An Overview of Alpha-Gal Syndrome

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Fall 2023 CLPC series

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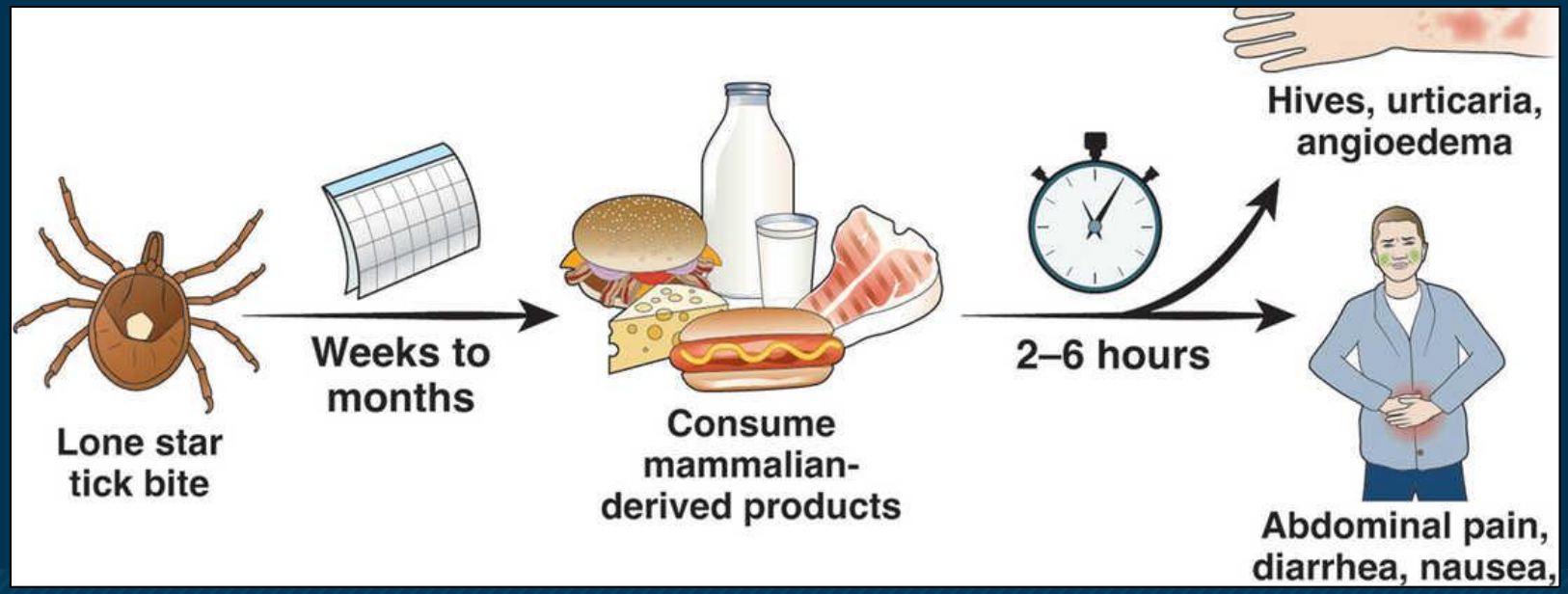
Learning Objectives

- Define/Describe Alpha-Gal Syndrome (α-Gal or AGS)/Mammalian Meat Allergy (MMA)/Red Meat Allergy (RMA)
- Describe pathophysiology of α-Gal Syndrome syndrome/MMA
- Describe laboratory testing, diagnostic approach, and treatment of α-Gal syndrome/MMA

https://www.npr.org/sections/health-shots/2023/04/02/1166431106/ticks-ick-the-latest-science-on-the-red-meat-allergy-caused-by-some-tick-bites

- CDC warns about red meat allergy caused by some tick bites
- Updated July 27, 2023 1:02 PM ET



CDC Press Release
For Immediate Release: Thursday, July 27, 2023

- Emerging Tick Bite-Associated Meat Allergy Potentially Affects Thousands
- Many healthcare providers not familiar with allergic condition
- 2 studies in Morbidity & Mortality Weekly Report (MMWR)

MMWR - the 2 studies

- Surveyed 1500 health care practitioners
- Nearly half had not heard of AGS
- 1/3 were not too confident in their ability to diagnose or manage patients with AGS

- Deidentified lab test results sIgE were examined from the commercial lab (Eurofins Viacor) which did all U.S. testing 2017-2021 for AGS
- 300,000 samples
- > 30% positive

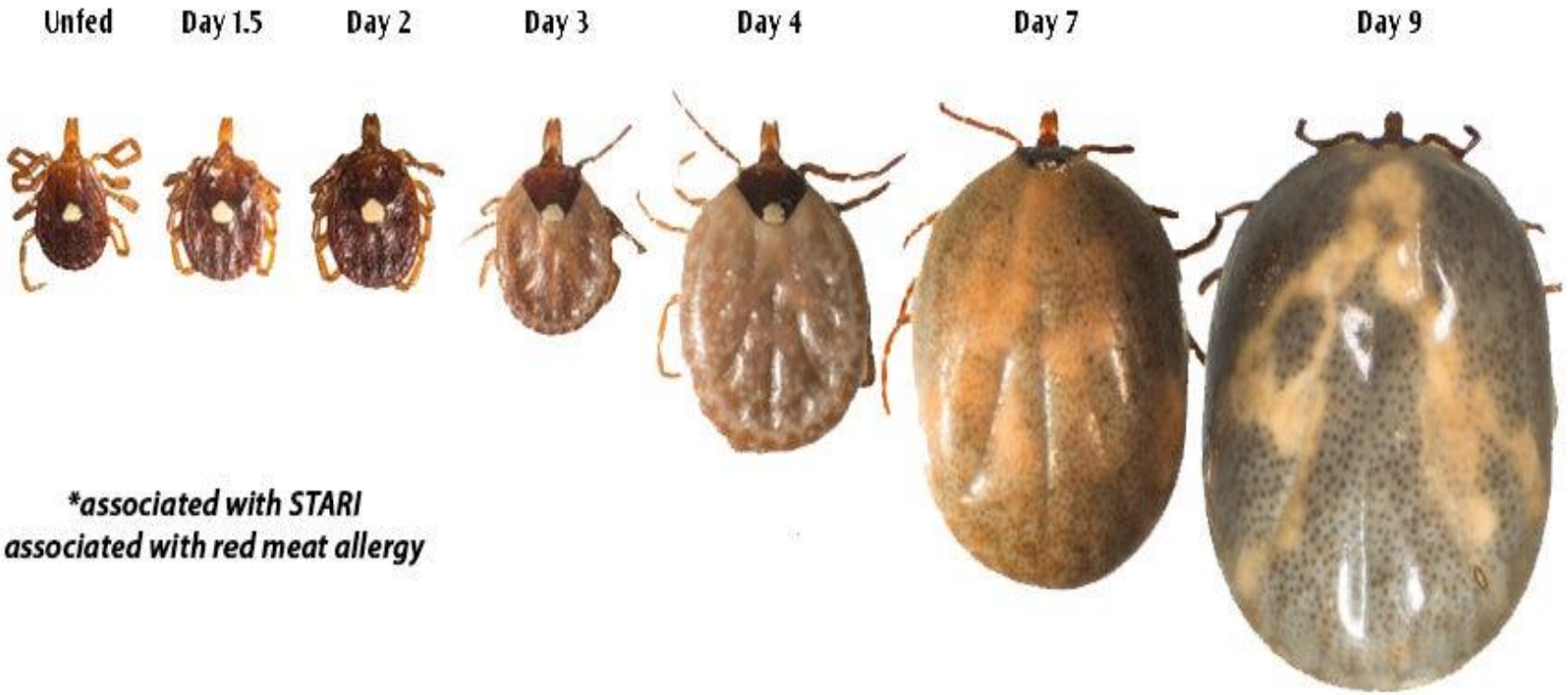
Amblyomma Americanum -Lone Star Tick *Family* Ixodidae ('Hard Ticks")

“Questing”

Mouth parts of the lone star tick

https://nigms.nih.gov/education/activities-and-multimedia/life-magnified

Female Adult-stage Lone Star tick
(Amblyomma americanum)

