

Research Paper

Lowering Fel D1 in Cats in order to Reduce Effects of Allergens

By: Anum Amir

S-ANIM-001

Abstract:

What causes cat allergies? Is it really their fur? Although this may be somewhat true, this is not the complete dilemma. What humans are allergic to is a secretoglobin in cats known as Fel D1 which is produced in a cat's saliva and sebaceous glands. When cats groom themselves, the protein is spread. Eventually, Fel D1 acts as an allergen which causes allergic reactions. This project is an in-depth research on the different methods to lower Fel D1 cats through both human and cat diet, environment, and exposure for cat owners to live allergy free. This will be achieved by investigating GMO vs. non-GMO foods, microbial exposure during childhood, and molecular engineering data and results. Finding these simple alternatives will reduce the usage of painful desensitization. To gather more information, a specialized allergist will be sought to take this research further based on their experiences with this topic. This project will transform the relationship between cats and humans.

What are Allergies?

Allergies occur when your immune system reacts to a foreign substance or mistakes a harmless substance for an invader. Your immune system produces substances known as antibodies.

Antibodies are blood proteins that counteract antigens. When you have allergies, your immune system makes antibodies that identify this substance and then releases a number of chemicals which then causes allergy symptoms. When you come into contact with the substance, your immune system's reaction can inflame your skin, sinuses, airways or digestive system. Common allergy triggers are:

- **Airborne allergens**, such as pollen, animal dander, dust mites and mold
- **Certain foods**, particularly peanuts, tree nuts, wheat, soy, fish, shellfish, eggs and milk
- **Insect stings**, such as from a bee or wasp
- **Medications**, particularly penicillin or penicillin-based antibiotics
- **Latex or other substances you touch** can cause allergic skin reactions

The exact reason why some people have allergies and others don't is unknown however genetics and environment are two large factors. If parents have allergies, a child is more likely also to develop an allergy. Some environmental factors are smoking, pollution, infection, and hormones. Most people with asthma are allergic to the pollen in the air. Mainly, it depends on one's immune system.

Why are people allergic to cats?

In a cat allergy, it is not the cat's fur that causes symptoms but the protein that is found in its dander (dead skin cells), saliva, and urine. The fur collects dander and can also carry other allergens like dust mites, mold, and pollen. When those proteins get into your airways, eyes, nose, mouth, or on your skin, it triggers allergy symptoms.

Fel d1 (Feline Domesticus allergen)

The protein that causes allergy symptoms is Fel d1. Fel d1 is a protein produced largely in cat saliva and sebaceous glands (secretes oil in hair and skin). It is produced for skin protection and to transport lipids, steroids, hormones, and pheromones. The amount of protein produced is not related to weight, color, or breed although studies have shown that older cats produce less compared to younger cats. Additionally, females tend to produce less than males and castrated males produce more than non-castrated males. The saliva is transferred to their fur and dander when they groom which causes allergic reactions. The spread is even greater when fur is spread across the furniture.

Experiment:

To reduce the amount of Fel d1 produced, cats were fed a diet incorporating increased eggs which contain IgY (immunoglobulin). Their function is defense against infectious agents appearing in the bloodstream at high concentrations following exposure to an antigen. This is the primary antibody found in chickens. In a study, 97% showed decreased levels of active Fel D1 in their hair and dander. On average, cats showed a 47% reduction of active Fel d1 on their hair after three weeks on the diet.

Feeding cats chicken eggs won't take care of the problem because anti-Fel d1 IgY doesn't occur naturally in chicken eggs—the chickens have to be exposed to the Fel d1 protein.

And the researchers exposed the chickens in the study too much of it. They responded by producing antibodies and laying eggs that contained anti-Fel d1 IgY antigen.

Food

Cat food is generally made up of 6 main nutrient groups: water proteins, fats, carbohydrates, vitamins, and minerals. To achieve the right balance of nutrients, pet food manufacturers blend mixtures of ingredients including meat and fish, vegetables, cereals, vitamins and minerals to produce foods that will satisfy the nutritional requirements of cats.

