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Stinging Insect Allergy


What's The Buzz?

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Disclosure

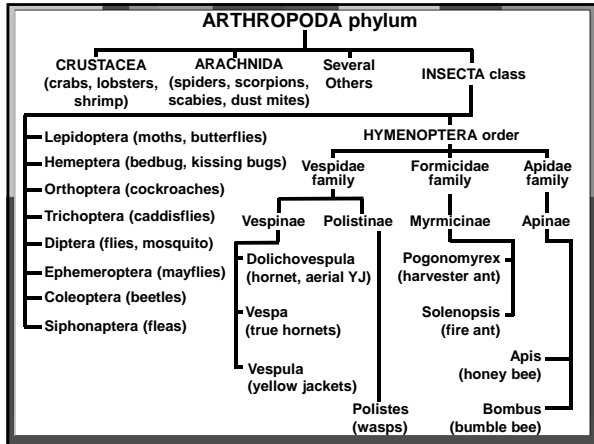
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- I do not intend to discuss an unapproved / investigative use of a commercial product / device in my presentation.



Learning Objectives

After completion of this activity, participants will be able to:

- List the insects most commonly associated with allergic reactions, and their basic characteristics
- Describe the different types of insect sting reactions, and their acute treatment
- Describe the chronic management of insect sting reactions, including avoidance and venom immunotherapy



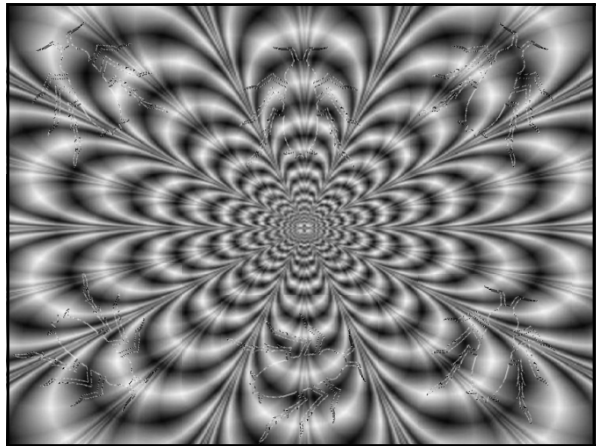
Indirect Effect of Arthropods

- Transmission of infectious agents
 - ~700 million mosquito-transmitted diseases per year
 - ~3 millions deaths per year
 - ~1 child dies of malaria every 30 seconds
- Damage to crops, animals, stored food
 - Grain weevils ruin from \$6 billion to \$12 billion of stored U.S. grain each year (5-10% of corn, soybeans, wheat, rice, sorghum, barley and other grains in US granaries)
- Damage to ornamental trees, homes, etc.
 - ~\$20 billion per year spent on termites in the US (control & damage)

Direct Effect of Arthropods

- Immune mediated hypersensitivity reactions
 - Via: injection, contact, inhalation, ingestion
- Non-immune mediated reactions
 - Envenomation
 - Contact irritant dermatitis/urticaria, blistering, toxic
- Myiasis (direct tissue invasion by fly larvae)
- Psychiatric
 - Entomophobia, Delusions of Parasitosis, Illusions of Parasitosis



Bak R. Cutis:2008;82,123(pt 1) and 257(pt 2)



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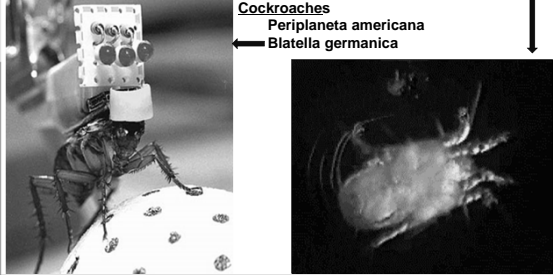
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Insect Allergy From Inhalation

Robo-roach

Dust mites
Dermatophagoides farinae
Dermatophagoides pteronyssinus

Cockroaches
Periplaneta americana
Blatella germanica



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Magnitude of Adverse Effects of Insects on Humans

