# Creepy Crawlers – To Like or Not to Like

## The Wonderful World of Insects

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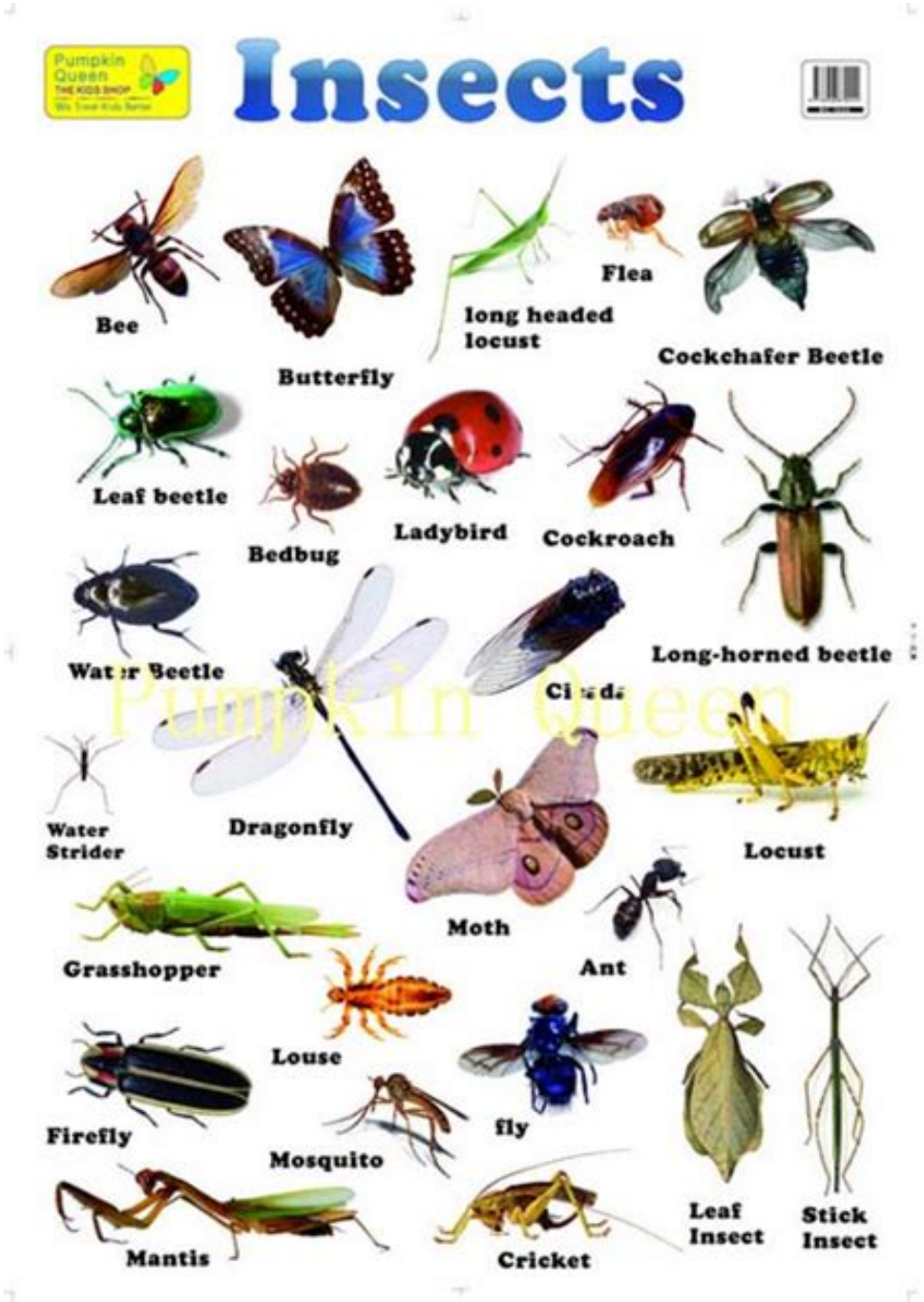
**February 25, 2021**