GMOs in Cat Food (Genetically Modified Organisms)

King, I. (2014, September 8). *GMO in Cat Food: What You Should Know*. The Conscious Cat.

<https://consciouscat.net/gmo-cat-food-know/>

- Genetic modification has been focused on cash crops such as corn and soy, but more and more GMO foods are making their way onto our grocery and pet store shelves.
- The FDA does not require humans or petfood food companies to identify GMOs on product labels so we could be ingesting them without knowing (They have only been around for about 20 years)
- A growing body of research is linking these foods to health problems in both humans and animals: allergies, dermatitis, irritable bowel syndrome, inflammatory bowel disease, recurring vomiting and diarrhea, and abnormalities in the liver, pancreas and immune system function
- USDA-certified organic; The use of GMOs is prohibited in organic products (But organic food is expensive)

GMO Pet Food. (n.d.). Authentica Petfoods. Retrieved March 12, 2023, from

<https://authenticapets.com/en/blog/gmo-pet-food>

- Dr Stephanie Seneff from MIT, is pointing out, we can no longer ignore what is actually happening as the initial unintended consequences of engineering foods are no longer looking inconsequential. Instead what's becoming evident is that the side effects of GMO foods for both humans and pets and animals, in general, are looking lethal
- affecting a food's actual/natural nutritional value, having an impact on toxins and allergic effects that they've been banned in 38 countries
- changing nutrient profiles and natural selection and survival of the fittest (the science of classifying or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health)
- Laboratory studies show tumors in rats fed GE foods actually developed cancer faster and had higher mortality rates than rats fed a standard diet.
- Top 5 GMO foods: soy, corn, beets, rice, and canola (70% off all processed food contain GMOS + generically modified vaccines)
- Unfortunately, the biotech companies that profit from getting these GMO GE crops into the market are not required to do safety studies nor are they required to have independent third-party studies

GMO: Are genetically modified crops safe in your dog food? (n.d.). Wwww.thewildest.com.

Retrieved March 12, 2023, from

<https://www.thewildest.com/dog-nutrition/gmo-safe-your-dog-food>

- Commercial foods are manufactured at high temperatures and pressures which alters them as “potentially more allergenic.” Also, contain industrial ingredients that are “more likely to contain GMO and herbicide contaminants.
- Roundup, a herbicide with glyphosate, can be found inside corn and soy; residues of Roundup in food can interact with the damaging effects of other environmental toxins. “Negative impact on the body is insidious and manifests slowly over time as inflammation damages cellular systems throughout the body,”

Human Food

Kurzgesagt. (2017). Are GMOs Good or Bad? Genetic Engineering & Our Food [YouTube Video]. In *YouTube*. <https://www.youtube.com/watch?v=7TmcXYp8xu4>

- Our world could never survive without GMOs

Prevalence of Allergies and Asthma | AAAAI. (2022). Aaaai.org.

<https://www.aaaai.org/Tools-for-the-Public/Conditions-Library/Allergies/prevalence-of-allergies-and-asthma#:~:text=A%20leading%20theory%20behind%20the>

- “Hygiene Hypothesis”: This theory suggests that living conditions in much of the world might be too clean and that kids aren't being exposed to germs that train their immune systems to tell the difference between harmless and harmful irritants.
- Studies have shown that increased antibiotic use parallels the rise in allergy and asthma (changes in bacterial flora; the unique relationship between virus and host)
- Many experts believe that lifestyle changes associated with diet and activity are leading to rising rates of chronic diseases; increased obesity
- Children spend more time indoors which decreases exposure to sunlight (Vitamin D)

Xu, C. (2015, August 10). *Nothing to Sneeze at: the Allergenicity of GMOs*. Science in the News. <https://sitn.hms.harvard.edu/flash/2015/allergies-and-gmos/>

- The prevalence of childhood allergies has increased by more than 50% in the last 20 years
- establish the policy that any protein that has been shown or even suspected to cause an allergic reaction should never be introduced into GMO crops
- structure of the introduced protein should be compared to all known allergens. Potential allergenicity is then further analyzed with comprehensive experiments