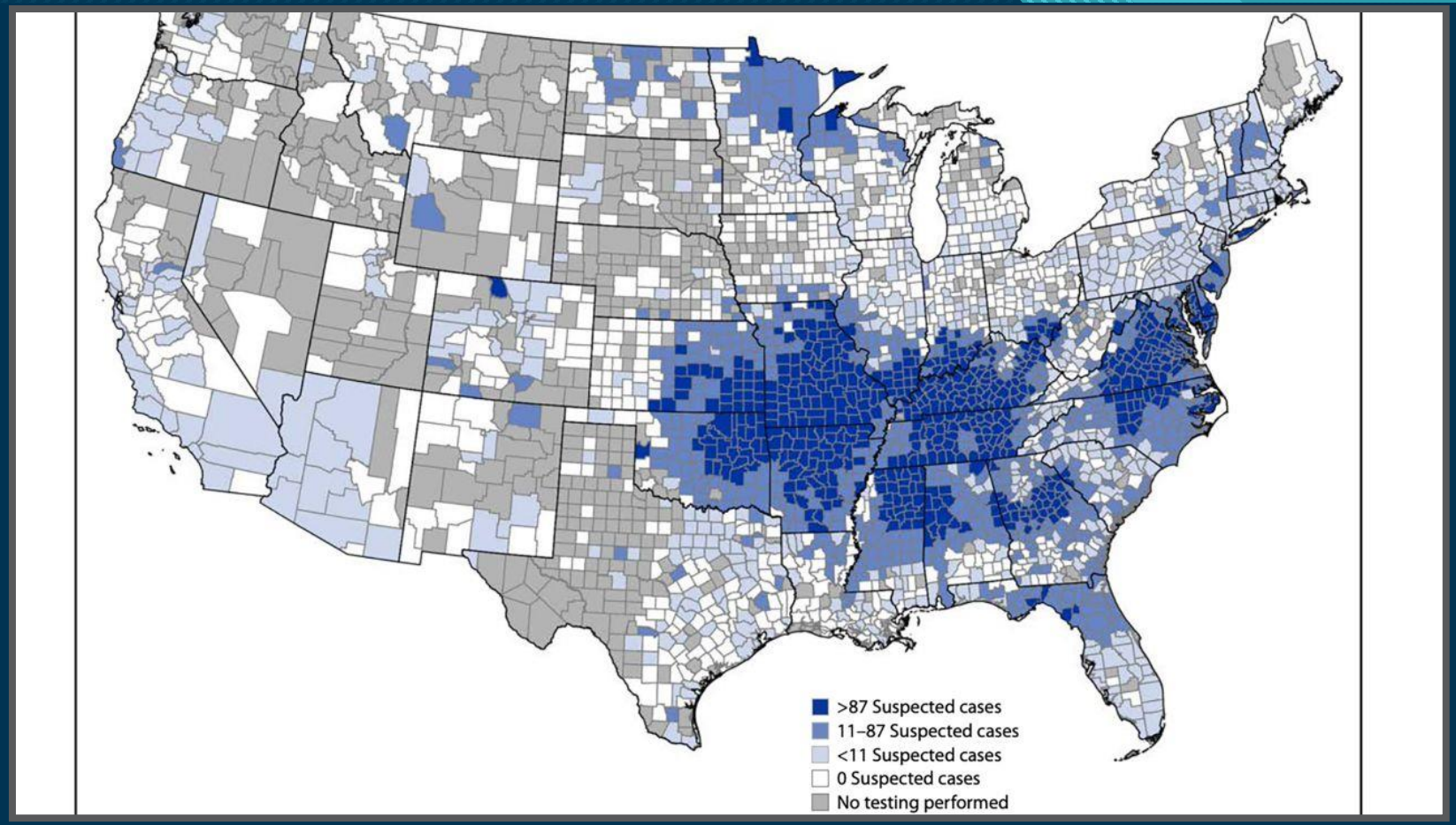


**associated with STARI*
associated with red meat allergy

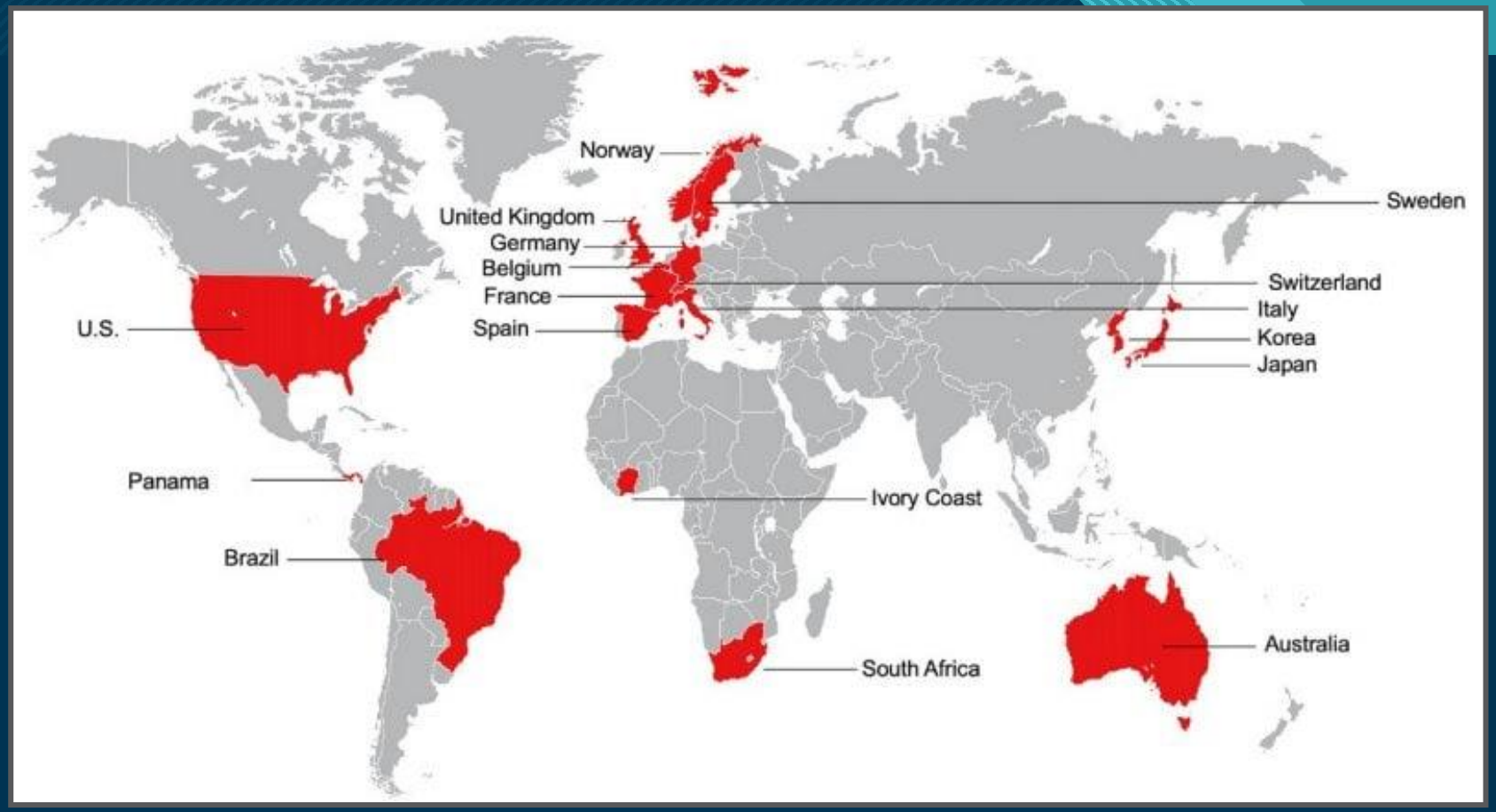
Blood engorged Female
Female laying eggs

Distribution of Lone Star Tick

CDC map of cases/million 2017- 2022



World wide α-Gal Syndrome



- All continents except Antarctica

α-Gal syndrome tick associations

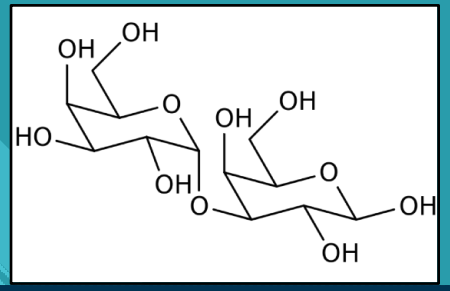
Scientific Name	Common Name(s)[a]	Geographic Range[a]
Amblyomma americanum	Lone Star Tick	North America (Southeastern US, Canada, Mexico)
Amblyomma cajennense	Cayenne Tick	North and Central America
Amblyomma hebraeum[b]	South African Bont Tick	South Africa
Amblyomma sculptum	N/A	South America (Brazil)
Amblyomma testudinarium	N/A	South Asia (India, Sri Lanka) and East Asia (including Japan)
Amblyomma variegatum[b]	Tropical Bont Tick	Southeast Asia, Africa
Haemaphysalis longicornis	Asian Longhorned Tick, Bush Tick	Japan
Ixodes australiensis	N/A	Australia
Ixodes holocyclus	Paralysis Tick	Australia, Southern Asia
Ixodes nipponensis[b]	Cattle Tick	Asia (including Korea, Japan)
Ixodes ricinus	Sheep Tick, Wood Tick, Deer Tick, Castor Bean Tick	North America, Europe and Northern Asia, Africa
Ixodes scapularis	Blacklegged Tick	Middle America, North America
Rhipicephalus spp (including *R. microplus; R. evertsi*)[b]	Asian Blue Tick, Australian Cattle Tick, Southern Cattle Tick, Cuban Tick, Madagascar Blue Tick, Puerto Rican Tick	Southern Asia, South America, North America, Caribbean, Australia, Africa

Notes: [a]Common name and Geographic Range reported in Integrated Taxonomic Information System (ITIS, https://www.itis.gov/)[138] and/or reviewed in Carson AS, Gardner A, Iweala OI.[19] [b]Suspected link, but not definitive association of tick with the development of alpha-gal syndrome.

Alpha Gal Syndrome - Not like usual tick diseases

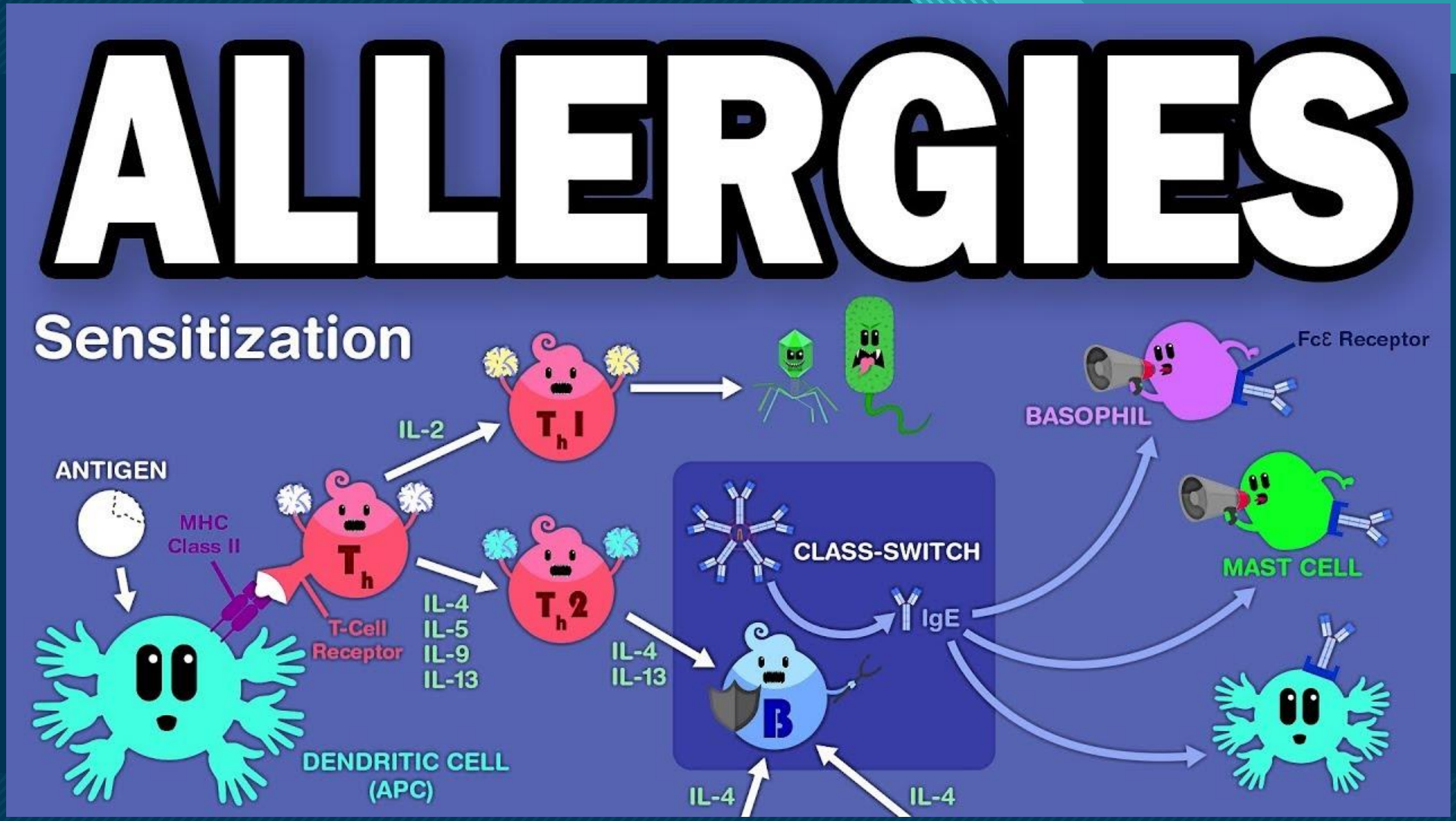
- Most ticks contain bacteria, protozoans, or viruses that cause disease
- Other diseases caused by ticks:
  - Ehrlichiosis: (*Ehrlichia* sp.) Lone Star tick
  - Lyme Disease: (*Borrelia burgdofi*) Black leg tick/ deer tick; US NE
    Babesiosis: (*B. microti*) Black leg tick; NE US & upper Midwest
  - Rocky Mtn Spotted Fever: (*Rickettsia*) Dog tick; Lone Star tick, US, now in desert SW and Mexico
  - Powassan Virus Disease (*Flavivirus*) 3 Ixodes sp. NE and Great Lakes, Canada, Russia
  - Tick Borne Encephalitis (*Flavivirus*) Ixodes; Europe & UK, Far East, Siberia

What is Alpha Gal ?



- A terminal sugar moiety linked to proteins or ceramide
- Found in most non-catarrhine mammals including cows, pigs, sheep, venison, rabbit, goat, bear, & in animal products
- NOT found in catarrhine - primate - mammals (humans, old world monkeys, apes) as well as birds, fish, reptiles
  - Mutation in the α-1,3-galactosyltransferase (α1,3GT) gene
- Found in the saliva of ticks; more found when tick has fed
- Alpha Gal Syndrome -Immunoglobulin E (IgE) mediated allergy to the disaccharide Alpha-gal (galactose-α-1,3-galactose)
  - Allergic reactions to meats described in Australia 30 years before “discovery” in US

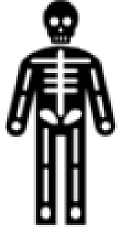
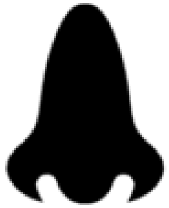
Th1 vs. Th2 responses.



