Dietary management

of gastrointestinal diseases

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Philosophie
Museen
Vorklinische Medizin
Naturwissenschaften

Institute of Animal Nutrition

Dietary management of gastrointestinal diseases

- Intestinal diseases are an important topic in small animal practice

  - Etiology often multifactorial, diagnosis and therapy complex

    - Dietary support through effects on intestinal physiology

      - Intestinal microbiota
      - Intestinal immune system

Outline

Basic remarks on digestive physiology

Nutritional effects on the intestine, microbiota and the immune system

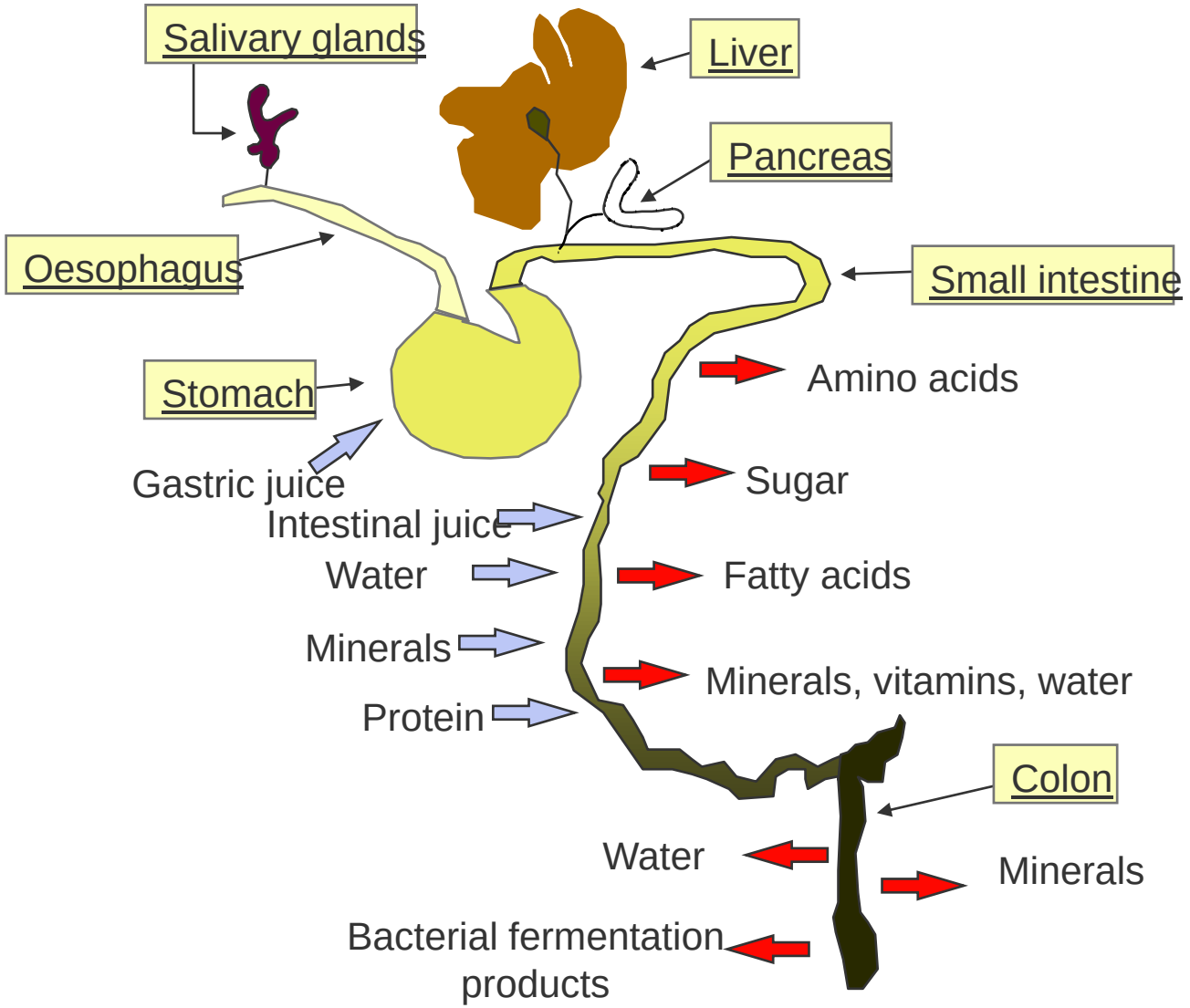
Dietetic principles and case studies

Dietary management of gastrointestinal diseases

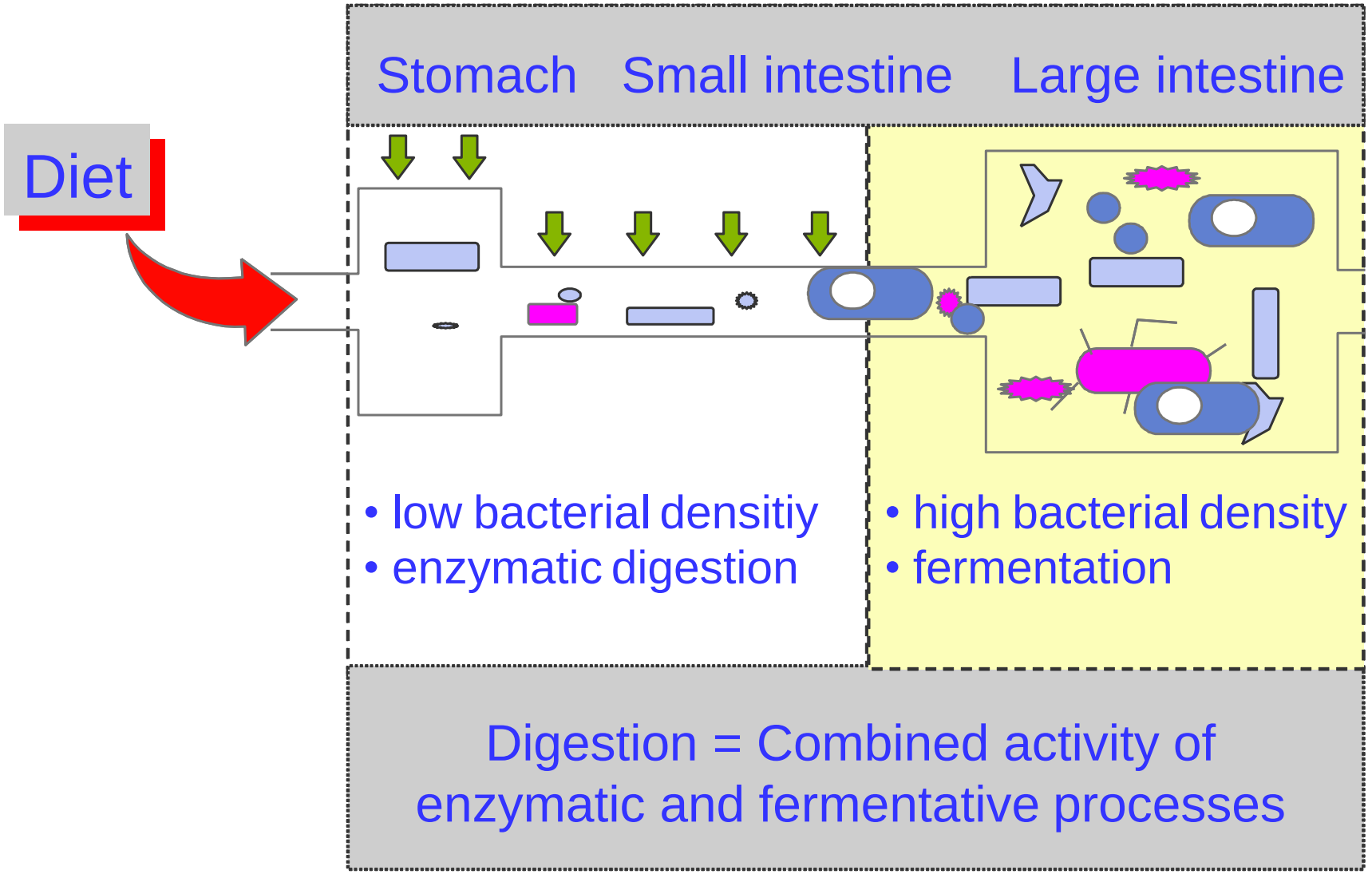
- Diet

  - Must meet the nutritional requirements
  - Possibly different from the healthy animal
  - Should support the management of the patient
  - Improve the symptoms
  - Functional support of the body's own healing processes