- **Transmission of disease**
- **Destruction of crops, non-food plants, food and homes**
- **Toxic envenomation**
- Allergic reactions

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EPIDEMIOLOGY

- **Life-threatening systemic reactions**
 - ~0.4% - 0.8% of children, ~3% of adults
- **Approximately 50-100 deaths/year in U.S.**
 - Most quickly - with shock in 10-15 minutes
 - ~1/2 of fatal reactions have no previous history of reactions
 - Concomitant asthma is risk factor for death
- **Sensitization is common - but not all are reactive**
 - 2%-7% of "normal" people have ↑venom-specific IgE
 - 12%-15% of population have positive venom skin tests
 - 20% positive for IgE if stung within last year
- **Males > females (2:1)**
- **Direct correlation to time spent outdoors**

Clark S. Curr Opin Allergy Clin Immunol. 2006;6:279; Bilo BM. Curr Opin Allergy Clin Immunol 2008;8:330.

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Diagnosis of Insect Venom Allergy

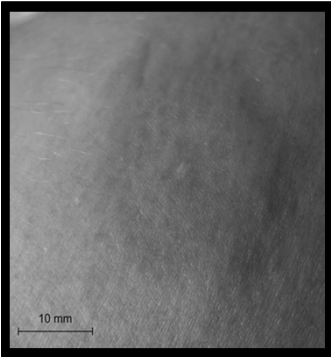
- Clinical History
- Physical Exam
- Allergy Testing
 - Skin testing
 - Blood tests (IgE, Basophil activation)
- Sting Challenge

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Examination of sting:

- May help distinguish between hymenoptera stings and other insects
- Will not differentiate type of hymenoptera
 - Fire ant stings have unique appearance



Emmanuel Boutet. Wikipedia. Bee sting 1 day after.

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Insect Sting - History


- Activity of person at time of sting
 - Gardening, digging, hiking, lawn mower, etc.
- Location of person at time of sting
 - Under eave, near garbage, near pool, food, etc.
- Type of insect activity in area where stung
- Time of year, part of country
- Visual identification of insect
 - Bring dead insect, stinger
- Identification of insect by characteristics

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

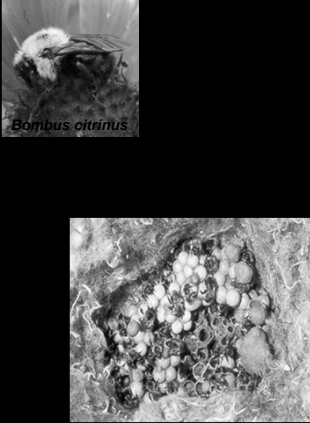
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	Apidae		Vespidae			
	Apinae		Vespiniae			Pollistinae
	Apis	Bombus	Vespula	Dolichovespula	Vespa	Polistes
	Honey Bee	Bumble Bee	Yellow Jacket	Aerial YJ and W/B-F Hornet	Hornet	Paper Wasp
Colonies						
Nest						
Feed						
Aggressive						
Leave Stinger						
Other						

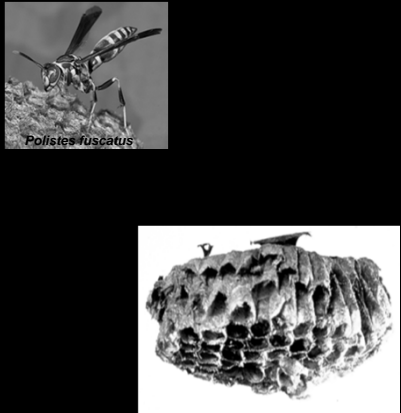
	Apis
	Honey Bee
Colonies	100s-1000s
Nest	Low structures
Feed	Nectar Pollen
Aggressive	+ European ++ African.
Leave Stinger	Yes
Other	<ul style="list-style-type: none"> *Commercially managed *Alarm pheromones *Usually perennial