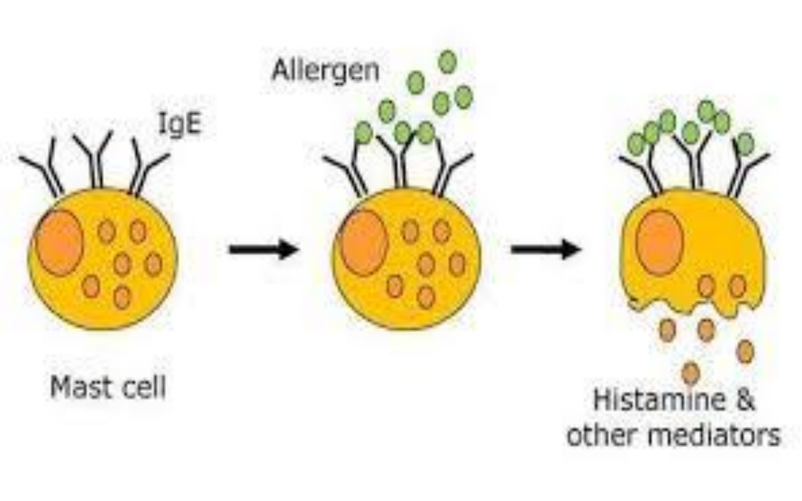
Definitions

- Allergic reaction – localized reaction, generally involves only one system such as the skin -Urticaria (hives) –swelling of the dermis
- Allergic angioedema –swelling underneath the skin (below the dermis) caused by fluid leakage into the surrounding skin and tissue. Most often occurs around the eyes, lips, tongue
- Anaphylaxis – a severe systemic allergic reaction involving two or more systems which may cause the collapse of circulatory &/or respiratory systems. (Due to massive release of inflammatory mediators; mediated by IgE)
- Anaphylactic shock –anaphylaxis plus hypotension and other signs of shock

Anaphylaxis

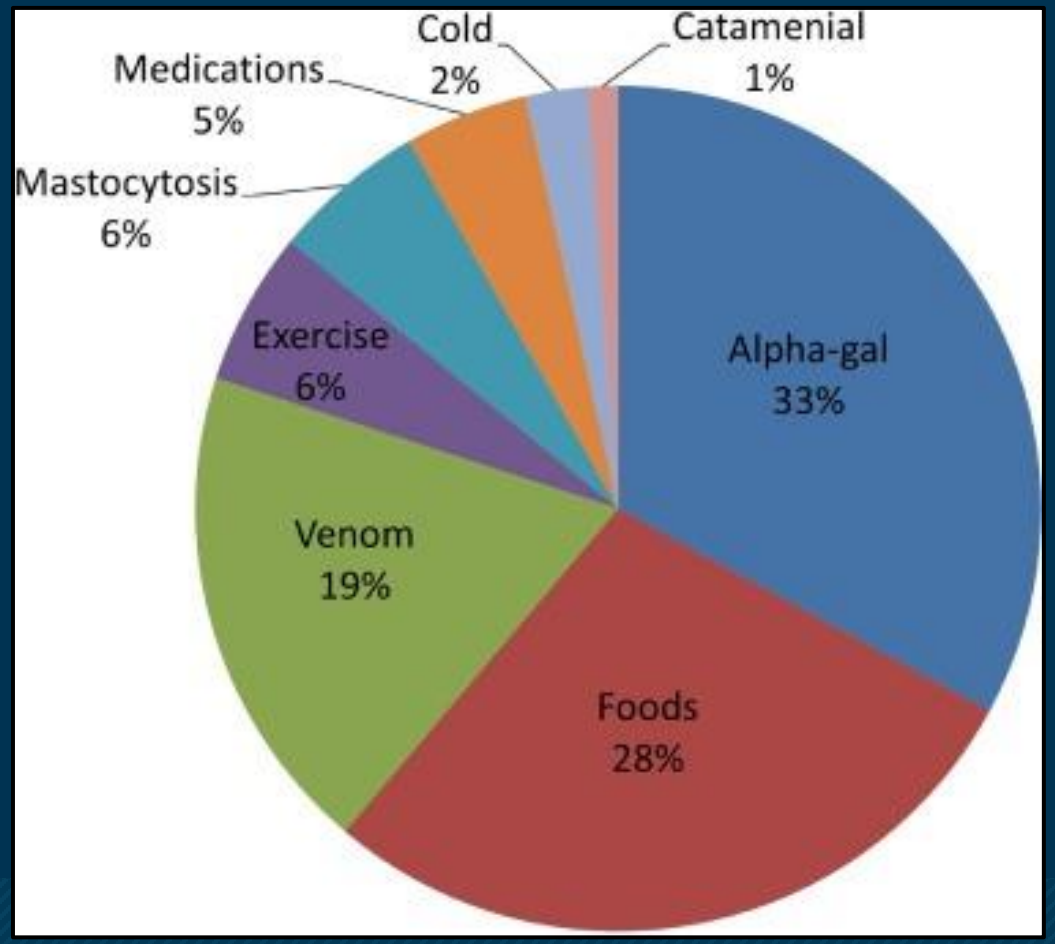
				

• Sense of 'impending doom'
• Acute onset of feeling unwell
• Change in demeanor (infants and toddlers)
• Cutaneous:
  • Flushing
  • Urticaria
  • Angioedema
  • Pruritus
	• Nasal congestion
	• Rhinorrhea
	• Sneezing
		• Wheezing
		• Persistent cough
		• Chest tightness
		• Respiratory distress
			• Nausea
			• Emesis
			• Cramping
			• Diarrhea
				• Tachycardia
				• Hypotension
				• Syncope



Increasing cases of Anaphylaxis in US Causes of Anaphylaxis, 2018

Definitive Cases



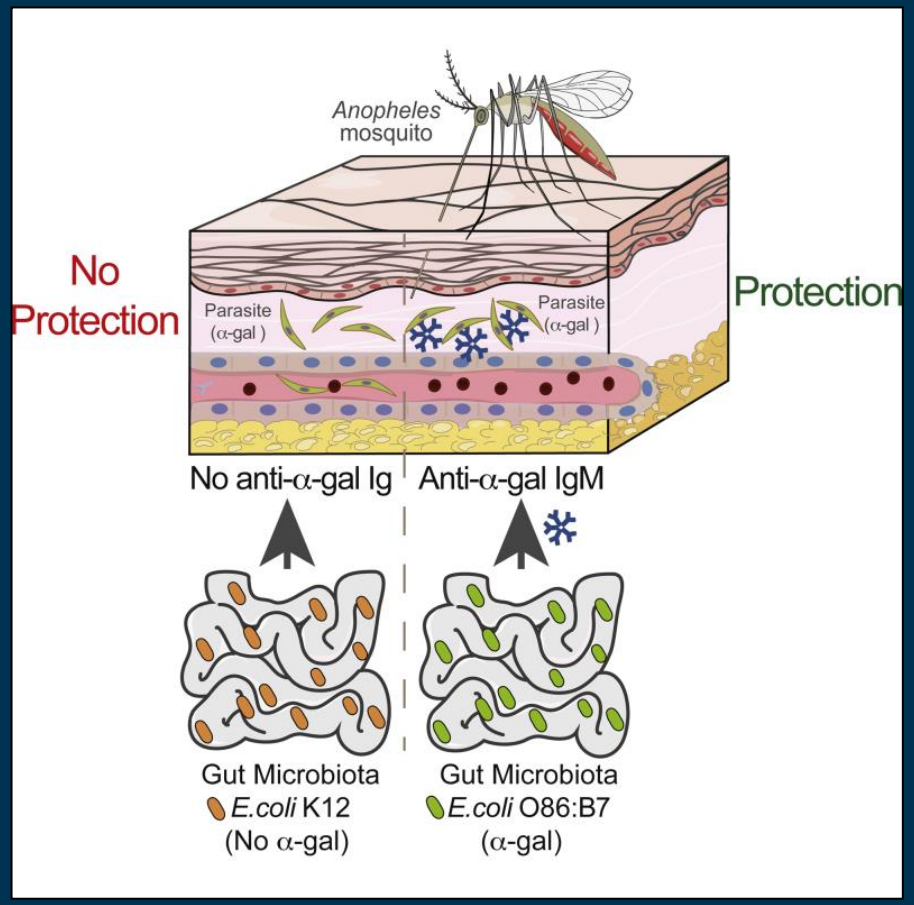
- U Tenn retrospective study 2006-2016
- 218 met NIAID & FAAN criteria for anaphylaxis
- 85 (39%) had “definitive cause”; 57 (39%)were probable cause, and 76(35%) were idiopathic
- AGS was found to be the number one trigger, accounting for 33% of cases with a definitive cause. The number two cause was all other food allergies combined at 28%
- Median age 42; 64% female
- Results differ from earlier retrospective studies
  - Idiopathic decreased to 35% (previously was 59%)

The changing face of anaphylaxis in adults and adolescents Annals of Allergy, Asthma & Immunology,2018-11-01, Volume 121, Issue 5, Pages 594-597

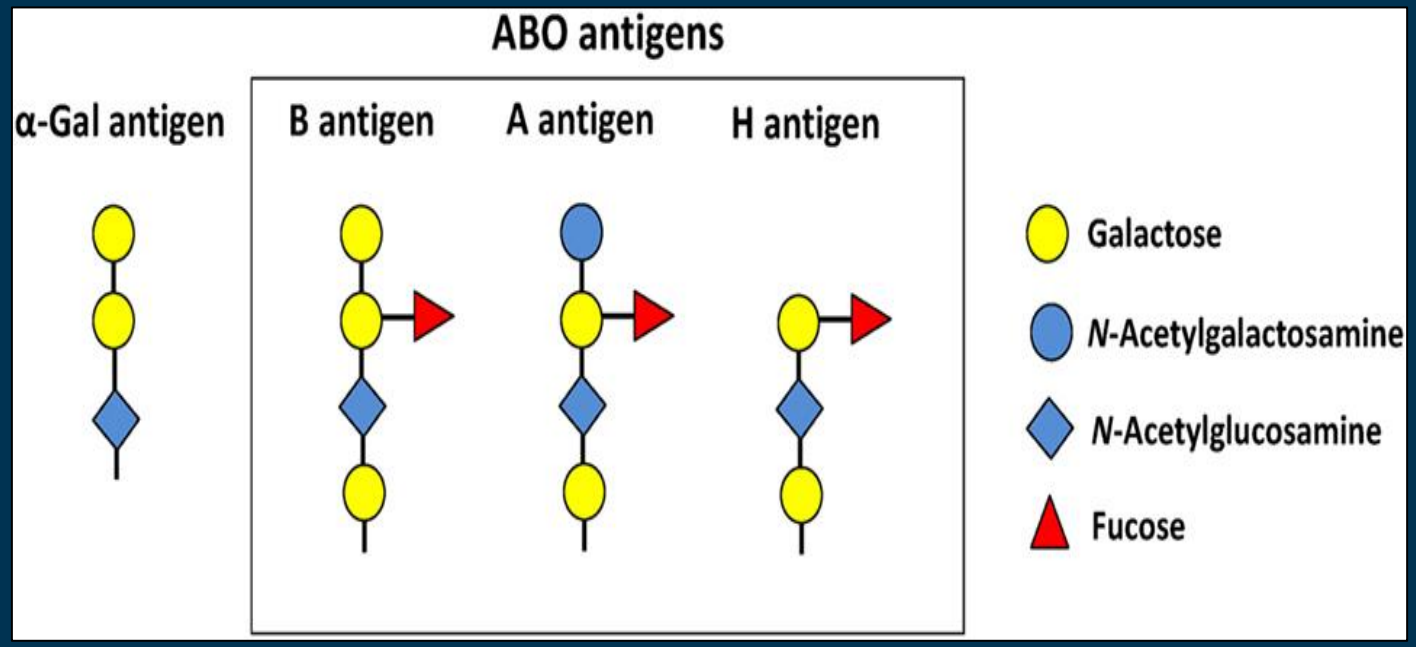
α-Gal

- All humans have IgG & IgM antibodies directed against α-Gal
  - Evolutionarily has thought to be protective against gut microbes and pathogens
  - Human pathogens (malaria, leishmaniasis, & Chagas disease)
  - Bacteria
  - Protozoa
  - Some fungi: Aspergillus sp. & Schizosaccharomyces pombe (but not in edible mushrooms)
  - Viruses incorporate alpha-gal into their envelope glycoproteins
  - Cobra venom
  - Amphibians

Hypothesis: Protection from malaria



α-Gal closely resembles the B group antigen structure



- Anti-α-Gal IgG antibodies can also recognize the blood group B antigen
- Blood group B antigen-expressing individuals (blood groups B and AB) have a lower level of α-Gal IgG antibody reactivity

The B antigen protects against the development of meat allergy

J Allergy Clin Immunol Pract. Sep-Oct 2018;6(5):1790-1791.e3.

- Patients expressing the B antigen of the ABO blood group system are protected from allergic sensitization to galactose-α-1,3-galactose and the development of red meat allergy.