Dietary management of gastrointestinal diseases

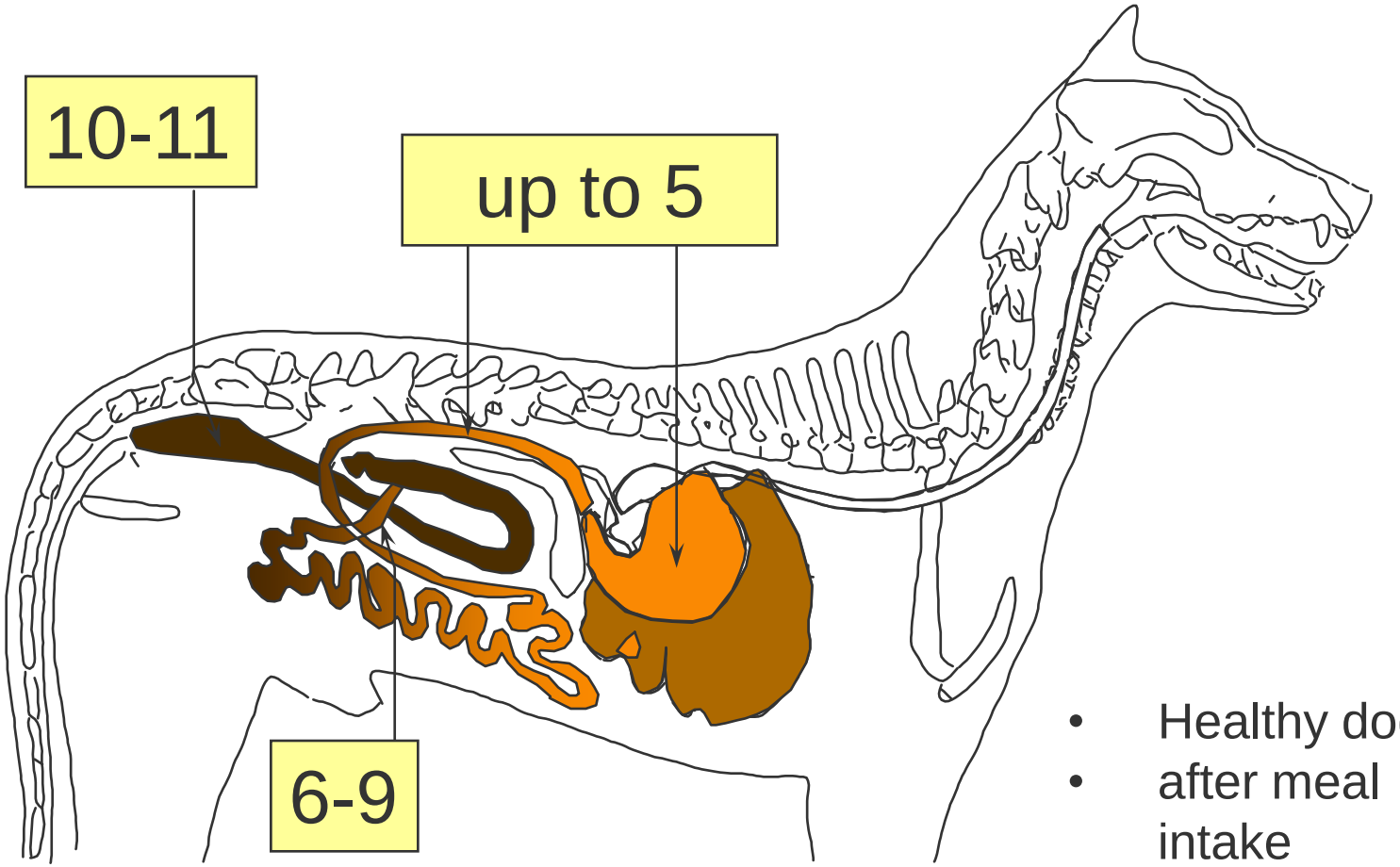


Dietary management of gastrointestinal diseases



Colonisation of the GI tract

Bacteria (log_{10} CFU/g)



