health Publications Group, 2006.
18. Fishman, Henry J., M.D. "Female Hormones May Affect Allergies, Asthma." February 9, 2006. ConsumerAffairs.com
<http://www.consumeraffairs.com/news04/fishman/2006/allergies_hormones.html> (Accessed October 31, 2007.)
19. University of Texas at Austin. "Evidence Of Estrogen And Progesterone Hormone Allergy Discovered." ScienceDaily 30 March 2006. 5 November 2007
<<http://www.sciencedaily.com/releases/2006/03/060330182210.htm>>
(Accessed October 29, 2007.)
20. Yawn, Barbara P. "Asthma therapy: does your patient need inhaled steroids?." *Consultant* 43.9: 1073, 2003.
21. Roby, Russell R., Richard H. Richardson, and Aristo Vojdani. "Hormone Allergy." *American Journal of Reproductive Immunology* 55:307, 2006.
22. Robinson, Richard. "Anaphylaxis." *Gale Encyclopedia of Medicine*. Vol 1. 2nd ed. Detroit: Gale, 2002.
23. Smith, Lendon. "Allergies and other nasty stressors." *Total Health* 17:8, 1995.
24. "Allergy glossary." *Discover* 19:S10(1), 1998.
25. Shaw, Kendall R. Ph.D. "Asthma and Allergy." *Drug Store News* 20:49,

1998.

26. NewsRx.net. "Atopic dermatitis can be caused by psychological stress; immunity is altered." *Managed Care Weekly* Dec 15, 2003: 97.
27. Newman, Judith. "Misery for all seasons: allergies: a modern epidemic." *National Geographic* 209:5, 2006.
28. Hajime, Kimata. "Laughter counteracts enhancement of plasma neurotrophin levels and allergic skin wheal responses by mobile phone-mediated stress." *Behavioral Medicine* 29:4, 2004.
29. National Women's Health Resource Center. "Allergies and women's health." *National Women's Health Report* 24:1, 2002.