TABLE I. Expected and observed frequencies of red meat allergy (RMA) according to ABO blood type or expression of the B antigen

	Control (n = 188)		RMA (n = 92)		
Blood type	Expected (%)	Observed (%)	Expected (%)	Observed (%)	*P* value
O	46.1	44.1	39.4	52.2	.212
A	37.1	38.3	40.4	43.5	.860
B	12.9	10.6	14.6	2.28	.026
AB	4.15	6.91	5.74	2.17	.126
O or A	83.2	82.4	79.8	95.7	.321
B or AB	17.0	17.6	20.3	4.35	.005

Expected frequencies are ethnicity-weighted according to population-based ABO distributions and representation of those populations in the control and RMA groups. *P* values are generated by χ^2 tests.

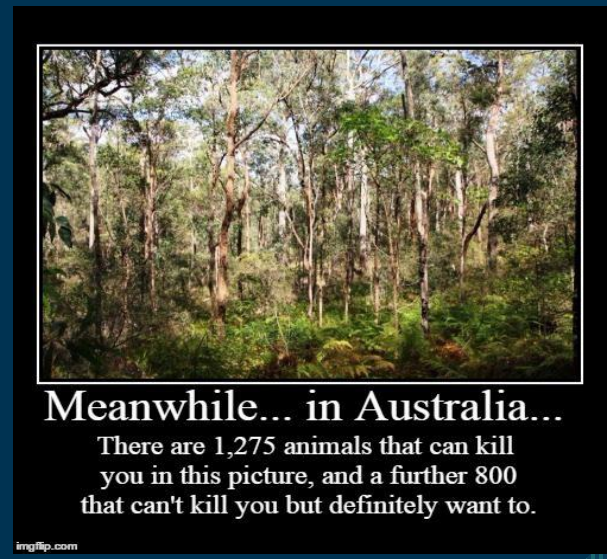
Transfusion risk?
An outbreak of anaphylactic transfusion reactions to group B plasma and platelets and its possible relationship to Alpha-Gal syndrome

- Case report : Three O+ patients receiving B type plasma or apheresis platelets emergently in two DC area hospitals From Nov 2022 – Feb 2023. All pts from S Maryland
- Chart review, pt interview (if poss), family interview; IgE specific to α -gal measured
  - Pt 1. Liver transplant, received B plasma, became worse, got other blood products, and expired. Serum tryptase elevated. IgE to α -Gal not done because were unaware of AGS
  - Pt. 2 Hx of cirrhosis, transferred with duodenal ulcer requiring transfusion, hx of 42 prior transfusions with allergic reactions to three. Received multiple transfusions. Another admission after collapsed after eating hamburgers for dinner. Got B plasma had severe reaction –responded to IV epi, solumedrol. Hx tick bites. Serum IgE to α -Gal elevated. Survived.
  - Pt. 3 - Found unconscious, Intracranial hemorrhage. Hx Crohn's Disease, and kidney transplant 6 months ago . 4 months prior had severe GI symptom & Increased ostomy output after eating beef/pork. Allergic to cats, dogs, horses, & grass. Hx tick bites. B apheresis platelets- Severe rxn requiring intubation. Elevated Serum IgE to α –Gal; got Klebsiella pneumonia; post transplant lymphoproliferative disorder; expired 25 days later

Transfusion 2023;63:1997–2000

Australian Findings

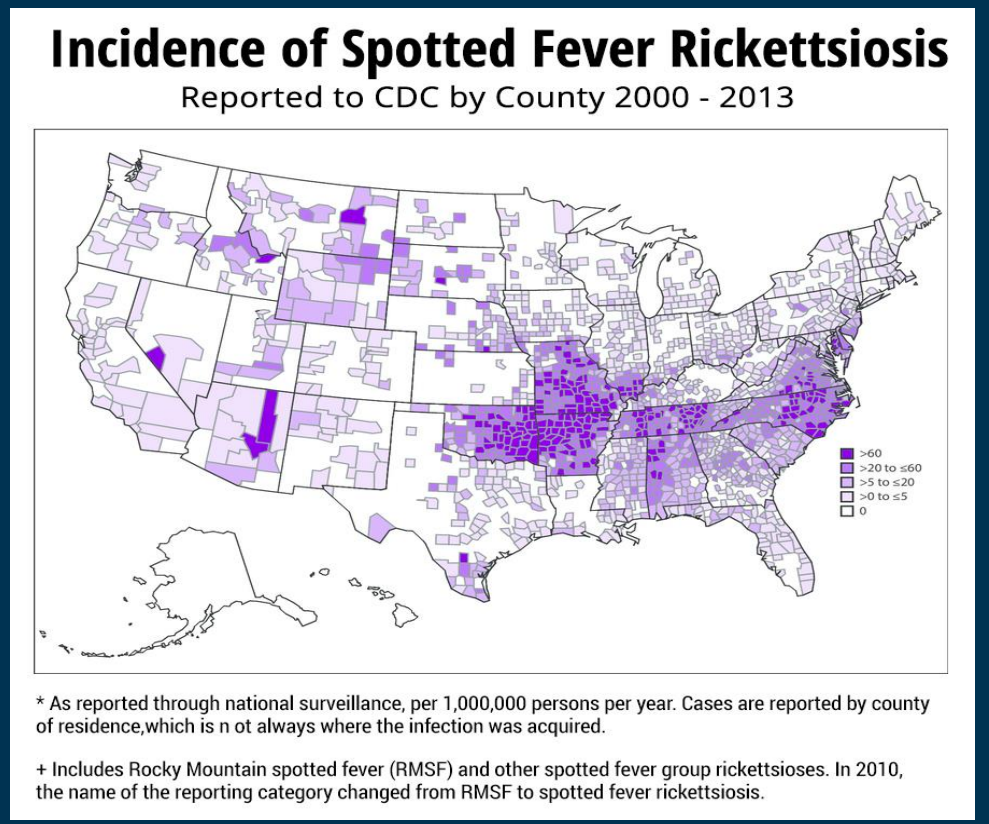
- MMA after tick bite was first reported in 2007 in Australia by Dr Sheryl van Nunen et al.
  - Cases – 24/25 adults in Australia developed red meat allergy after reporting tick bites
  - She had a series of meat allergy cases dating back to the 80’s
- Worldwide, Australia has the highest prevalence of MMA



“Discovery” in U.S. Cetuximab

- Chimeric mouse-human IgG1 monoclonal antibody to EGFR
- Used for metastatic colorectal cancer and squamous cell carcinoma of head and neck
- Caused death on first infusion in one patient in Arkansas
- AR MD contacted her mentor @ UVa to help ID the cause. Formed a research team to investigate
- Cetuximab was causing severe urticarial or anaphylactic reactions in up to 15% of patients in the area: VA, NC, TN, AR, MO
- One of the team pointed out that these reactions to the drug overlapped the geographic area for incidence of Rocky Mtn Spotted Fever
- People who didn’t get Cetuximab started coming to research clinic with symptoms and sometimes anaphylaxis several hours after eating meat. All had been bitten by ticks.
- 2008 NEJM identified alpha gal as the cause
- In 2009, the US team described patients with Alpha-Gal IgE who experienced delayed reactions after eating meat in a history of tick bites

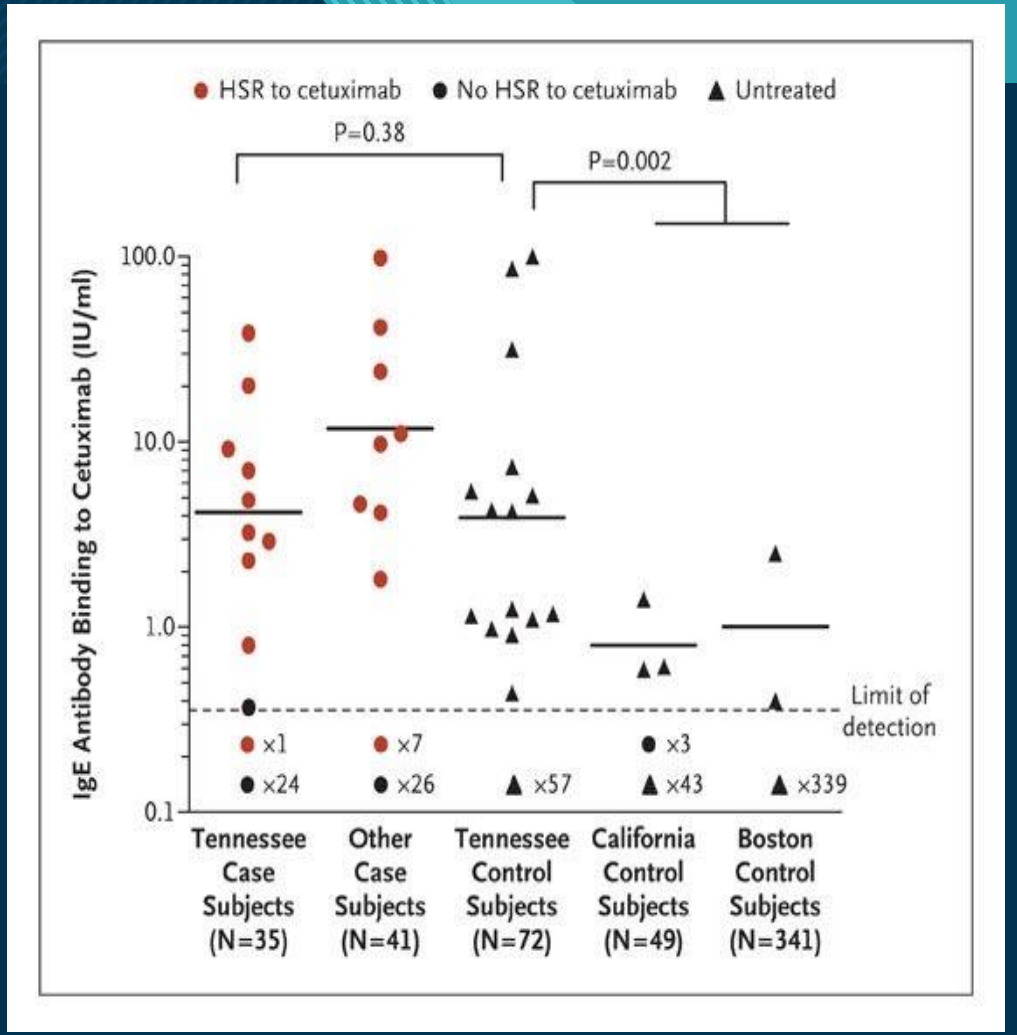
States where anaphylactic reactions to Cituximab occurred compared to Rocky Mtn Spotted Fever



NEJM study – examined IgE Abs against Cituximab

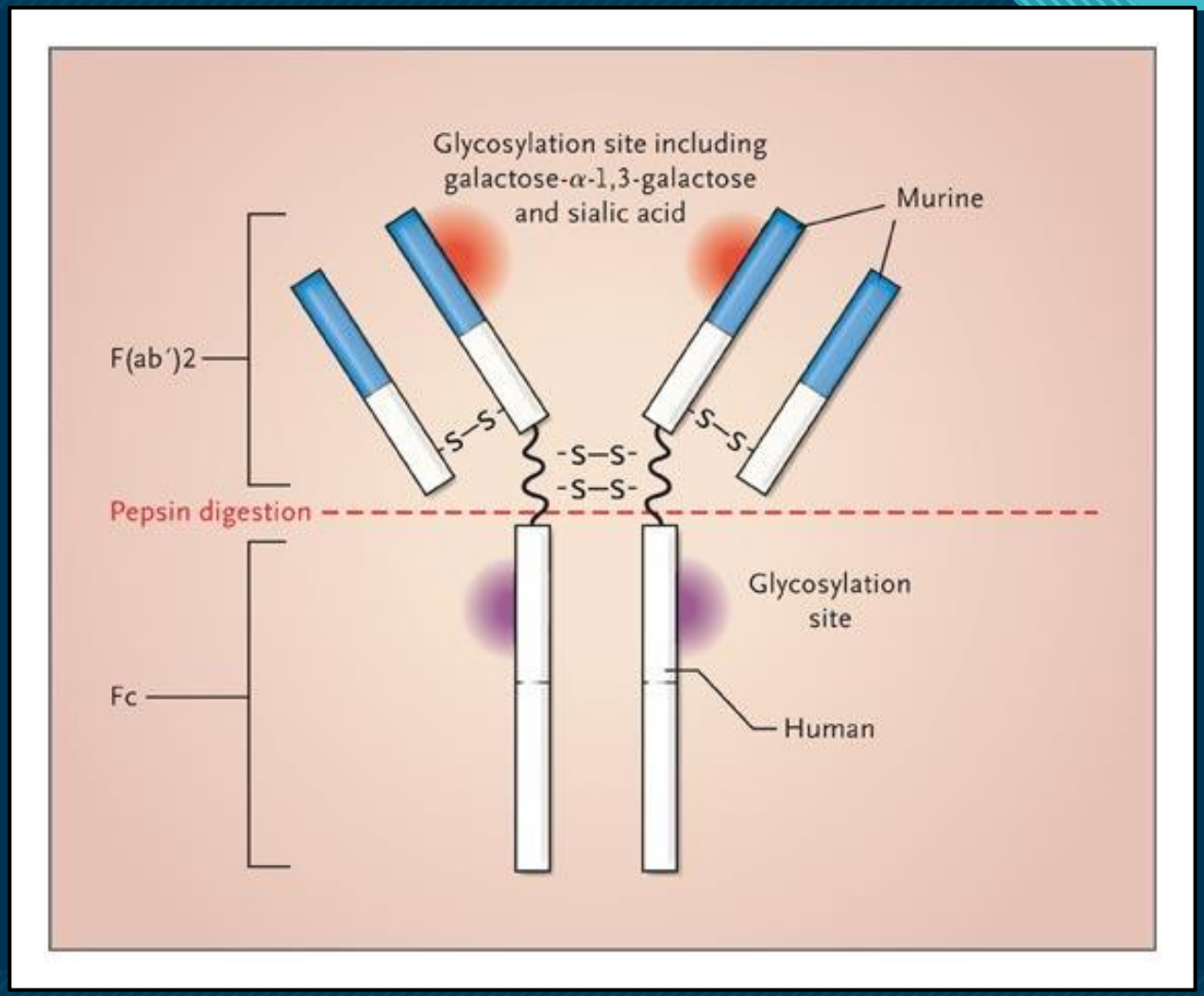
- Group 1 Pre-treatment samples -TN, AR, NC case subjects, 76 – who got the drug
- Group 2 Tennessee controls, 72
- Group 3 California H & N cancer pts, 49
- Group 4 Boston female controls, 341