- Healthy dogs,
- after meal intake

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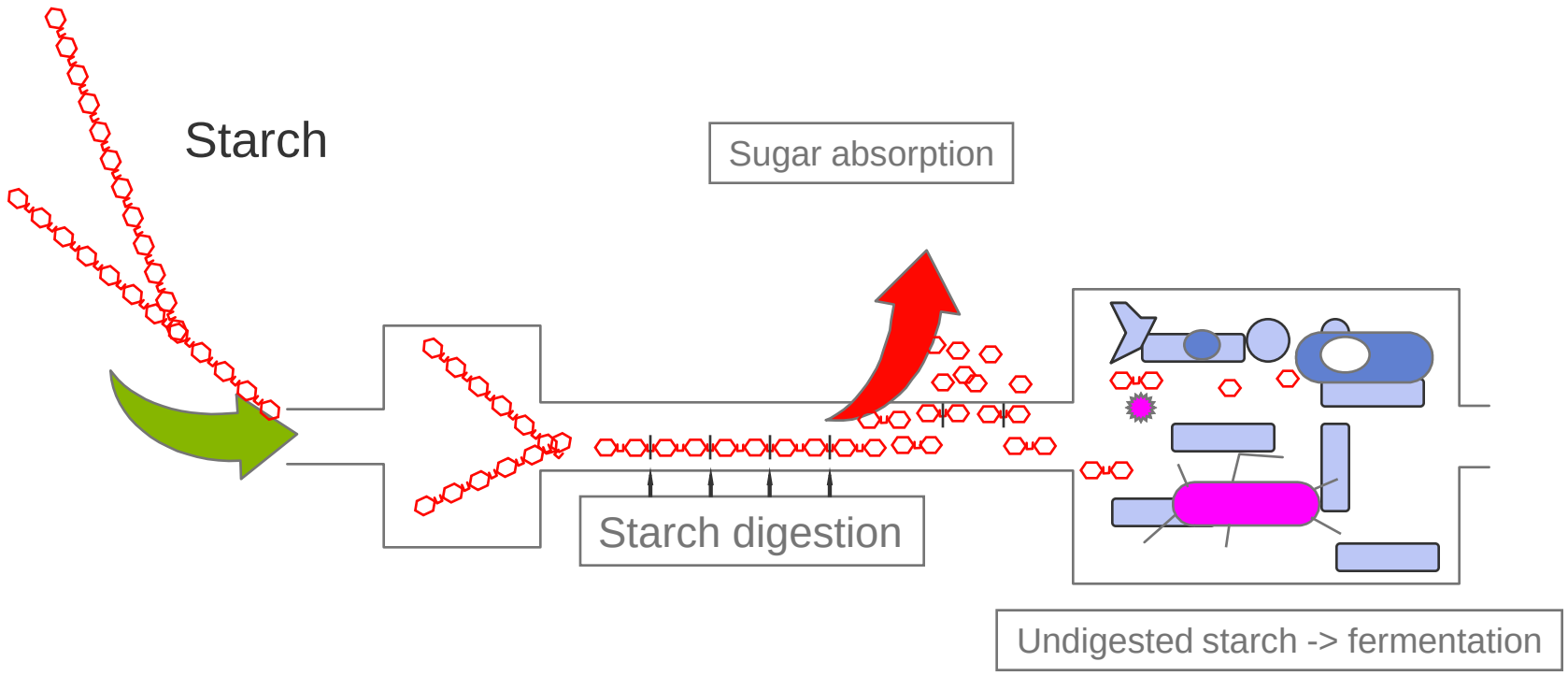
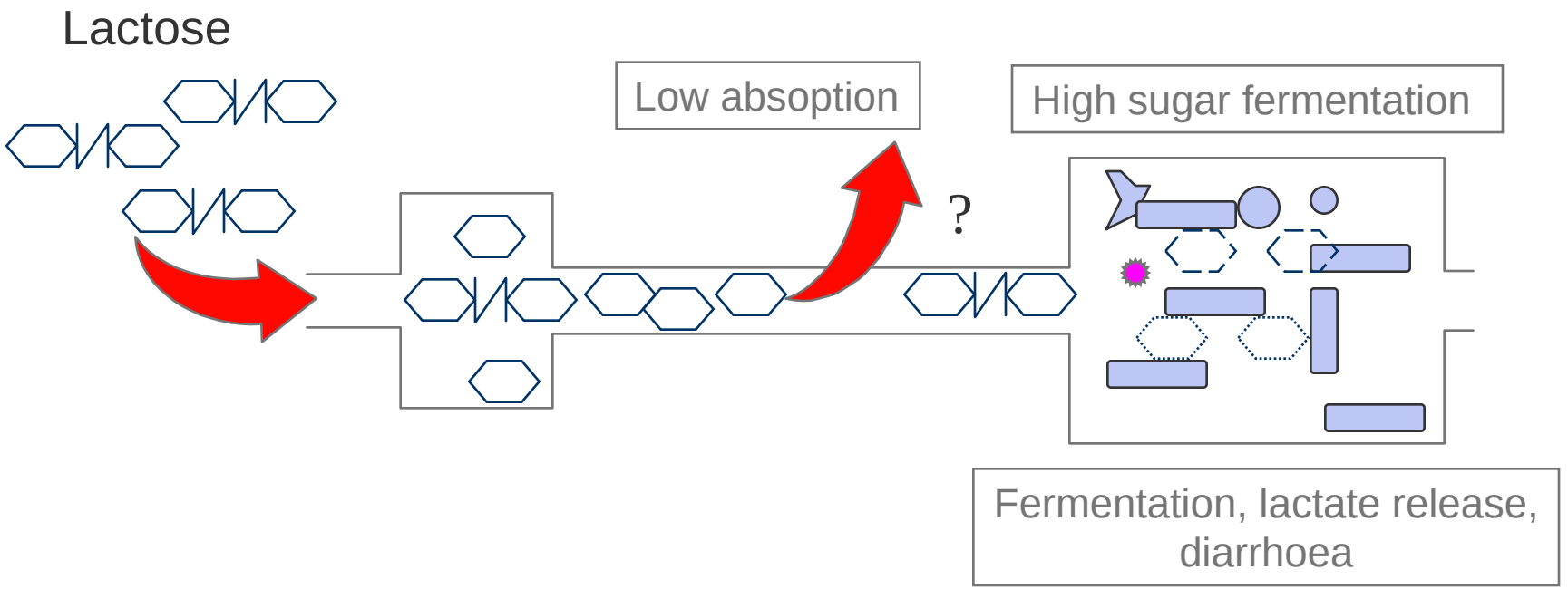
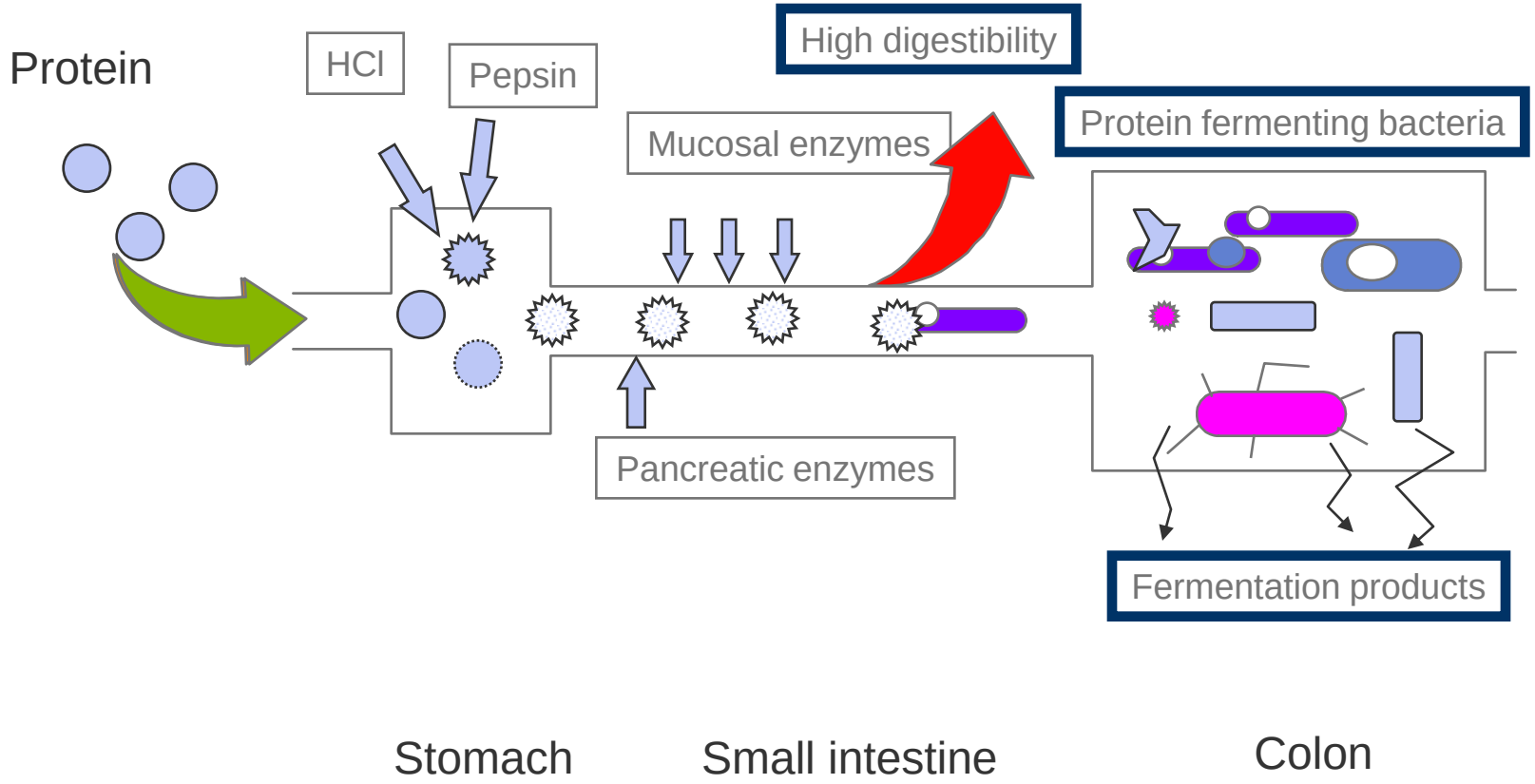
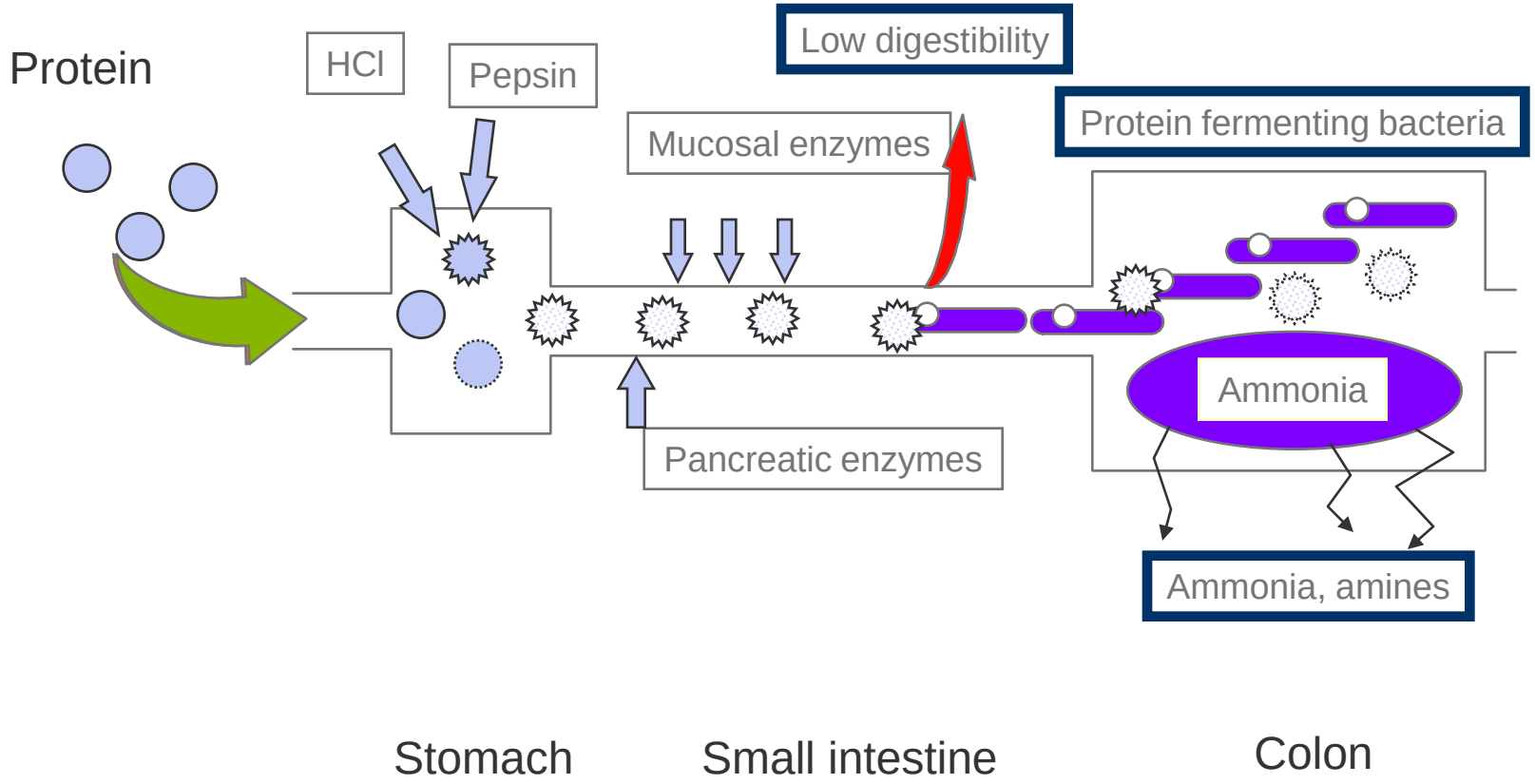