Immunomodulators (treatments)

- medications act by directly changing the behavior of the immune system

Mueller, R. S., Jensen-Jarolim, E., Roth-Walter, F., Marti, E., Janda, J., Seida, A. A., & DeBoer, D. (2018). Allergen immunotherapy in people, dogs, cats and horses – differences, similarities and research needs. *Allergy*, 73(10), 1989–1999. <https://doi.org/10.1111/all.13464>

- Although subcutaneous immunotherapy is used for atopic dermatitis in cats

Pet allergy - Diagnosis and treatment - Mayo Clinic. (n.d.). www.mayoclinic.org.

<https://www.mayoclinic.org/diseases-conditions/pet-allergy/diagnosis-treatment/drc-20352198>

- **Antihistamines** reduce the production of an immune system chemical that is active in an allergic reaction, and they help relieve itching, sneezing and runny nose
- **Immunotherapy**. You can “train” your immune system not to be sensitive to an allergen

Bonnet, B., Messaoudi, K., Jacomet, F., Michaud, E., Fauquert, J. L., Caillaud, D., & Evrard, B. (2018). An update on molecular cat allergens: Fel d 1 and what else? Chapter 1: Fel d 1, the

major cat allergen. *Allergy, Asthma & Clinical Immunology*, 14(1).
<https://doi.org/10.1186/s13223-018-0239-8>

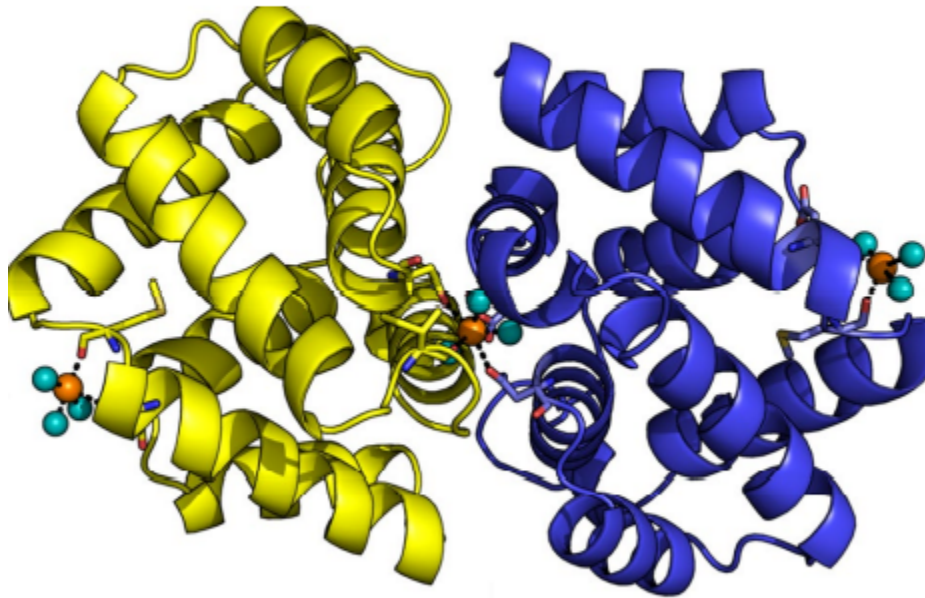
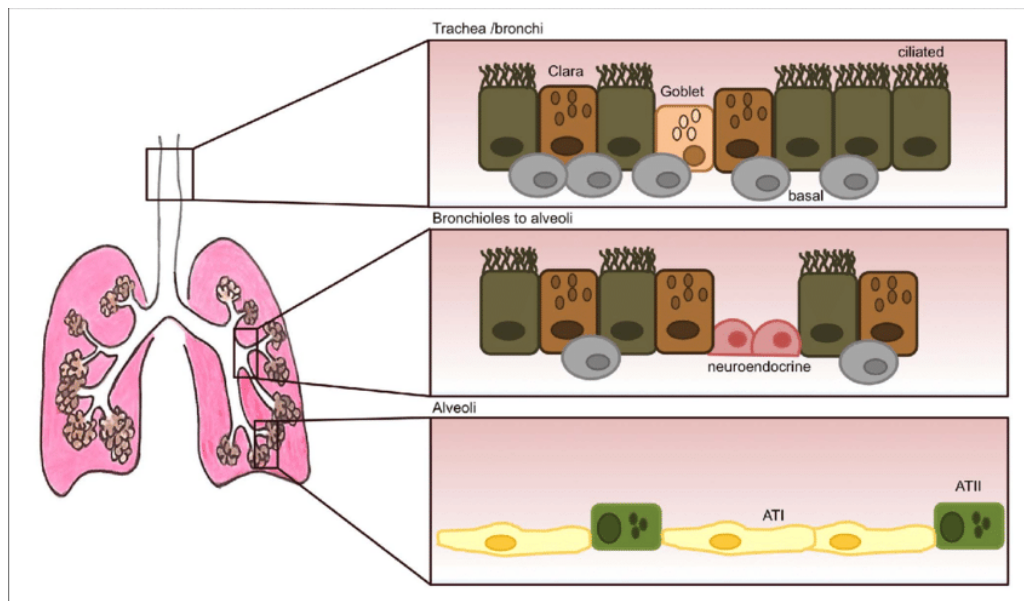