- In most subjects who had a hypersensitivity reaction to cetuximab**, IgE antibodies against cetuximab were present in serum before therapy. The antibodies were specific for galactose-α-1,3-galactose**



Cetuximab-Induced Anaphylaxis and IgE Specific for Galactose-α-1,3-Galactose
N Engl J Med 2008; 358:1109-1117 DOI: 10.1056/NEJMoa074943

Characterization of the epitopes on Cituximab



IgE-mediated food allergies

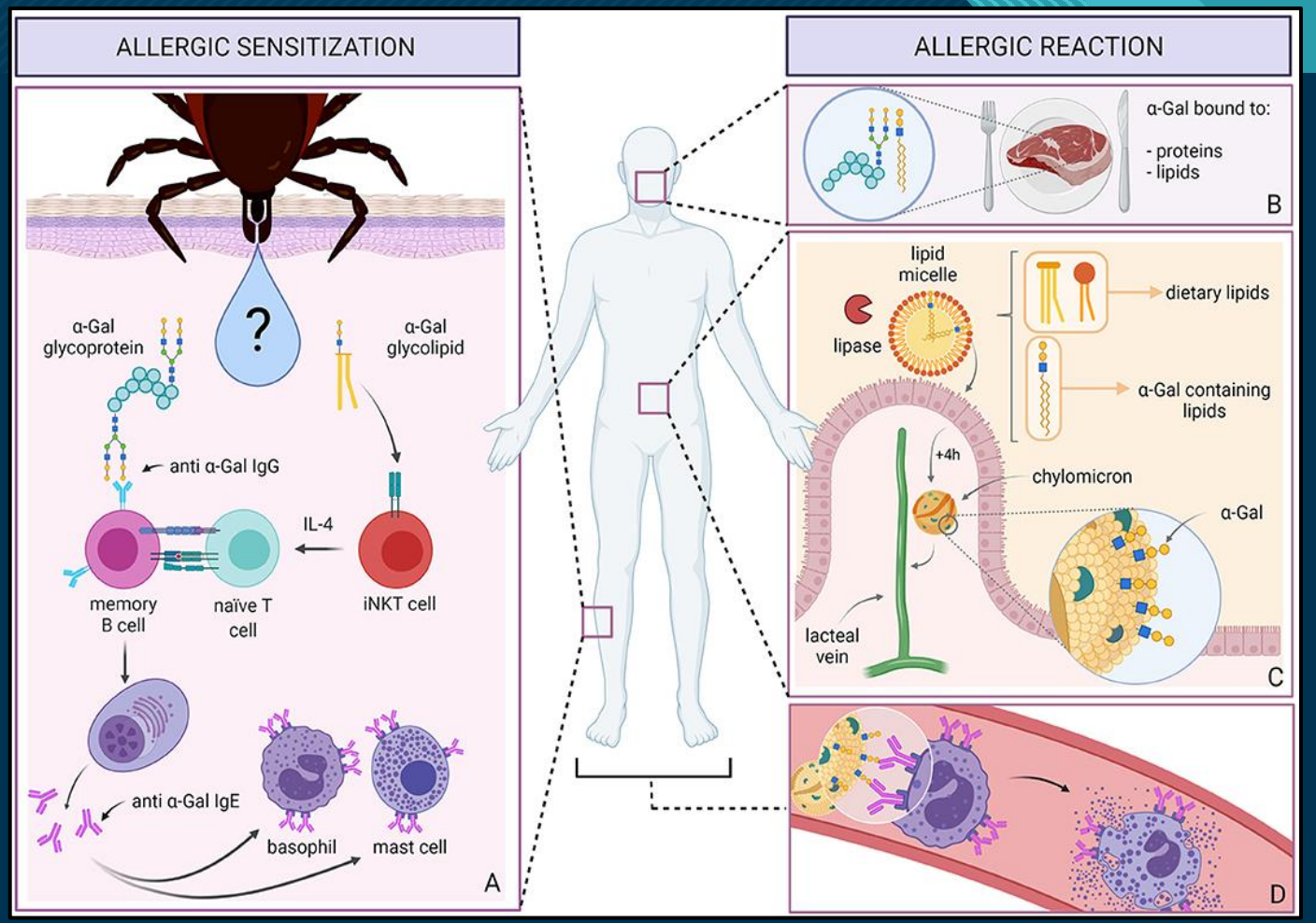
Conventional

- IgE Abs form against a **protein antigen**
- IgE Abs associated with allergen exposure
- **Immediate** hypersensitivity (anaphylaxis) is characteristic

AGS

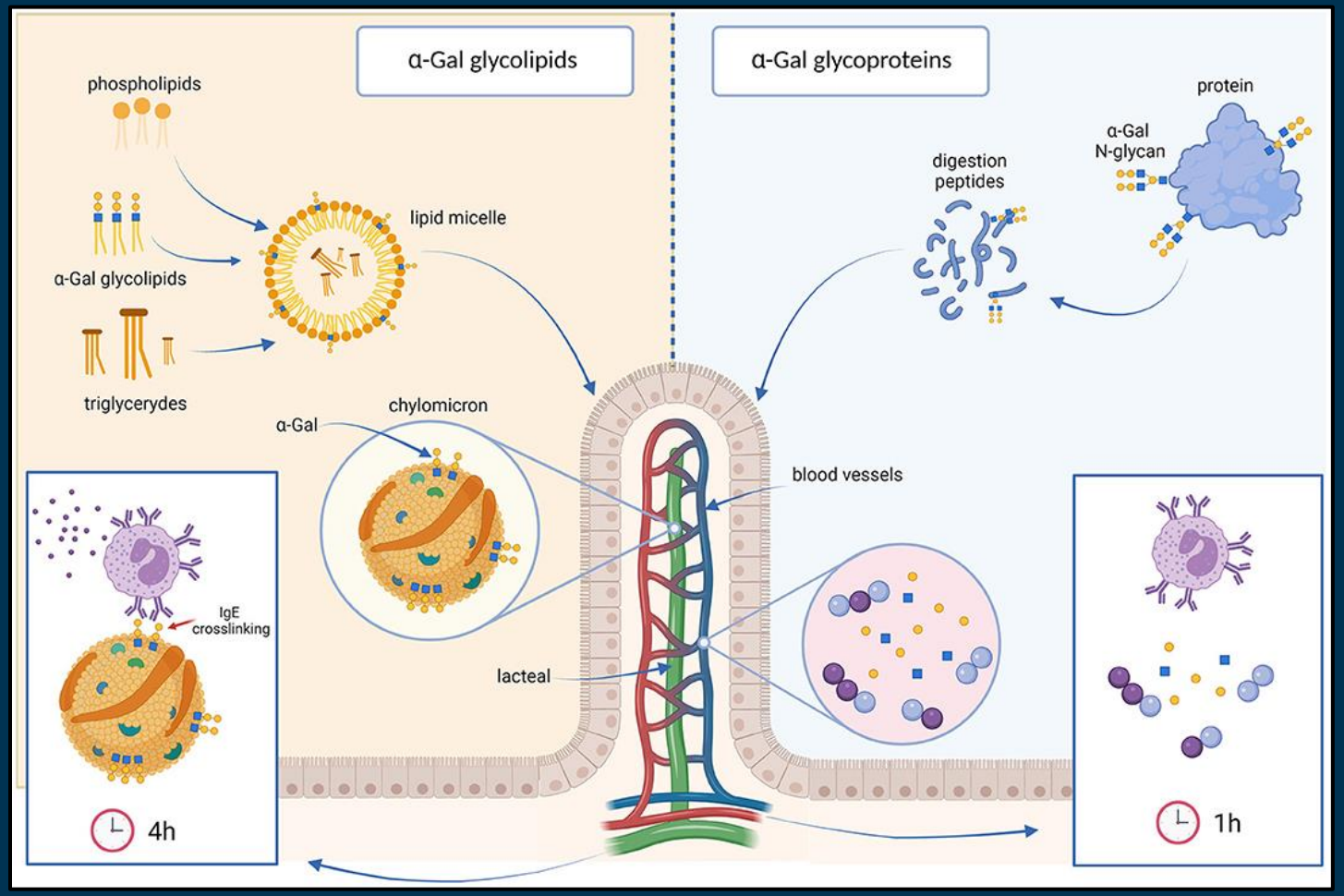
- IgE Abs form against **the α-gal sugar**
- IgE Abs associated with exposure to a **tick bite**
- **Delayed onset**; typically >2 hrs; generally 3-6 hrs after ingestion
- Immediate onset –after infusion with Cituximab

Allergic sensitization & allergic reaction to α-Gal

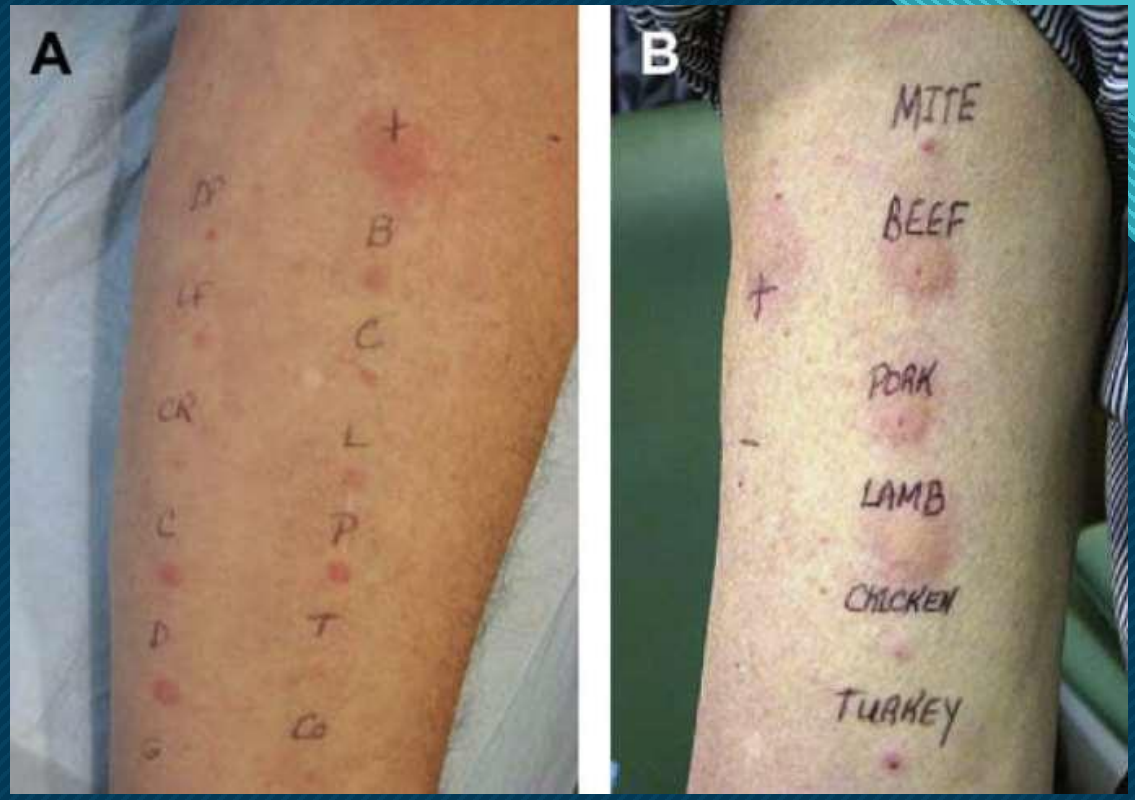


Romain-Carrasco P et al. 2021. The α-Gal Syndrome and Potential Mechanisms. Frontiers in Allergy. Vol 2 Article 783279