Starch
Sugar absorption
Starch digestion
Undigested starch -> fermentation
Stomach
Small intestine
Colon


Lactose
Low absoption
?
High sugar fermentation
Fermentation, lactate release, diarrhoea

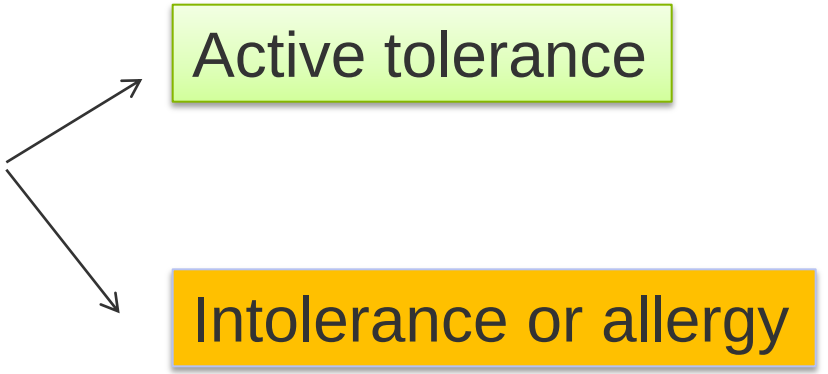

Protein
HCl
Pepsin
Mucosal enzymes
High digestibility
Protein fermenting bacteria
Pancreatic enzymes
Fermentation products
Stomach
Small intestine
Colon


Protein
HCl
Pepsin
Low digestibility
Protein fermenting bacteria
Mucosal enzymes
Ammonia
Pancreatic enzymes
Ammonia, amines
Stomach
Small intestine
Colon