**Lifetime Learning Institute - NoVa**

# *INSECTA*

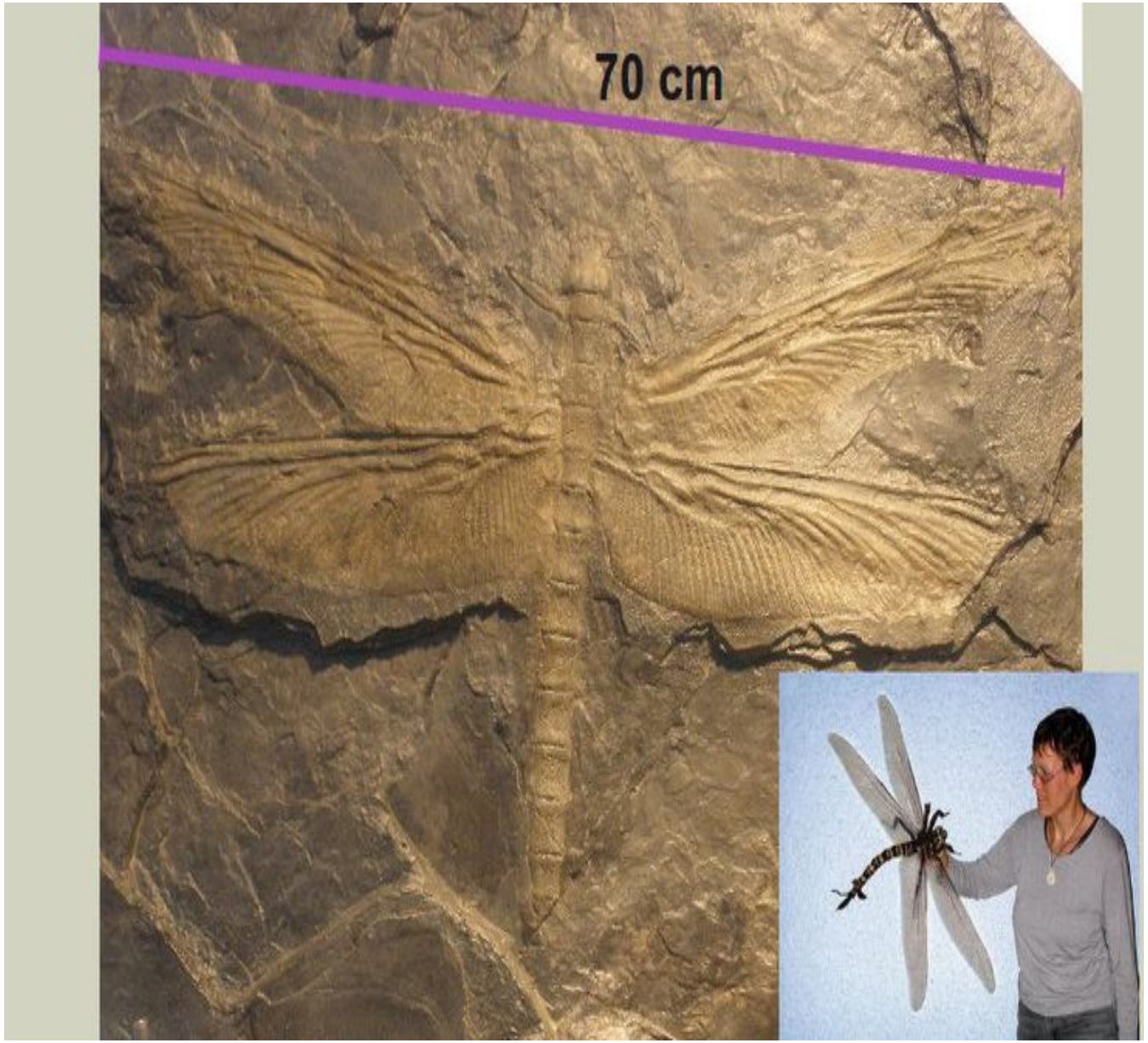
- No vertebrae - external skeleton
- Most diverse
- One million+ identified
- 30 million estimate – 50% all known living things
- 29 orders

- Not include other invertebrates (Arthropods)
  - spiders
  - ticks
  - mites
  - centipedes
  - scorpions
  - lobsters



# Origins

- **Back 400M years to Devonian Period (Age of Fishes)**
- **Flourish in Carboniferous Period (Age of Amphibians)**
    - **true bugs**
    - **cockroaches**
    - **dragonflies**
    - **mayflies**
    - **griffinfly (dragonfly ancestor) - with wingspan of 28 inches**