Why does the reaction take so long? α-Gal bound to Glycolipids “Glycolipid Hypothesis”



Skin Prick Test (SPT) and Intradermal (ID test) in patients with IgE antibodies to α-gal



Commins SP, et al. 2009 Delayed anaphylaxis, angioedema, or urticaria after consumption of red meat in patients with IgE antibodies specific for galactose-a-1,3-galactose J Allergy Clin Immunol 2009;123:426-33

Results from expanded study

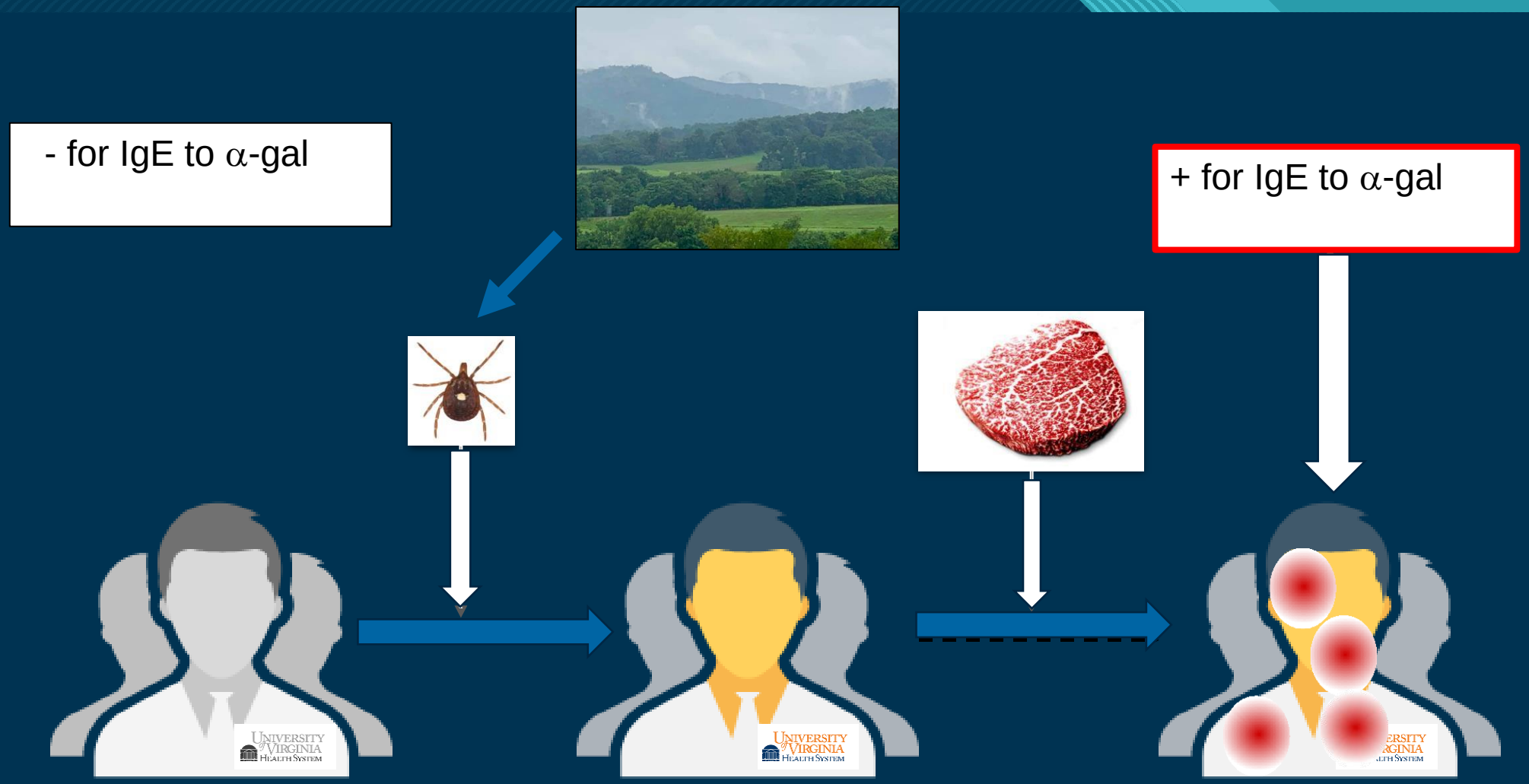
People who live in rural areas where tick bites are more common have a higher prevalence of IgE Abs to α-Gal than people who live in cities

TABLE II. Prevalence of IgE antibodies to alpha-gal in different populations related to local prevalence of tick bites

	Prevalence*	Percentage
Virginia clinic populations		
Patients presenting with delayed anaphylaxis to red meat†[9]	117/121 (99)	97
Asthma in the clinic‡	6/56 (3)	11
Random populations in the Southeast§		
Tennessee[5]	24/107 (11)	22
North Carolina	15/75 (9)	20
Virginia (ER)[16,17]	25/136 (8)	18
Southeastern populations, total	64/318 (28)	20
Areas where tick bites are rare		
Boston Women's Study (adults)[18]	2/341 (0)	<1
Norrbotten, Sweden (age 18 y)[19]	1/150 (0)	<1
Northern California		
Stanford University cancer patients[5]	3/49 (0)	6
Travis Air Force Base, asthmatic patients and control subjects[20]	1/117 (0)	1
University of California, San Francisco, asthmatic patients and control subjects	3/136 (1)	2
Northern California, total	7/302 (1)	2
Tropical areas where tick bites are common‖		
Kabati, Kenya (rural)[21]	100/131 (50)	76
Thika, Kenya (moderately sized industrial town)[21]	36/123 (10)	29
Esmeraldas Province, Ecuador[22]	110/295 (36)	37

J Allergy Clin Immunol. 2011 May;127(5):1286-93.e6.

“3 researchers developed red-meat allergy and recalled being bitten by a tick weeks-months before”



Steinke, JW et al. J Allergy Clin Immunol 2015;**135**:589-96.

Alpha-gal syndrome (AGS) reactions can include:

- Rash
- Hives
- Nausea or vomiting
- Heartburn
- Severe stomach pain
- Diarrhea
- Difficulty breathing
- Drop in blood pressure
- Dizziness or faintness
- Recurrent angioedema
- Anaphylaxis
- **Symptoms commonly appear two to six hours after eating meat or exposure to products containing alpha-gal**
- Reactions can be different from person to person and can range from mild to severe or even life-threatening.
- People may not have an allergic reaction after every alpha-gal exposure.
- A person who thinks they may have AGS (MMA) should talk to a doctor (CDC recommendations, 2020)

Sometimes ONLY GI symptoms

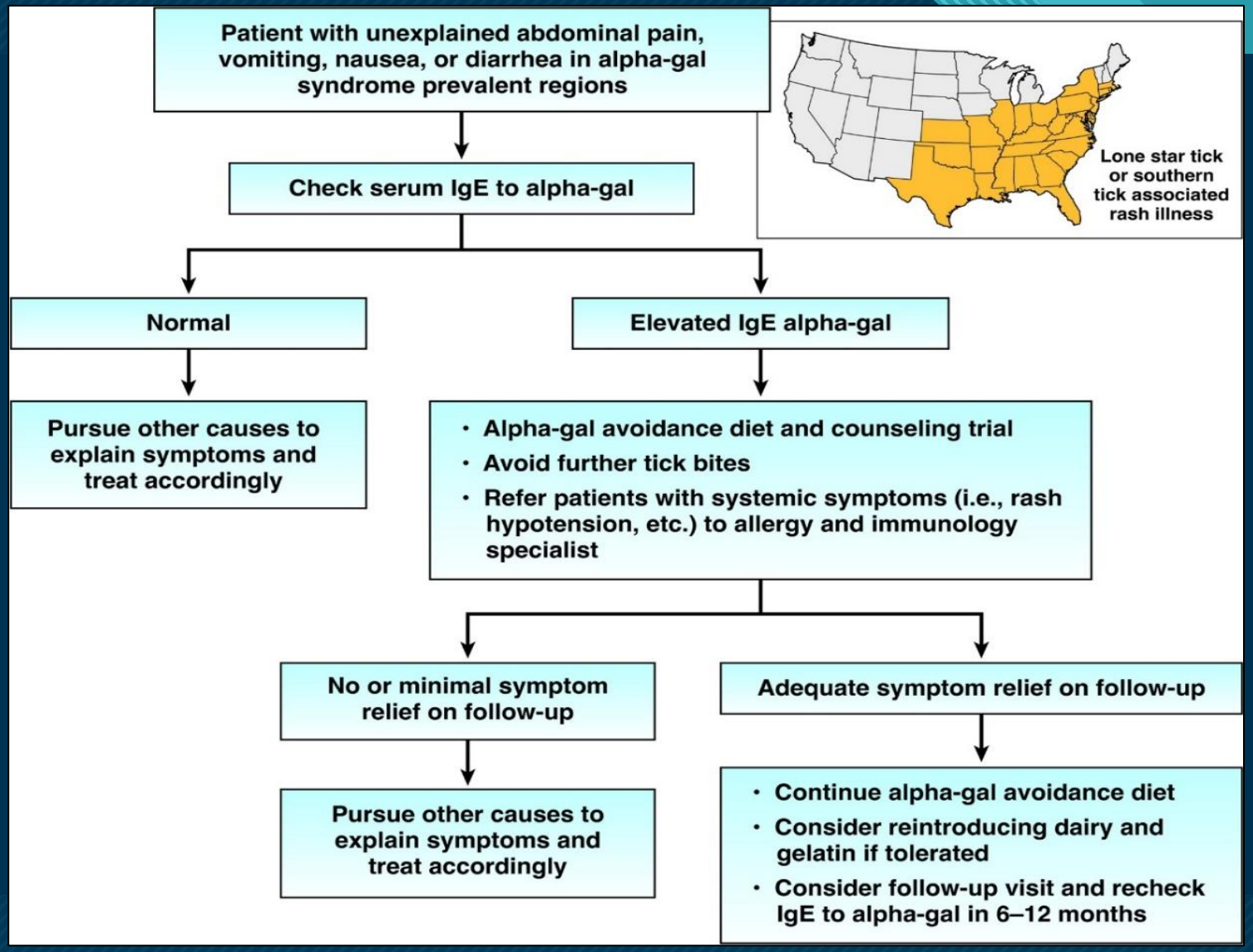
Modulating/amplifying co-factors

- Ingesting a greater amount of allergen (mammalian meat or meat product)
- The effect of cooking (slow cooking or reheating of the meat dish breaks down the connective tissue in meat, increasing alpha-gal availability)
- Offal consumption (e.g. sausage encasings, liver, kidney), because offal contains higher concentrations of the alpha-gal allergen
- Co-ingestion of alcohol
- Sleep deprivation
- Exercise, particularly within two hours
- Inclusion of spices, usually chilli and capsicum (but not nutmeg, black pepper or bay leaf)
- Prior administration of non-steroidal anti-inflammatory agents (within 24 hours)
- Being otherwise unwell/recent illness (e.g. upper respiratory tract infection)
- Being in the premenstrual/perimenstrual phase.