Immune system of the gut

- Immune reaction

- Reaction pattern

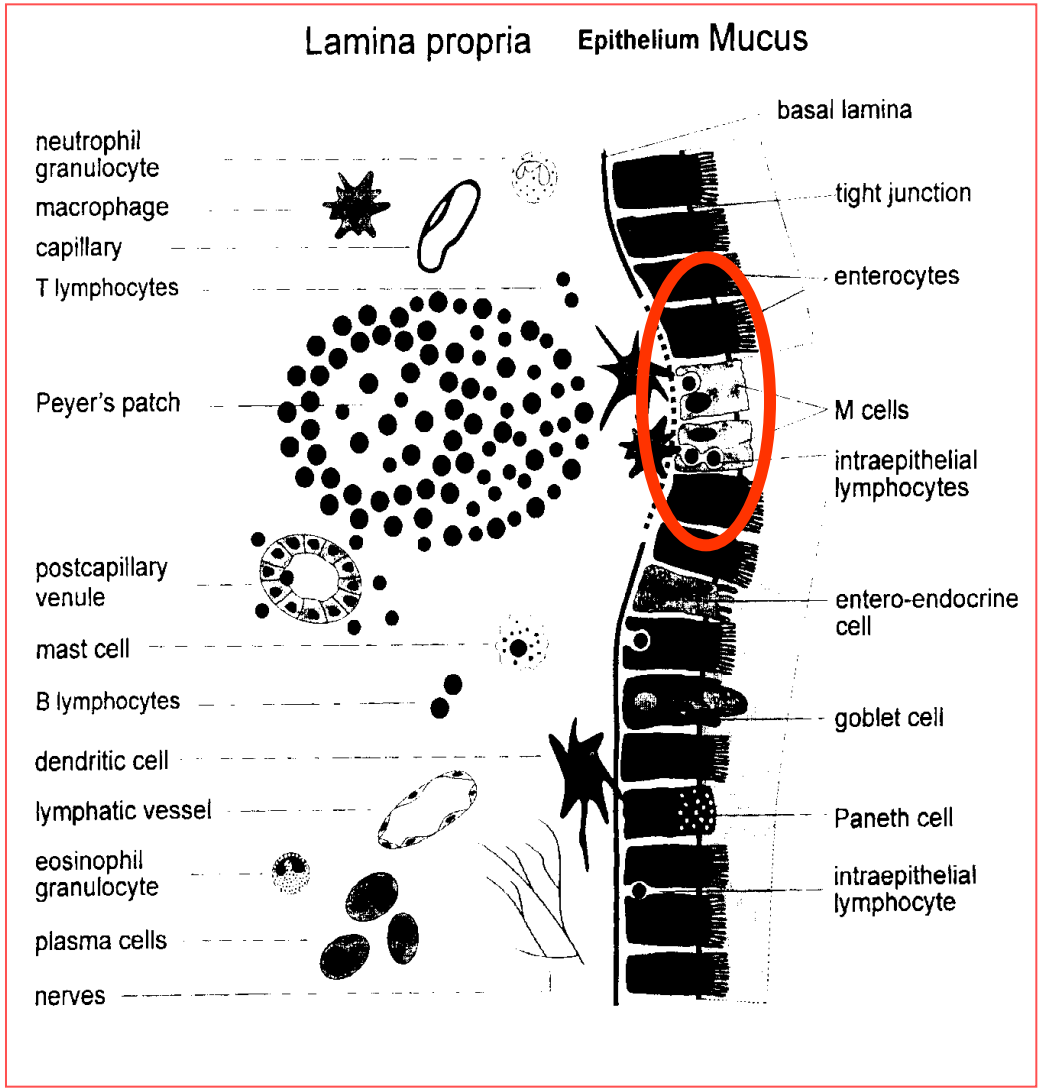


Oral Tolerance

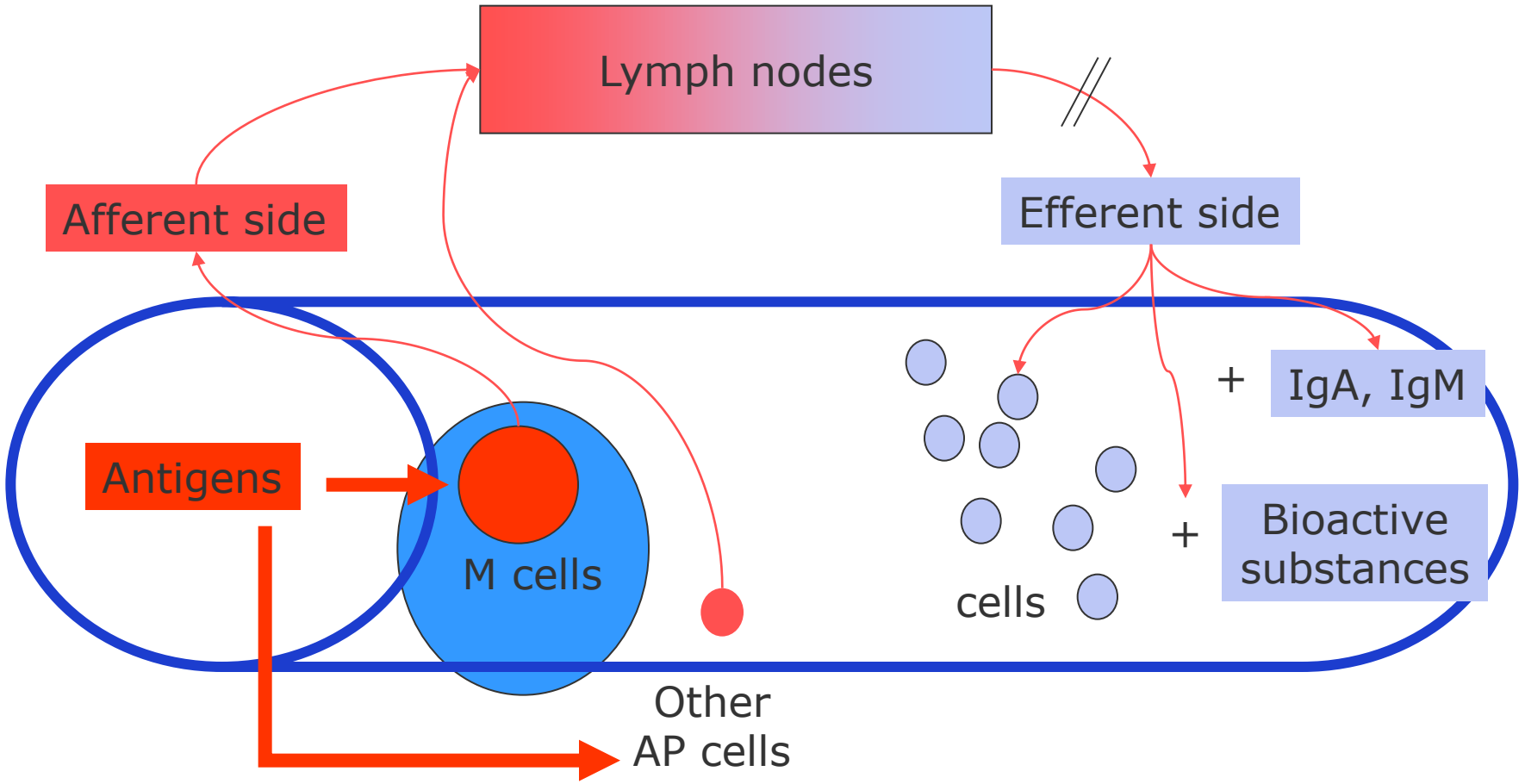
- Absent reactivity to animal feed

  - Through different mechanisms

    - Active process
    - Anti-inflammatory cytokine patterns: IL-10, TGF-β
    - "Habituation"



Pabst and Rothkötter 1998


Lymph nodes
Afferent side
Efferent side
Antigens
M cells
+
IgA, IgM
+
Bioactive substances
cells
Other AP cells

- Allergy/Intolerance

  - Mostly dietary proteins
  - Rarely other feed ingredients

    - Additives
    - Mites

Critical Reviews in Food Science and Nutrition, 46:259–273 (2006)

ISSN: 1040-8398
DOI: 10.1080/10408390591001117

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Food Allergy in Dogs and Cats: A Review

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Food allergy (FA) is defined as "all immune-mediated reactions following food intake," in contrast with food intolerance (FI), which is non-immune-mediated. Impairment of the mucosal barrier and loss of oral tolerance are risk factors for the development of FA. Type I, III, and IV hypersensitivity reactions are the most likely immunologic mechanisms. Food allergens are (glyco-)proteins with a molecular weight from 10–70 kDa and are resistant to treatment with heat, acid, and proteases. The exact prevalence of FA in dogs and cats remains unknown. There is no breed, sex or age predilection, although some breeds are commonly affected. Before the onset of clinical signs, the animals have been fed the offending food components for at least two years, although some animals are less than a year old. FA is a non-seasonal disease with skin and/or gastrointestinal disorders. Pruritus is the main complaint and is mostly corticoid-resistant. In 20–30% of the cases, dogs and cats have concurrent allergic diseases (atopy/flea-allergic dermatitis). A reliable diagnosis can only be made with dietary elimination-challenge trials. Provocation testing is necessary for the identification of the causative food component(s). Therapy of FA consists of avoiding the offending food component(s).

Keywords adverse food reactions, clinical signs, diagnosis, hypoallergenic diet, therapy

