Nutrition and the Immune System: Advances, Implications and a Case Study
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A healthy immune system is central to the overall health and longevity of your dog. The immune system has been traditionally considered in anatomical terms. However, to completely appreciate its role, it has to be defined in functional terms- not just a collection of cells, tissue and organs, but a finely orchestrated combination of biological systems and processes, designed to protect your dog. Interestingly, significant amount of immune cells reside in the lining of the gut in what is referred to as 'gut-associated lymphoid tissue'. As a result, the diets you feed your dog interact with a substantial part of his immune system, making nutrition an effective means of influencing the immune system. We will discuss Nestle Purina's strategy at targeting the immune system via nutrition and describe how an immune-enhancing ingredient is evaluated, tested and formulated into diet, as a case-study in 'Research to Retail'.

Biographical Profile

Dr. Ebenezer Satyaraj earned a Doctor of Philosophy in Immunology from the National Institute of Immunology, New Delhi, India in 1996. He continued his training at the University Of Chicago, Illinois, as a Postdoctoral Fellow in Department of Molecular Genetics & Cell Biology doing research in Molecular Immunology. Dr. Satyaraj then accepted a teaching position at the Department of Medicine, Northwestern University Medical School in Chicago where he taught Immunology and conducted research in the area of autoimmunity. In 2001 he joined Molecular Staging Inc. a biotech company working in the area of disease biomarkers where he coordinated research collaborations with the universities and pharmaceutical industry. Dr. Satyaraj has authored numerous scientific and technical publications, including a recent publication in the Journal Science that explains size variations in dogs. Dr. Satyaraj joined Purina in 2003 where he currently serves as Research Scientist in the Nestle Research Center conducting research in the area of nutritional immunology & cytokine biology. He and his family live in Wildwood, Missouri.

Nutrition and the Immune System – conference notes

Two key ideas
- A healthy immune system is central overall health and longevity
- The immune system can be effectively modulated by nutrition

What we learn through genomics needs to be applied to the whole animal.

The immune system consists of a collection of cells, tissues and organs, that is part of a finely orchestrated combination of biological systems and process that protect the integrity of the organism from internal and external threats.
- Innate arm – primary defense
- Adaptive arm – secondary defense through recognition, optimization and memory processes (vaccines, etc)
The gut is the largest immune organ – the majority of the immune cells are in your gut - which makes it easier to moderate immune responses.

Why enhance immune health of a healthy animal?
Even in a healthy animal can have a deficient immune system. The young and the old have an immune system will not at its optimum level. Stress, fatigue and disease also alter immune system levels and thus responses.

Immunity gap in puppies
- Puppies’ immune system takes several weeks to months to fully develop
- Maternal antibodies from colostrum lasts for about 12 weeks
- Early vaccination are administered after 10-12 weeks to avoid interference from maternal antibodies
- For the first 12 weeks of age your pup is primarily protected by maternal antibodies
- Maternal antibodies, however, may not be sufficient even if the pup is weaned appropriately
  - Insufficient antibodies produced by mom
  - Inadequate intake of colostrum
  - Insufficient absorption of antibodies by the pup
  - Movement of pup to different geographic area

Modulating immune system
Genes and life stage are set and cannot be modulated, however lifestyle and diet can be modulated. Knowing that the majority of the immune cells are in the gut, make it easier to modulate.

Nutrition = immunity
1st stage – complete balanced nutrition
2nd stage – optimizing macro & micronutrients (selenium, Vit E, Vit D, etc) this stage is passive – giving ingredients for a strong system
3rd stage – Strengthening & training the immune system (the use of probiotics) this stage is active
4th stage – Personalized Nutrition, i.e. a dog with a compromised immune system – modulate the immune response

Examples of modulating immunity through nutrition:

Target physiology
- Discovery phase – research of products and identify ingredients that are safe and healthy
- Nutritional trials – design nutritional trials, confirm statistical power of studies
- Formulate diet – alter current products or modulate new products

Whey proteins – do they work for dogs?
- Antimicrobial activity
- Anticancer activity
- They are an excellent source of cystine and glutamine
  - Glutamine is preferred fuel for muscle and immune cells
  - Immune cells cannot synthesize glutamine
  - Exercise, stress can deplete glutamine making immune cells weak.
Nutritional trial
48 Alaskan sled dogs, 2-6 years of age
4 diets
  Control
  Test diet with WPC-1, WPC-2, WPC-3
Trial lasted four weeks
  Pretest, all animals given control food
  All animals given boosters
Immune and gut health measurement
  Immune analysis
  Gut health measurements – fecal measurements & analysis
Weight and blood profiles
  No change in weight or blood profiles
*dogs fed wpc1 & wpc3 showed improved immune response and local immune status
The immune system in animals fed diets with whey proteins is not hyperactive, it is responding appropriately and responding to stress as needed.

Test stress immune response
2 day rest
Begin training again – and analyze the gut microflora through testing fecal samples
  In the control group, there was a shift in microflora (only 50% similarity)
  In the test groups, there was no significant change in microflora (~80% similarity)
Therefore protein whey produced a stable gut under stress