Alpha Gal Sensitization - other

- Tick bites; also Chiggers (?) -larvae in a species of mites, family Trombiculidae
- Allergy can occur in kids or adults
- Time course may be confounding
- # of tick bites may play role
- Unclear role for underlying atopy, conflicting studies

Diagnostic Approach



Pertinent History for Alpha-Gal Syndrome

- Timing
  - Night time symptoms are most common
  - Itching often the earliest symptom
- Ticks
  - Known tick bites or a history of outdoor activities in areas with ticks
  - Persistent irritation at site of tick bite
- Diet
  - Red meat, fatty meats, high fat dairy in diet

- If patient affirms ≥2 of these, consider testing for alpha-gal IgE

α-Gal IgE

- **Positive test result** Using the **cut-off of >0.1 IU/mL** (specificity of 92.3% and sensitivity of 100%)
- α-Gal IgE levels **higher than 2% of the total IgE levels**
  - α-Gal allergic individuals are frequently non-atopic individuals with low total IgE levels >> suggested to compare with total IgE levels
- α-Gal specific IgE declines over time (Possible reason for seronegative testing despite a history of symptoms)
- Additional tick bites lead to increases in α-Gal specific IgE

Other helpful tests

- Basophil Activation Test
  - Differentiate between α-Gal allergic patients and asymptomatic α-Gal sensitized patients
  - Higher basophil reactivity and sensitivity in patients with the α-Gal syndrome
- Tryptase – (IgE dependent MC activation) Serial measurement of total mast cell tryptase may help differentiate Anaphylaxis from other mimics

Oral food challenge

- Gold standard
- Risk of life-threatening anaphylactic reactions requiring multiple doses of epinephrine or emergency medical transport
- Typical challenge is 2 pork sausage patties prior to arrival in clinic

Commins SP. Expert Rev Clin Immunol 2020;16:667-77.

Problem - Health Care Team not aware of Alpha-Gal Syndrome

- Alpha Gal – not the same as alpha galactosidase
- Problem – coding test requests properly

2022 ICD-10-CM Diagnosis Code

Z91.014

Allergy to mammalian meats

https://alphagalinformation.org/

The Wrong Test

- ~~Alpha-Galactosidase~~ **— this is the wrong test!**

- ~~α-Galactosidase A Deficiency—~~ **this is the wrong test!**

- The main reasons why this test is sometimes mistakenly ordered are:
  - Even though a-galactosidase *has nothing to do* with alpha-gal syndrome, the names sound similar (and abbreviations are the same!) Remember Alpha-gal is (galactose-α-1,3-galactose)
  - Doctors and laboratory staff have trouble finding the correct test codes

Updated 5/6/23

Quest and Labcorp alpha-gal IgE test codes

Quest Alpha-gal IgE Test Code: 10554

Labcorp Alpha-gal IgE Test Code: 650001

Updated 5/6/23

Quest and Labcorp Alpha-gal Panel test codes

Quest Alpha-gal Panel Test Code: 10555

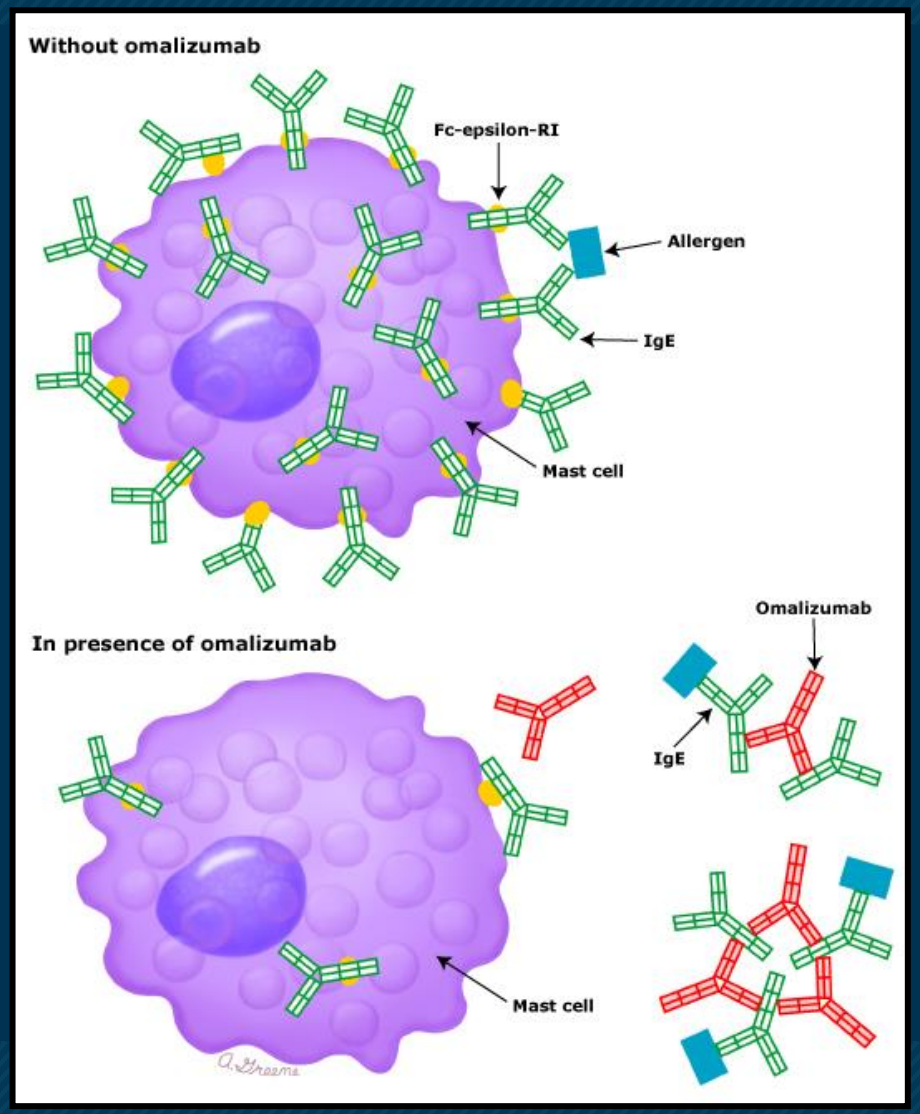
Labcorp Alpha-gal Panel Test Code: 650003

Note: experts rarely order the full panel, which is more expensive and not usually needed for diagnosis.

Approach to treatment

- Avoidance of meats, and other α-Gal containing products
- Avoidance of ticks
- Oral antihistamines
- Oral corticosteroids
- Oral Cromolyn (mast cell stabilizer)
- EpiPen
- Newer anti-IgE drug, Omalizumab

Omalizumab – binds free IgE



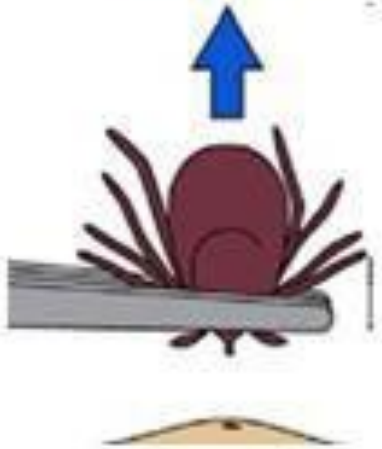
Tick bite prevention tips:

- When possible, avoid areas where ticks can be found, including tall grasses, bushes, shrubs and leaf litter
- Use a bug spray or repellent with 30% or more of DEET (can be used on skin)
- CDC recommends permethrin treatment of clothes, boots, gear. (Do not use on skin). Can buy pre-treated clothing ($)
- Wear clothing that covers your arms and legs to give ticks fewer places to bite.
- Tuck pants into socks while hiking.
- Examine your children, pets and gear after an outdoor excursion.
- Check your scalp, behind your knees, belly button and around your body after being outdoors.

How to Remove a Tick

Step 1: Use fine-tipped tweezers to grasp the tick as close to the skin's surface as possible. The goal is to remove the entire tick including its head and mouth.

Step 2: Pull upward with steady, even pressure. Do not twist or jerk the tick!



Step 3: Clean the bite area and your hands with rubbing alcohol, an iodine scrub, or soap and water.

Other meat products

- Gelatins made from beef or pork collagen
  - Jello, gummy bears
  - Gelatin casings for medicines
  - Gummy vitamins/supplements
  - Tooth paste
  - Topical numbing agents for dental procedures
- Products containing mammalian fats, like lard, tallow or suet
- Broths, stocks, gravies and bouillons made with meat
- Snake anti-venoms produced in horse or sheep
- Drugs produced in/from animals – Heparin, Cituximab
- Red algae (carrageenan) -used as a thickener in many food products including milk substitutes

Hidden Gelatin/a-Gal

- Nuts –may use gelatin to make salt stick
- Marshmallows
- Altoids brand mints
- Kellogg's Frosted Pop Tarts and Frosted Shredded Mini Wheats
- Candy corn
- Starburst
- Ice cream
- Puddings
- Jiffy Corn Muffin Mix

https://spoonfulapp.com/

- Airborne fumes from cooking (bacon; barbecue)

Other products may contain a-Gal

- Lanolin in lipstick & lotions
- Clothing –wool, cashmere, alpaca, suede
- Animal feed
- Milk and butter
- Personal care items: lotions, soaps, detergents, deodorants, cosmetics, & cosmetic brushes
- Vaccines– Excipients for stabilization or during manufacture (CDC) - MMR and Zoster Zostavix
- Drugs manufactured in animals – Abatacept, Infliximab
- Pancreatic enzymes
- Heparin
- Some thyroid hormone preps
- Bioprosthetic heart valves

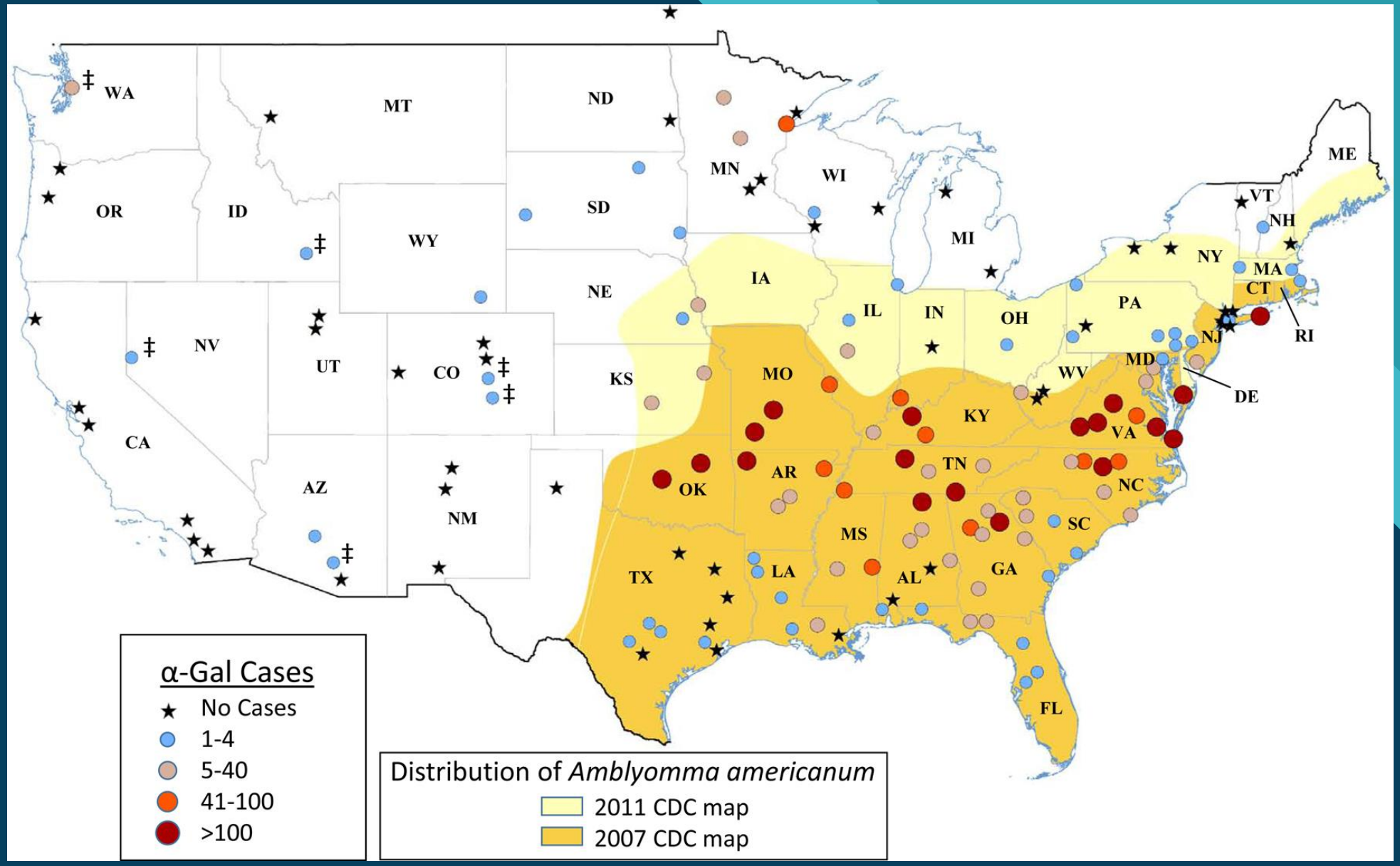
Biggest challenges

- Greater training for health care professionals
  - Is the medical team aware of alpha-gal syndrome?
  - Awareness of medicines that may contain meat products
- Drug labeling –mammalian products used in the manufacture of drugs
- Food labeling – hidden alpha gal
- Testing – send outs
- Awareness campaigns for the public
- Some people may become allergic to their pets