Apidae		
Apinae		
	Apis	Bombus
	Honey Bee	Bumble Bee
Colonies	100s-1000s	15-250
Nest	Low structures	Ground, low struct.
Feed	Nectar Pollen	Nectar Pollen
Aggressive	+ European ++ African.	+
Leave Stinger	Yes	Usually not
Other	<ul style="list-style-type: none"> *Commercially managed *Alarm pheromones *Usually perennial 	<ul style="list-style-type: none"> *Loud and slow *Annual



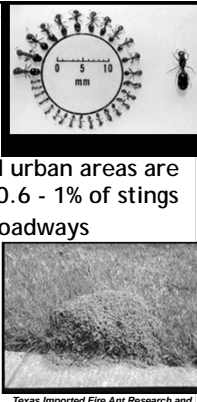
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Colonies		Polistinae
Nest		Polistes
Feed		Paper Wasp
Aggressive		10-25
Leave Stinger		Aerial
Other		Pred., Nectar, ++, No, •Slow flier, •Thin thorax, long legs, •Annual

Imported Fire Ants

- Native to Argentina, Uruguay & Brazil
 - U.S. -1918 in Mobile, AL
- 30-60% of population in infested urban areas are stung each year, anaphylaxis in 0.6 - 1% of stings
- Common around human areas, roadways
 - Attracted to electricity/ozone
- Very aggressive, attack in mass, repeated stings
 - Crawl 1.6 cm/sec (crawl from foot → waist on an average adult in 60 seconds)

Lockey RF. Hosp Pract 1990;March 15:109; Prahlow JA. Am J Forensic Med Path 1998;19:137; DeShazo RD. NEJM 1990;323:462;



Texas Imported Fire Ant Research and Management Project
http://fireant.tamu.edu/img/ants/img0031_med.jpg (Photo by Bart Drees)

Imported Fire Ant Quarantine




Date Modified: October 28, 2009

www.aphis.usda.gov/plant_health/plant_pest_info/fireants/downloads/fireant.pdf

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Which one is the 'Killer' Bee?



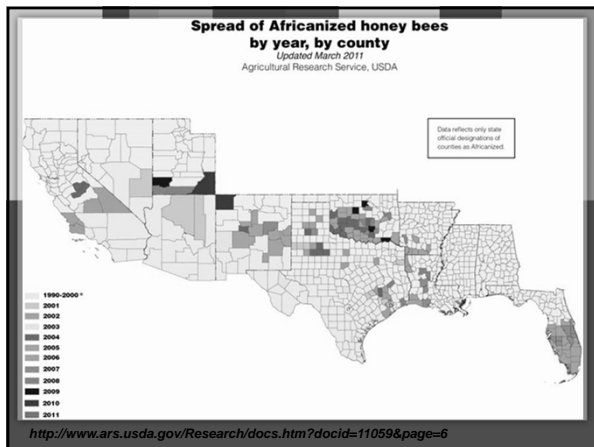
Crozier YC. *Experientia* 1991;42:968; Sylvester HA. *Am Bee J* 1987;127:511

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Africanized Honey Bees

- Entered U.S. 10/90 at Hidalgo, TX
- First U.S. fatality 7/93 in Harlingen, TX
- Less venom/sting, but similar composition
- More aggressive when disturbed
 - Defend with hundreds versus dozens of bees
 - ++ More 'alarm' pheromone released with stings
 - "Time to anger" 3 seconds vs. 19 seconds
 - "Defend/chase" 1/2 mile vs. 450 yards
- Less selectivity of hive sites--more likely to be near human activity

Vetter RS. *West J Med* 1999;170:223; Sherman RA. *West J med* 1995;163;541; Betten DP. *Pediatrics* 2006;117:231; Schumacher MJ. *Arch Int Med* 1995;155:2018



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Mass Stinging Africanized Honey Bees

- LD₅₀ approximately 19 stings/kg
– 1100/1400 stings for average female/male
- May be much less in those with underlying cardiovascular, respiratory or neurologic disease
- 500 stings approximates 1 rattlesnake bite



Vetter RS. West J Med 1999;170:223; Sherman RA. West J Med 1995;163:541; Betten DP. Pediatrics 2006;117:231. Photos: LA County Fire Department.