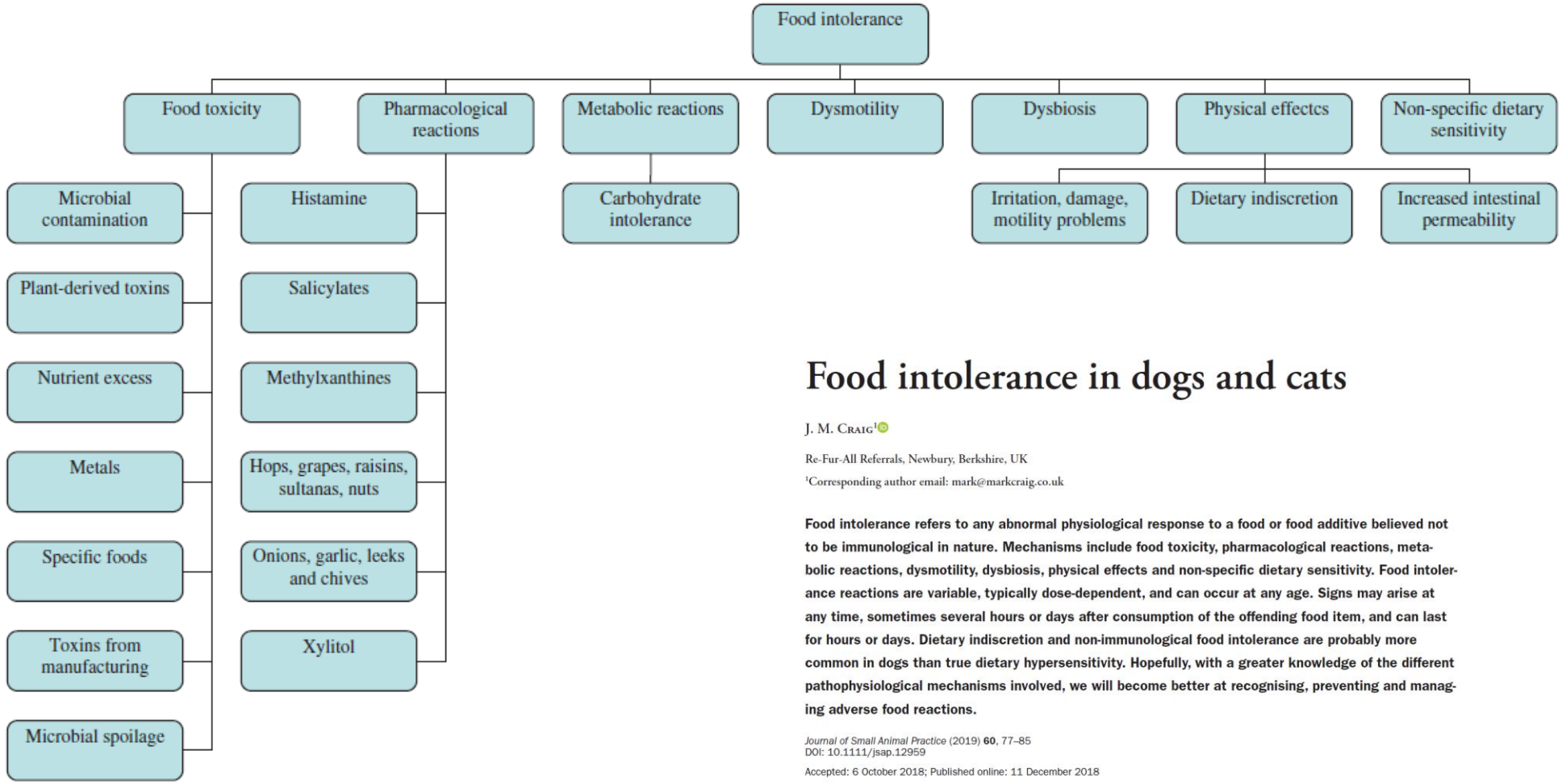

FIG 1. Flow chart of food intolerance in dogs and cats

Food intolerance in dogs and cats

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Food intolerance refers to any abnormal physiological response to a food or food additive believed not to be immunological in nature. Mechanisms include food toxicity, pharmacological reactions, metabolic reactions, dysmotility, dysbiosis, physical effects and non-specific dietary sensitivity. Food intolerance reactions are variable, typically dose-dependent, and can occur at any age. Signs may arise at any time, sometimes several hours or days after consumption of the offending food item, and can last for hours or days. Dietary indiscretion and non-immunological food intolerance are probably more common in dogs than true dietary hypersensitivity. Hopefully, with a greater knowledge of the different pathophysiological mechanisms involved, we will become better at recognising, preventing and managing adverse food reactions.

Journal of Small Animal Practice (2019) **60**, 77–85
DOI: 10.1111/jsap.12959

Accepted: 6 October 2018; Published online: 11 December 2018

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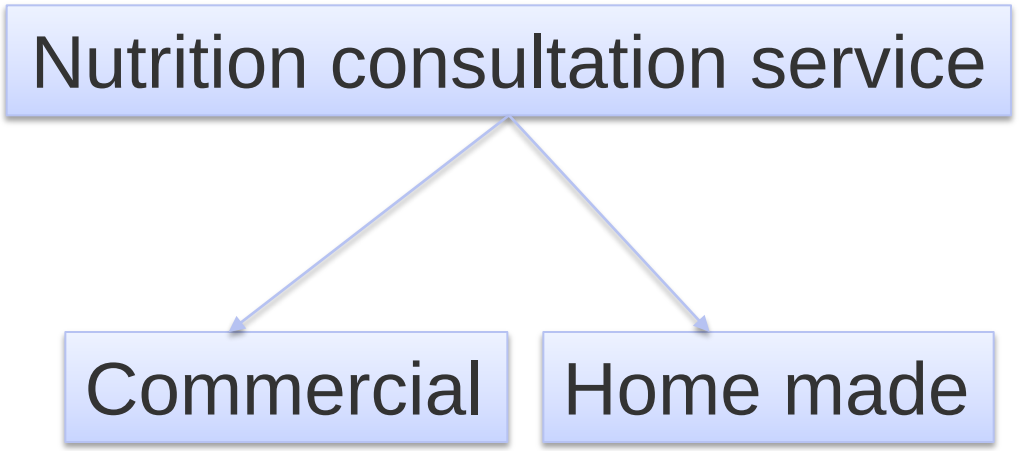
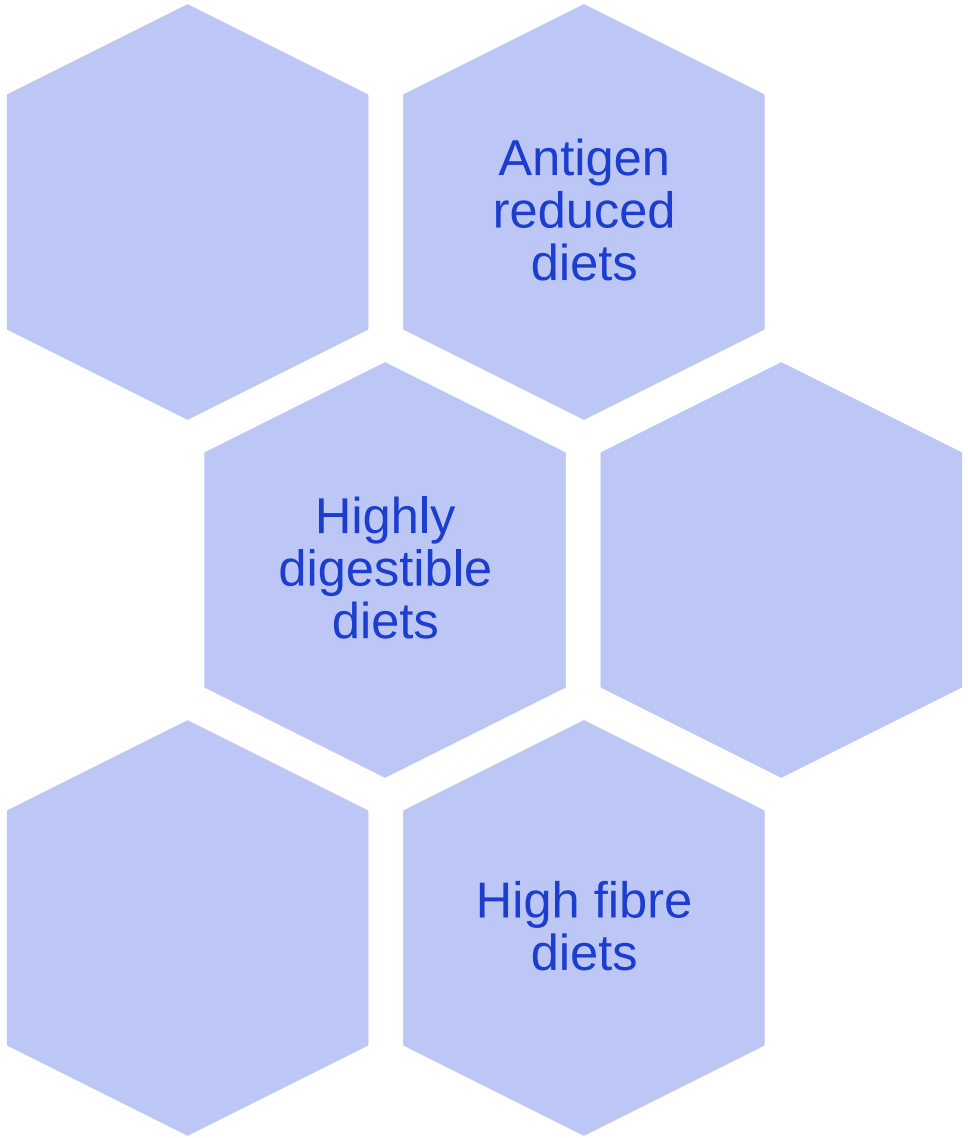
Dietetic principles and case studies

- Diet: Alternatives that are available





- Labrador Retriever

  - Episodic diarrhoea, intestinal dysbiosis detected
  - male, 4 years, 31 kg body weight
  - Concerns: Owner wishes a diet based on horse meat, as the dog tolerates this, in contrast to other types of meat

Nutrition consultation service, Nadine Paßlack

- Inflammatory bowel disease (IBD)

  - Idiopathic
  - Chronic, often recurrent
  - Inflammation of the mucosa

    - Small and/or large intestine
    - Lymphocytes, plasma cells, granulocytes

- Inflammatory bowel disease (IBD)

  - Disposition
  - Microorganisms
  - Dysregulation of the immune system
    - Breakdown of tolerance mechanisms
    - Exogenous factors: diet, environment
    - Endogenous factors: intestinal microbiota, others?

- Dietary intolerance

  - Adverse reactions to food, food intolerance, dietary allergy
  - Theoretically divided in non-immunological and immunological disorders
  - Discrimination is practically difficult or impossible

- Allergy: (too) often diagnosed?

  - Dietary proteins
  - Other feed ingredients
  - Feed additives?
  - Mites?