- **Psychological impact of alpha gal allergy: Long journey to diagnosis; considerable distress at continued allergic and anaphylactic reactions –patient information/advocacy websites have filled the gap**

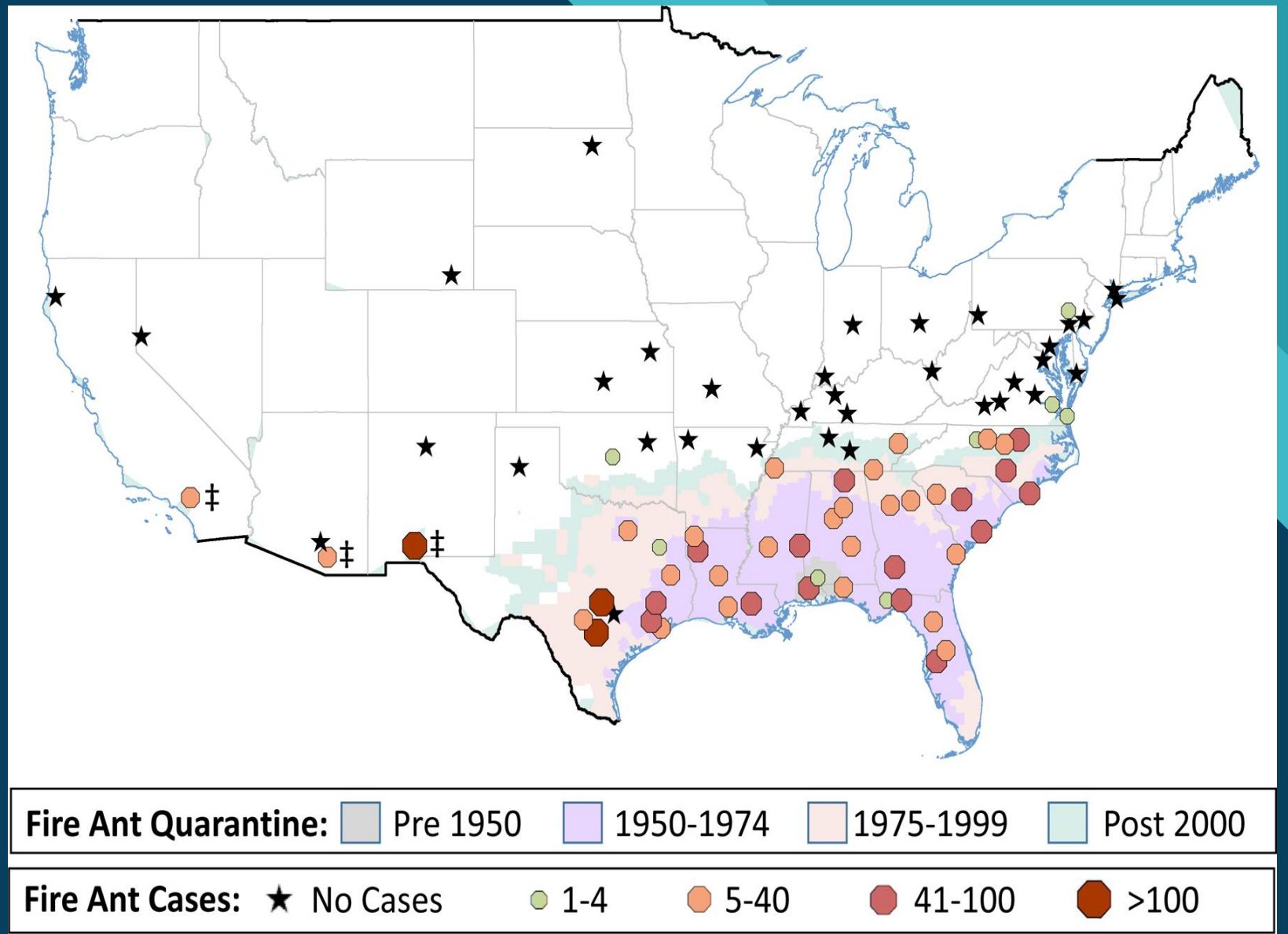
I live in La. and we are outdoors all the time. Should I be worried?

Cases of α-Gal syndrome identified by a survey of U.S. allergists



IFA(Imported Fire Ants) Quarantine Areas and Fire Ant Anaphylaxis cases from second survey

- Two types of IFA came to America in 1918 & 1930 through the port of Mobile, AL.
- Cargo boats coming from S. America used soil as ballast.
- Damage crops, agricultural equipment, impact wildlife, painful bites that can cause anaphylaxis.
- APHIS – Animal and Plant Health Inspection Service (USDA) – works to prevent spread of IFA by enforcing Federal Quarantine & works with states to regulate high risk commodities such as nursery stock, sod, hay, & soil moving equipment.



Delayed Anaphylaxis to Red Meat Questionnaire

Are you aware of the basic details of delayed anaphylaxis to red meat? Yes _ No ___ How many have you tested on the basis of history? __ ; or

0 1-4 5-40 40-100 >100

Have you diagnosed cases in your practice? Yes _ No ___ If so, how many in the last 3 years? *#* __ *or*

0 1-4 5-40 40-100 >100

Are you aware of any other practices in your region or state that are seeing cases? _____; contact information for those practices

If you have seen cases of delayed anaphylaxis to red meat:

a) How did you confirm cases: Skin tests _ Laboratory tests _ Approximately how many of the cases you tested because of a suggestive history have been negative for IgE to alpha-gal?

b) What is the range of times before start of reactions after eating mammalian products?

c) Do you question patients about: Tick bites _ Insect bites _ Chiggers

d) How common is a positive answer about tick or chigger bites? *< 50% 50-70% >70%*

In confirmed cases:

What % become free of attacks on a diet avoiding red meat? *<50% 50- 70% 70-90% >90%*

If symptoms persist, do you recommend: Dairy Free diet ___ or other treatment

Experience IFA allergy:

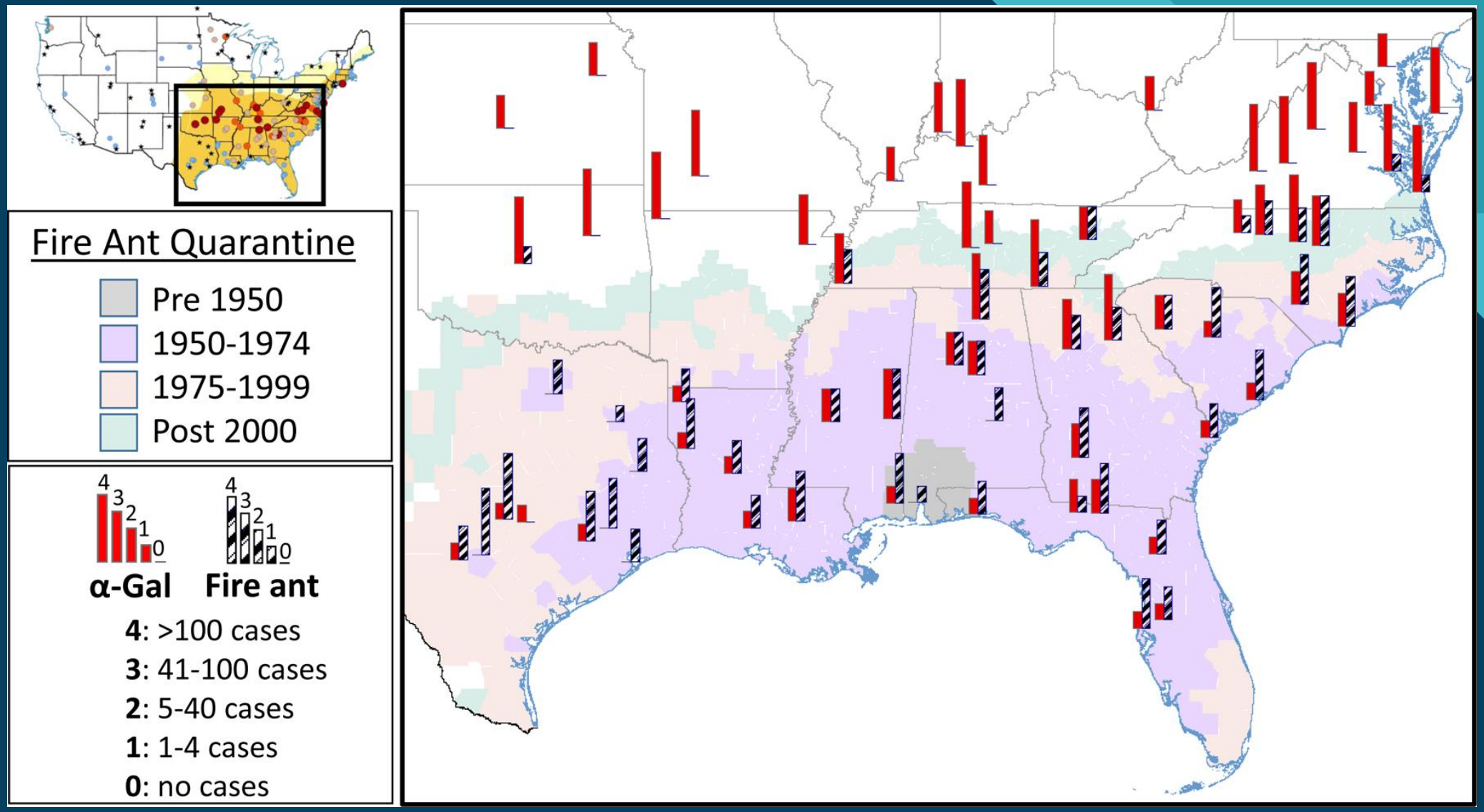
How many cases have you seen that relate to allergic reactions to fire ant bites in the last 3 years?

0 1-4 5-40 40-100 >100

How many on ImmunoTherapy (IT) for Fire Ant? _____ Are you aware of any other practices in your region or state that are seeing cases? ___;
contact information for those practices

FIG E2. Questionnaire of allergists in practice for second phase of the survey.

Epidemiological study –overlapping maps of Specific IgE for α-Gal & IFA overlaid on the quarantine data



Why? Fire Ant predation on ticks!

- Tests in BR and Pine Grove LA - Lone star ticks released into two areas with IFA 1.A. Untreated; B. Untreated but with barrier 2. Mirex treated to suppress fire ants
  - More larvae & ticks survived in the Mirex treated areas; None survived in non-treated areas. Barrier allowed survival
- *Environmental Entomology*, Volume 1, Issue 3, 1 June 1972, Pages 362–365,
- Mirex is no longer used due to its damage to the natural environment

Imported Fire Ants (IFA)

https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/imported-fire-ants/CT_Imported_Fire_Ants#:~:text=APHIS%20works%20to%20prevent%20artificial,hay%20and%20soil%2Dmoving%20equipment.

Dec 2020 - FDA approves “GAL SAFE” pigs made by Revivicor using “Intentional Genomic Alteration”

https://www.medpagetoday.com/allergyimmunology/allergy/90211

FYI: Informative University websites

- https://web.uri.edu/tickencounter/fieldguide/tick-growth-comparison-charts/
- https://bugoftheweek.com/blog
- https://entnemdept.ufl.edu/creatures/urban/medical/lone_star_tick.htm

Questions?

- https://amaroohills.com
- https://alphagalinformation.org
- https://www.twoalphagals.com

Thank You !

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