Quantity of Venom

- Honey bee -- ~30-50 mcg/sting
- Bumble bee -- ~10-30 mcg/sting
- Wasp -- ~5-17 mcg/sting
- Hornet -- ~2.5-5 mcg/sting
- Yellow jacket -- ~1.7-3.1 mcg/sting
- Fire ant -- ~0.05-0.1 mcg/sting

Hoffman DR. Ann Allergy 1984;52:276



Types of Insect Sting Reactions

- Local ("Expected" or "Normal")
 - Unique local for fire ants
- Large local
- Systemic
 - Cutaneous
 - Multi-systemic (life threatening)
- Toxic (envenomation from mass stings)
- Idiopathic
 - Serum sickness, Guillan-Barre, nephritis, vasculitis, others)

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Local Reactions

- "Normal" or "expected" reaction to venom components of stings
- Pain, itching, erythema, edema at site of sting
- Usually transient (hours) may last a few days
- Fire ants have unique "normal" local reactions

Golden DBK. *J Allergy Clin Immunol* 2011;127:852 (854e1).

Fire Ant Bite - Sting



Multiple Fire Ant Stings



Reschly MJ. *Cutis* 2000;66:179 (Photo by Murray S. Blum, University of Georgia Creative Commons Attribution 3.0 License.)

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Fire Ant Sting
30 minutes



<http://www.entomology.msstate.edu/resources/tips/ants/stingdescriptions.html>

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Fire Ant Sting
1 hour



<http://www.entomology.msstate.edu/resources/tips/ants/stingdescriptions.html>

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Fire Ant Sting
24 hours



<http://www.entomology.msstate.edu/resources/tips/ants/stingdescriptions.html>

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Fire Ant Sting 72 hours



<http://www.entomology.msstate.edu/resources/tips/ants/stingdescriptions.html>

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Fire Ant Sting 1 week



<http://www.entomology.msstate.edu/resources/tips/ants/stingdescriptions.html>

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Fire Ant Sting 1 month



<http://www.entomology.msstate.edu/resources/tips/ants/stingdescriptions.html>

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Acute Management Local Reactions

- Prompt/proper removal of stinger
 - "Scrape out" (speed more important than technique)
- Keep area clean
 - Prophylactic antibiotics not recommended
 - Tetanus prophylaxis usually not indicated
 - Consider for ground dwelling vespids
- Symptomatic treatment as needed
 - Antihistamines for itching, cool compresses
 - Pain medicine (acetaminophen)
- For fire ants - do not unroof vesicle, allow to dry

Clark S. Curr Opin Allergy Clin Immunol 2006;6:279; Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Large Local Reactions

- >10 cm in size
 - Often crosses over a joint
- Contiguous with site of sting
- Peaks at 48-72 hrs & can last days to wks
- Pain, itching, erythema, warmth, swelling, numbness
 - Compartment syndrome possible if severe
- ~95% of patients with LLR will have +IgE

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Acute Management Large Local Reactions

- Remove all possible 'constrictors' (rings, watches, bracelets, piercings, etc.)
- Cool compress, elevation
- Pain medications & antihistamines
- Systemic steroids for significant swelling
 - Or start prophylactically for those with a past history of significant swelling
- Monitor for complications (secondary infection, compartment syndrome)

Clark S. Curr Opin Allergy Clin Immunol 2006;6:279; Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1); Severino M. Curr Opin Allergy Clin Immunol 2009;9:334.