Diet

- Common allergens
  - milk
  - soy products
  - beef
  - wheat
  - oats
  - eggs
  - horsemeat
  - Chicken
  - Corn
  - pork meat
  - Fish (cats…)
  - Gluten (Setter)

- Cross-reactivities
  - cereals
  - fish
  - poultry
  - pork products
  - beef products
  - legumes
  - mutton

- Antigen reduced diets

  - After elimination trial
  - Alternatives
    - Commercial diets
      - Limited ingredients
      - Hydrolyzed diets
    - Home cooked diets

Elimination diet

- As few components as possible
- Meat from the horse, sheep, rabbit, turkey, possibly also fish

Only meat = too much protein

- Carbohydrate sources: potatoes, rice
- Duration 3 - 10 weeks

Reducing antigen load

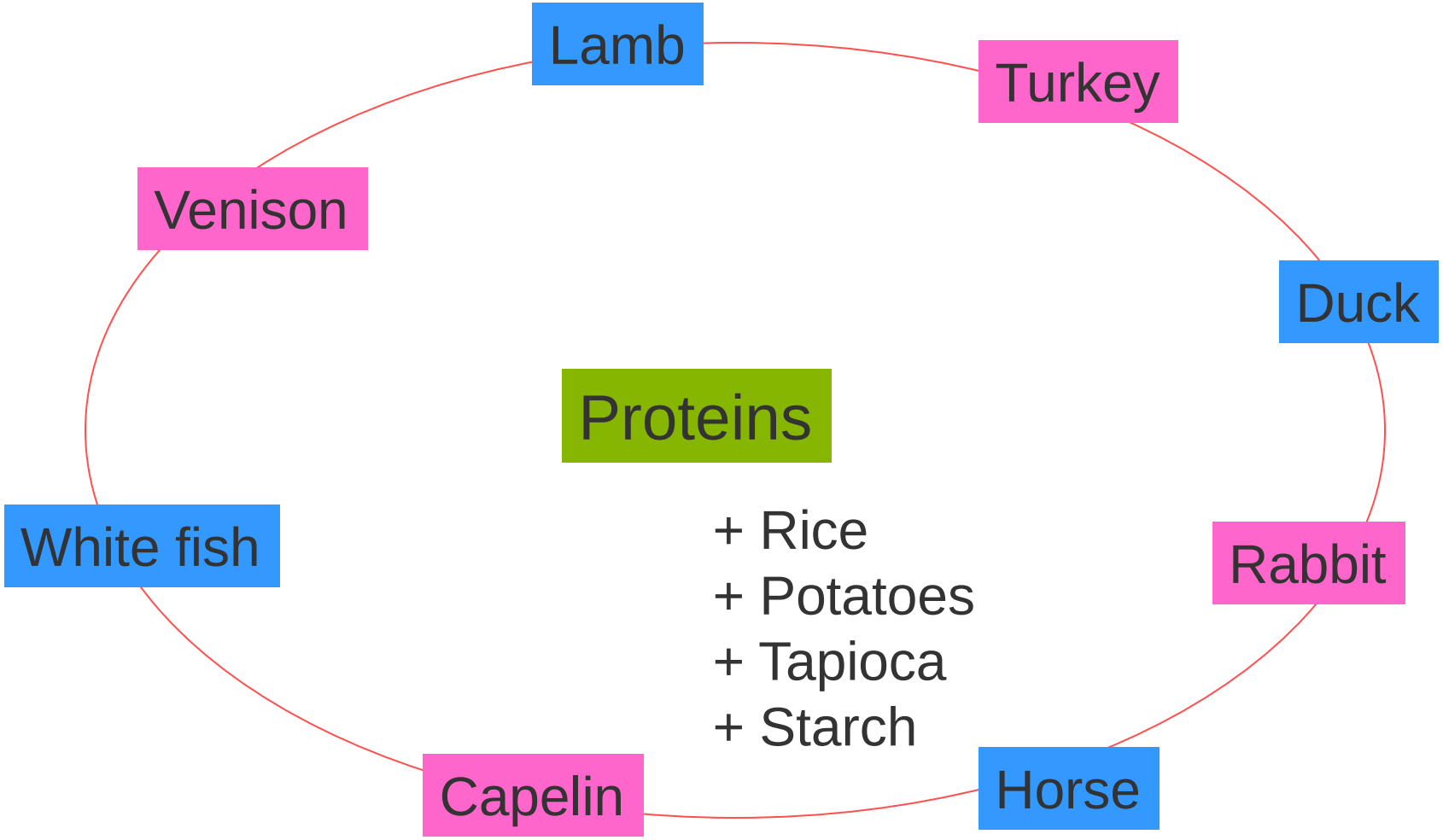
- Elimination diets by using

1. home prepared diets
2. commercial diets with single or a limited number of protein sources; or
3. hydrolyzed protein diets

Elimination diet

- Dog, 15 kg
  - 350 g lamb meat
- or
  - 300 g horse meat
  - 300 g potatoes
  - 30 g oil

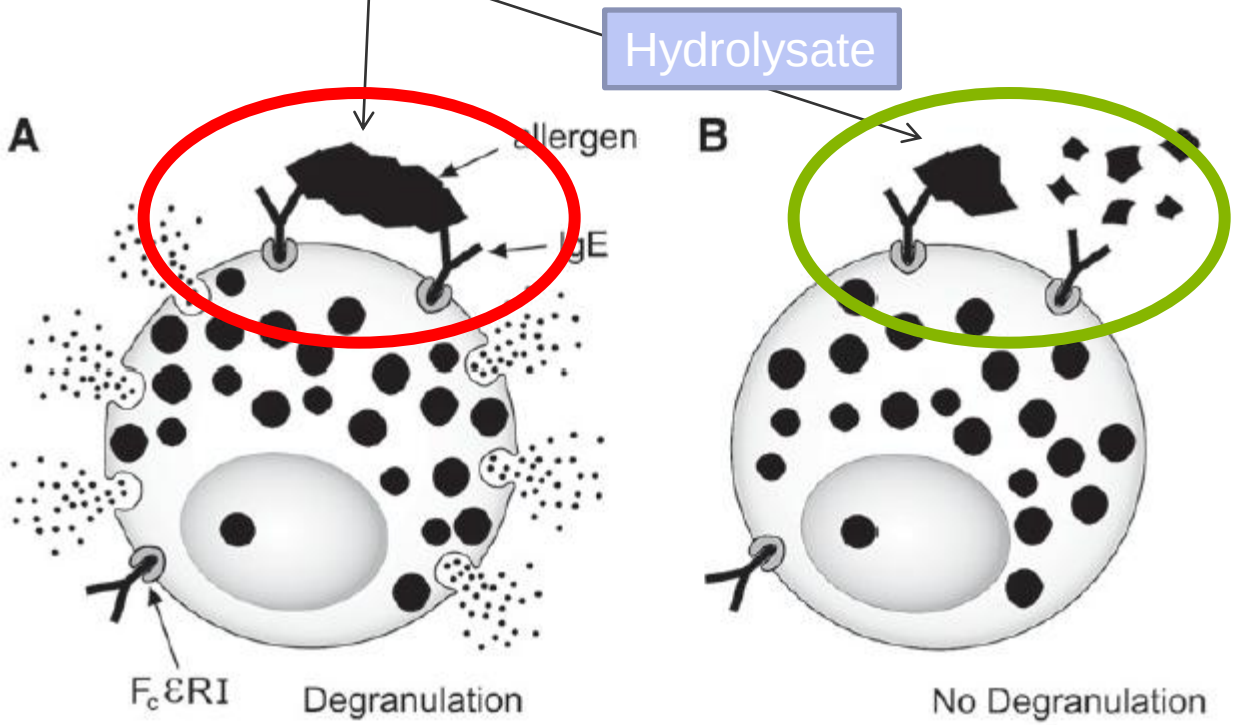
- Hypoallergenic diets



- Hydrolyzed diets

  - Predigested
  - Lower molecular weight peptides
    - Digestibility ↑
    - Reduced antigen challenge
    - Critical assessment needed (Marks et al. 2002)