Fig. 1 Fel d 1 crystallographic structure highlighting the location of the calcium ions. From Ligabue-Braun et al. [16] reprints in open access



Secretoglobin - an overview | *ScienceDirect Topics*. (n.d.). www.sciencedirect.com. Retrieved March 14, 2023, from <https://www.sciencedirect.com/topics/neuroscience/secretoglobin>

Protein

Although all these requirements are needed, the most important is a protein (cats are obligate carnivores.) Cats use protein for energy when possible and need more of certain amino acids for building blocks of muscles and fuel bodily processes. Proteins are the building blocks of body organs and tissues, everything from cartilage and tendons to hair, skin, blood and of course muscles, and the heart. They can also function as enzymes, hormones and antibodies. The protein in cat food is broken down into key components called amino acids. A cat's body absorbs amino acids and puts them to use by creating new proteins or fueling other bodily processes. Taurine is a required component of proteins in cats and deficiency can contribute to various serious health problems.

How are proteins made?

Transcription: the process of taking a single gene of DNA and copying it into a structure called mRNA

Translation: Taking the mRNA to produce a protein

Additional References:

Allergies and asthma: Double trouble. (n.d.). Mayo Clinic.

<https://www.mayoclinic.org/diseases-conditions/asthma/in-depth/allergies-and-asthma/art-20047458#:~:text=Allergies%20and%20asthma%20often%20occur>

Food, U. P. (n.d.). *What's In Cat Food.* Www.ukpetfood.org. Retrieved January 21, 2023, from

<https://www.ukpetfood.org/resource/whats-in-cat-food.html#:~:text=They%20are%20water%20poteins%2C%20fats>

Matt. (2019). A Novel Approach to the Reduction of Cat Allergen Fel d1 Through Inclusion of an Egg Product Ingredient Containing Anti-Fel d1 IgY Antibodies in the Feline Diet. *EMJ Allergy Immunol.*

Allergy & Immunology 4.1 2019, 4(1), 40–46.

<https://doi.org/10.33590/emjallergyimmunol/10310972>

MayoClinic. (2018). *Allergies - Symptoms and causes.* Mayo Clinic.

<https://www.mayoclinic.org/diseases-conditions/allergies/symptoms-causes/syc-20351497>

Pet Allergy. (n.d.). Asthma & Allergy Foundation of America.

<https://aafa.org/allergies/types-of-allergies/pet-dog-cat-allergies/#:~:text=You%20are%20allergic%20to%20the>

Study shows a change in feline diet could curb cat allergies in people. (n.d.). Www.aaha.org.

Retrieved January 21, 2023, from

<https://www.aaha.org/publications/newstat/articles/2019-06/study-shows-a-change-in-feline-diet-could-curb-cat-allergies-in-people/#:~:text=The%20primary%20allergen%20that%20stimulates>