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Secondary Infections

- Antibiotics not part of routine treatment of local or large local reactions
- Late onset (>2-3 days) ascending lymphangitis, regional lymphadenopathy and fever suggest infection
 - Of those infected: *Staph. aureus* in ~75%
 - MRSA as in community
- May be more common in vespid stings

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Systemic Reactions

- Cutaneous
 - Urticaria, angioedema, generalized flushing / pruritis
- Multi-system (anaphylaxis)
 - **Laryngeal edema (dyspnea, stridor, hoarseness, difficulty swallowing, lump in throat, drooling)
 - *Bronchospasm (dyspnea, chest tightness, wheezing)
 - *Hypotension, arrhythmias (dizziness, pale, fainting), bradycardia, angina, MI
 - Nausea, vomiting, diarrhea, uterine contraction

* = Life-threatening ** = Most common cause of death

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Systemic Reactions

- The slower the onset of the reaction, the less likely to be life-threatening
 - In contradistinction to food allergic reactions
- Most common symptoms
 - Cutaneous: 80% adults and kids have any
 - Only cutaneous: 15% adults, 60% kids
 - Respiratory: 70% adults and ~30% kids have any
 - Hypotension: 60% adults (30% LOC), rare kids
 - Abdominal cramps: kids > adults
 - Uterine contractions

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Acute Management Systemic Reactions

- Treat like anaphylaxis from any trigger
- Cutaneous only: antihistamines, glucocorticoids
- Systemic
 - Epinephrine
 - Bronchodilators, steroids, antihistamines
 - Volume expanders, pressors, respiratory support (oxygen, airway maintenance, assisted ventilation)
- Biphasic / protracted reactions can occur
 - Observation at least 6 hours after resolution
 - Less common than with foods

Clark S. Curr Opin Allergy Clin Immunol 2006;6:279; Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Risk of Systemic Reactions Upon Re-sting

- Reactions usually stereotypical (not always!)
- Related to severity of initial reaction and age and interval between stings
 - Short interval between stings increases the risk for reaction to subsequent stings
 - Risk of systemic reactions remains 20-30% even after 10-20 years
 - Numerous and frequent stings (>200/year) may induce tolerance

Hauk P. J Ped 1995;126:185; Golden DBK Curr Opin Allergy Clin Immunol 2006;6:289; Valentine MD. NEJM 1990;323:1601; Golden DBK. J Allergy Clin Immunol 2011;127: (854e1)

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Risk of Systemic Reactions Upon Re-sting

- Previous rxn: Local ("normal") reaction
 - Risk low (~ same as general population ~3%)
- Previous rxn: Large local reaction
 - < 16 years old -- risk low
 - > 16 years old -- risk may be higher (? 5-15%)
- Previous rxn: Cutaneous symptoms only
 - < 16 years old -- risk ~ 10% risk of systemic, but usually cutaneous again
 - > 16 years old -- risk ? (may be high)
- Previous rxn: Systemic reaction
 - 60% chance of repeat systemic reactions (but may be as low as 30% in children)

Hauk P. J Ped 1995;126:185; Golden DBK Curr Opin Allergy Clin Immunol 2006;6:289; Valentine MD. NEJM 1990;323:1601; Golden DBK. NEJM 2004;351:668

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Venom Allergy Testing


- Skin test is preferred over blood IgE tests
- Any individual with systemic reaction
 - Selected patients with large local reactions
- If venom skin test is negative but patient has a convincing history and/or severe reaction:
 - Use venom-specific IgE (“RAST”) to confirm
 - If blood IgE testing is also negative, repeat skin and blood tests in 3-6 months

Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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Goals of Venom Immunotherapy (“Allergy Shots”)

- Prevent systemic reactions in high-risk patients
- Alleviate patient anxiety relative to insect stings



Eberlink JNGO. Curr Opin Allergy Clin Immunol 2003;3:287;Golden DBK. J Allergy Clin Immunol 2011;127:852 (854e1).