Materials: meat, liver, soy



Cave 2006

Gluten sensitive enteropathy

- GSE is a specialized type of food sensitivity
  - adverse reaction to gluten (wheat protein)
  - certain lines of Irish setters
    - aberrant immune response to gluten?
    - direct toxic effect of the gluten?
    - or both
- Gluten-free diet (i.e. avoid wheat, rye, barley, oats and triticale which is a wheat-rye hybrid)

- Case 1

  - Moderate protein content with high protein quality
  - Higher crude fibre contents (soluble and insoluble fibres; especially wheat bran is favourable for dysbiosis; up to 1-2 g/kg BW/day)
  - Check acceptance
  - Ration based on horse meat possible
  - New protein source that has not been used so far may become available

- Diet

Food item	Daily amount
Horse meat	220 g
Rice	300 g
Oil	18 g
Wheat bran	30 g
Carrots	100 g
Salt	2 g
Mineral supplement	11 g

- Case 2:

  - German Shepherd, 6 years, male
  - Loses weight quickly despite increased appetite
  - Deteriorated general condition
  - Low cobalamin content in serum

- Case 2:

  - Carbohydrate-rich rations cause a foamy faeces
  - Fat-rich diets rather a pasty consistency
  - The faeces are disposed of frequently and in large quantities and often contain undigested food components
  - Veterinary clinics: Fatty degeneration of the liver

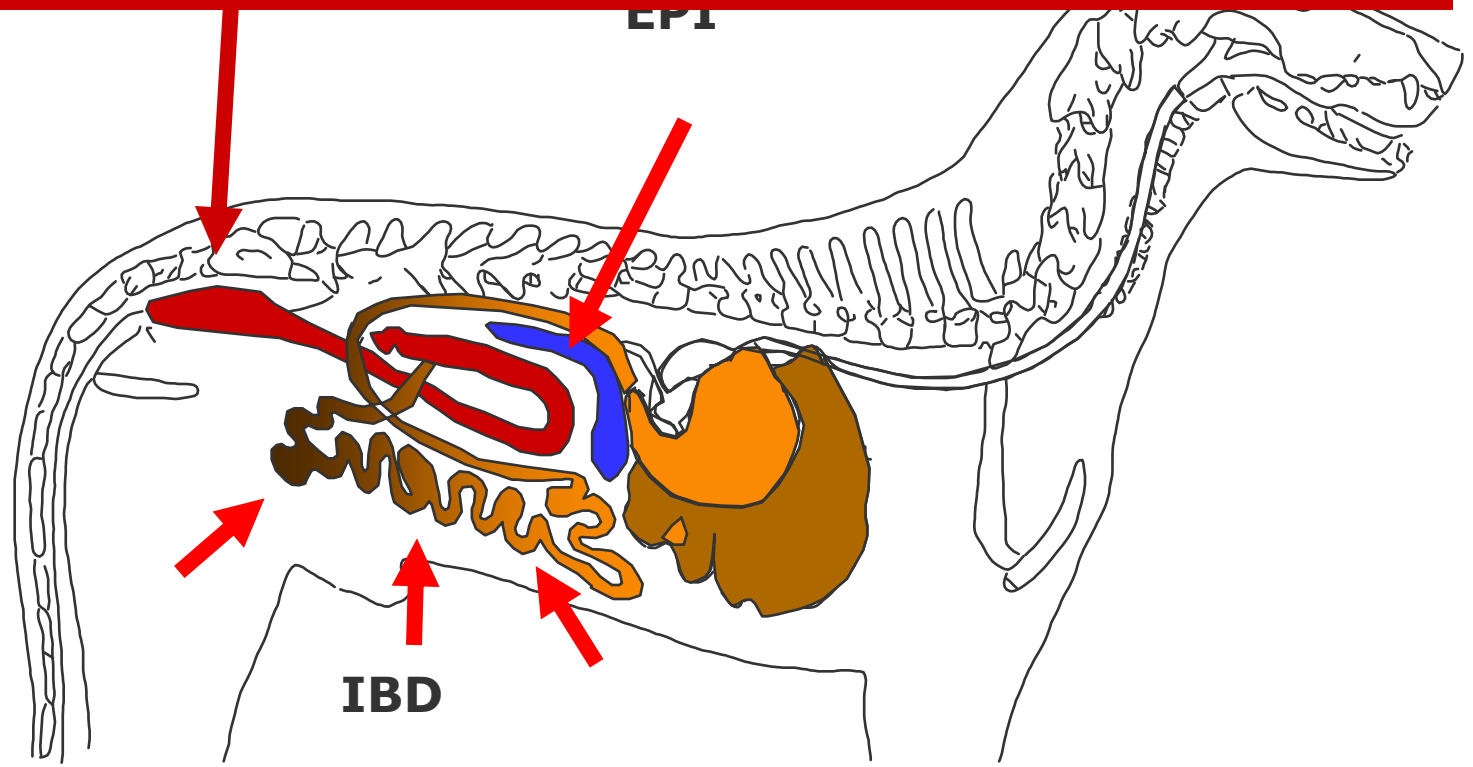
- Exocrine pancreatic insufficiency

  - Serum trypsin like immunoreactivity

    - Lower than 2.5-5.0 µg/L
    - Repeatedly subnormal cTLI values → subclinical EPI and highly suggestive for partial PAA

(Westermarck and Wiberg 2003; Steiner et al. 2006)

- Water and electrolyte absorption ↓:
  - Na, K (Ca, Mg, P)
- Microbial activity ↑
  - Protein: ammonia, biogenic amines, butyrate, gas
  - Starch/sugar: volatile fatty acids, gas



- Highly digestible diets
  - Commercial products
  - Home made diets
    - Proteins: cottage cheese, eggs, lean meat
    - Gelatinized starch: rice as first choice
  - Fat:
    - Start with restricted amounts – weight loss
    - With enzyme substitution – higher tolerance (Lecoindre and Biourge 2005)

- Small Intestinal Bacterial Overgrowth (SIBO) / Antibiotic-Responsive Diarrhea (ARD)

  - Idiopathic or secondary
  - Abnormal colonization of the upper gut
  - and/or increased bacterial metabolic activity

- Microbiota is regarded as important factor in GI problems

  - SIBO/ARD

    - Dietary sensitivity of dogs may result from disturbed microbial microecology
    - Microbial and dietary antigens can interact with the immune system and can trigger clinical disease due to immunological intolerance

- Case 2: Dietary management

  - Minimum amount of fat, high in linoleic acid
  - Pancreatic enzymes
  - Easily digestible proteins, meat
  - Cooked starch
  - Zinc, vitamin B_{12} and fat-soluble vitamins
    - 1500 µg of cobalamin

- Case 2: Dietary management

Food item	Daily amount
Chicken meat	400 g
Rice	350 g
Oil (sunflower, fish)	10 + 2 g
Wheat bran	6 g
Carrots	50 g
Salt	2 g
Mineral supplement	18 g

+ 8 g Enzyme preparation

- Case 3

  - Mongrel, 8 years, female, 15 kg
  - Defaecation frequently, sometimes with mucus and blood
  - Diarrhoea also observed due to stress
  - Chronic colitis
  - Inflammation of the mucosa

- Colitis

  - Fibre-rich components such as bran, cellulose or pectin-rich feedstuffs such as carrots
  - Higher filling of the colon regulates the disturbed intestinal motility
  - Microbial fermentation of fibre → Short-chain fatty acids, especially butyric acid
  - Allergic cause cannot be excluded → use novel protein

- High fibre diets
  - Preference for large bowel patients
  - Commercial diets
  - Supplements
    - Psyllium
    - Wheat bran
    - Cellulose
    - Vegetables: carrots

- Fibre:

  - Water binding – peristalsis regulation – gut flora

    - Unsoluble fibre: bran/cellulose
    - Soluble fibre: carrots, psyllium

- Case 3:

Food item	Daily amount
Turkey meat	600 g
Oat flakes	160 g
Oil	10 g
Wheat bran	30 g
Carrots/cellulose	25 + 25 g
Mineral supplement	8 g

- Conclusion

1. Dietetics can be a particularly good aid for dogs with intestinal diseases
2. In many cases it is the first option in treatment
3. The food composition must be chosen according to the underlying cause of the disease