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VIT - Indications

- Demonstrate presence of venom-specific IgE
- Systemic reaction in any age (absolute)
- Cutaneous reactions in adults (>16 years)
 - Children with cutaneous reactions only typically have more benign course
- Large local reactions (LLR) in adults to prevent anaphylaxis and ↓ severity of LLR
- LLR in children to ↓ severity of LLR
- Other considerations
 - Risk of re-sting, life-style changes (QOL), accessibility to medical care, coexisting medical and psychosocial conditions

Valentine MD. NEJM 1990;323:1601; Golden DBK. J Allergy Clin Immunol 2011;127: (854e1)

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VIT - Efficacy and Safety

- ~>95% effective in preventing systemic reactions upon re-sting
 - ~80-90% for honey bee
 - Some evidence that VIT may decrease severity of large local reactions and serum sickness
- Up to 12% have adverse reaction to VIT
 - Overestimate? - especially in children
- Rare reports of fatal reactions after completion of course VIT + negative skin tests

Golden DBK. NEJM 2004;351:668; Golden DBK. J Allergy Clin Immunol 2011;127: (854e1)

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VIT - Duration of Treatment


- Recommended duration ~(3-) 5 years
 - 5 years is optimal (less relapse than 3 years)
- Possibly longer or indefinite(?) if:
 - Severe initial reaction
 - Systemic reactions from VIT or from 'field' sting
 - Honey bee VIT
- Considerations:
 - Effect on QOL (work/leisure), comorbidities (disease/meds), risk of exposures (work/leisure), psychosocial factors, patient preference

Keating MU. J Allergy Clin Immunol 1991;88:339; Golden DBK. J Allergy Clin Immunol 2011;127:(854e1)

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Auto-injectable Epinephrine

- Mandatory for all patients with prior systemic reactions (including cutaneous)
 - Should prescribe at least 2 per patient
- ? For those with large local reactions
- Not necessary for local reactions
- No absolute contraindication
- EpiPen®, Auvi-Q™, generic
 - <1/3 of patients presenting to ED receive Rx for epinephrine
 - Only 20-39% referred to allergist



Rudders SA. Ann Allergy Asthma Immunol. 2005;105:85

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Referral To An Allergist

- Systemic or anaphylactic reactions to known or suspected insect sting
- Cutaneous or large local reactions in most pts.
- Need education regarding stinging insect avoidance and emergency treatment
- Might be a candidate for venom immunotherapy
- Has co-existing situation that might complicate treatment of anaphylaxis (e.g. beta-blocker therapy, asthma, cardiac problems, etc.)
- Patient anxiety

Golden DBK. J Allergy Clin Immunol 2011;127: (854e1)

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Insect repellents (e.g. DEET, etc.) do not work for stinging insects!



The Far Side
8/25/88
Gary Larson


"Wait a minute! ... McCallister, you fool!
This isn't what I said to bring!"

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Insect Avoidance

Use Caution in High Risk Situations

- At home- garbage areas, eaves, wall cavities, tree hollows, pool
- Keep them outside (fix cracks, holes, screens, inspect periodically)
- With gardening, digging, tree trimming, taking out garbage, swimming, hiking
 - Esp. vibration: mowers, hedge trimmers
- In the wild- decaying logs, stumps, trees, subterranean cavities



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Insect Avoidance Personal Protection



- **Avoid insect 'attractants'**
 - Don't act like a flower! (no bright colors, dark colors, perfumes (cosmetics, sunscreens, etc.)
 - Sweets, meats, rotting fruit, outdoor pet food
 - Body odor, perspiration, suede, leather, wool
- **Wear 'insect-resistant' clothing**
 - Light/white cotton, smooth-finish texture
 - Cover as much of body as possible
 - Elastic wrist/ankles, ankle-high shoes, long white socks, tuck in pant legs into socks

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Insect Avoidance Common Sense Measures




- **Leave high-risk area if possible**
 - Insect pheromones
- **Call professionals to eradicate any known or suspected nests**
 - Consider periodic surveillance by experts
- **Don't tease, swat, 'rescue', etc., avoid rapid movements (esp. near hive/nest)**
- **Keep insecticides handy (esp. for car)**
- **Never walk outside without shoes**

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"Bee-zoar"

"...she had been thirsty and described having taken a long, deep swallow from a soft-drink can. She felt a sudden pain in her oropharynx..."



Endoscopic View of the Bee in Patient's Stomach

THE NEW ENGLAND JOURNAL OF MEDICINE
Lynch, J. P. et al. N Engl J Med 1997;336:1763-1764