# How to Identify?

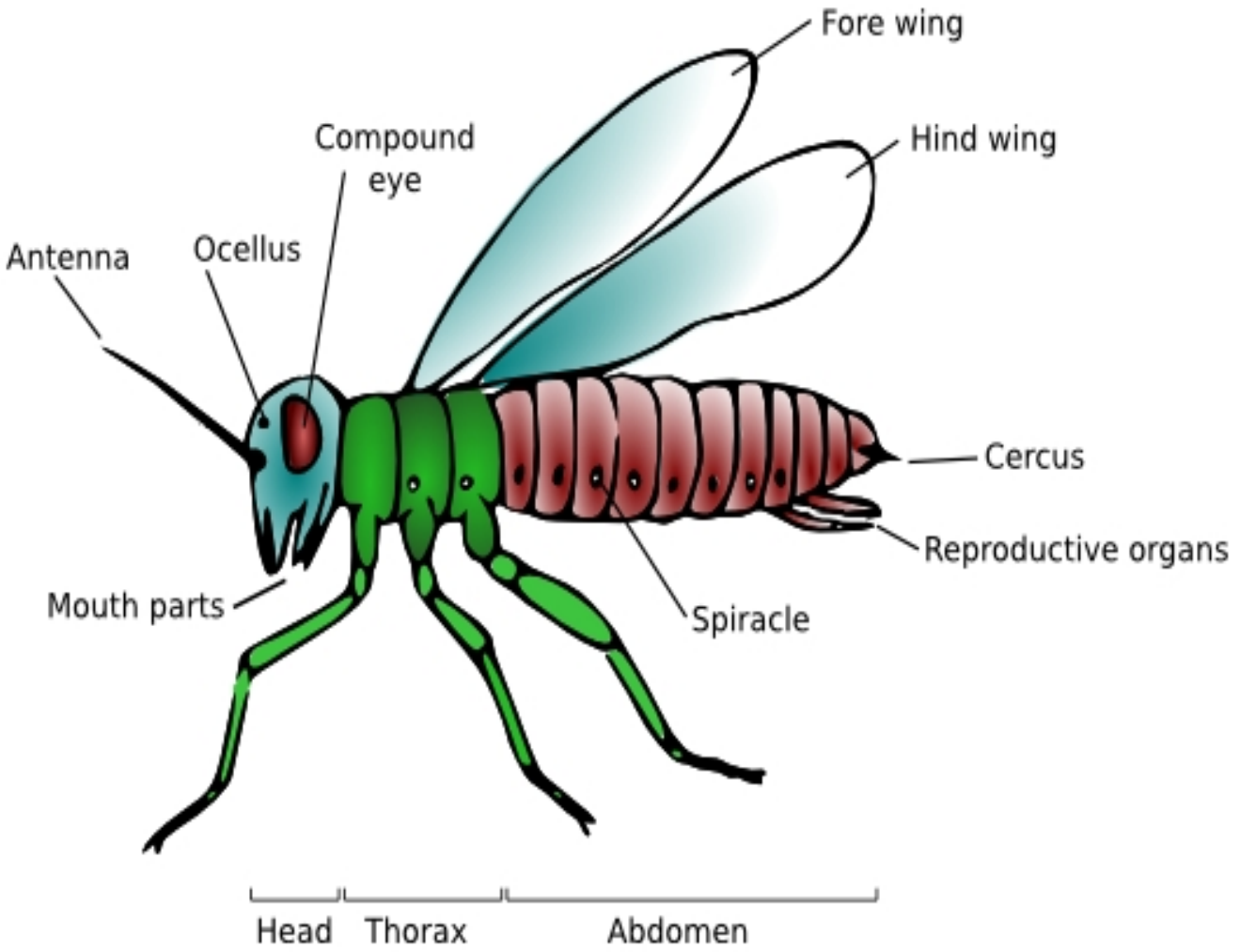
- Invertebrates – Exoskeleton rather than backbone
- Small – to be more versatile
  - Can withstand falls
  - Can walk on water
  - Can walk upside down

# Cold Blooded

- Cannot produce own body heat
- Need sun's warmth to function
  - butterfly needs 60+ degrees F
- Get energy from environment (rather than food)
- For winter – some spend time under log/stone with lower body processes
- Need less food in cold because activity slowed
- Usually live only one year

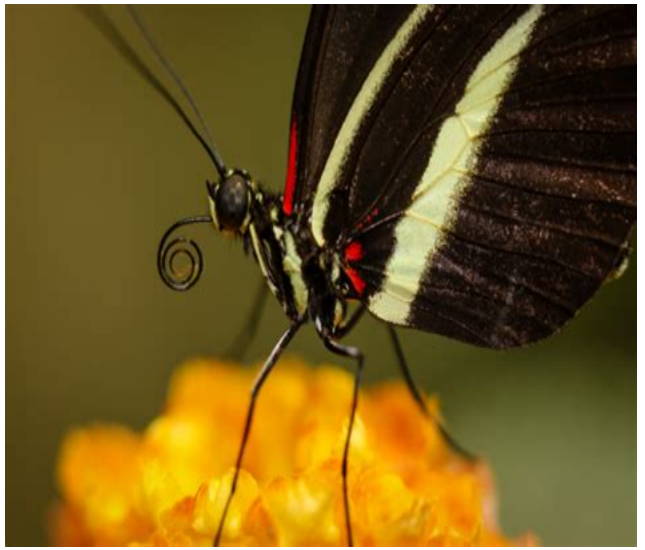
# 3 Body Parts

- **Head**
- **Thorax**
- **Abdomen**



# Mouth Parts
# 4 Types

- Chewing - Beetles, grasshoppers, termites, & mantids
  - to feed on plant matter
  - predators
- Piercing & sucking
  - Weevils, aphids, cicadas and stinkbugs (true bug)
- soaking or sponging
  - Flies have spongelike mouth for collecting fluids
- sipping or siphoning
  - butterflies uncurl proboscis to drink nectar like a straw

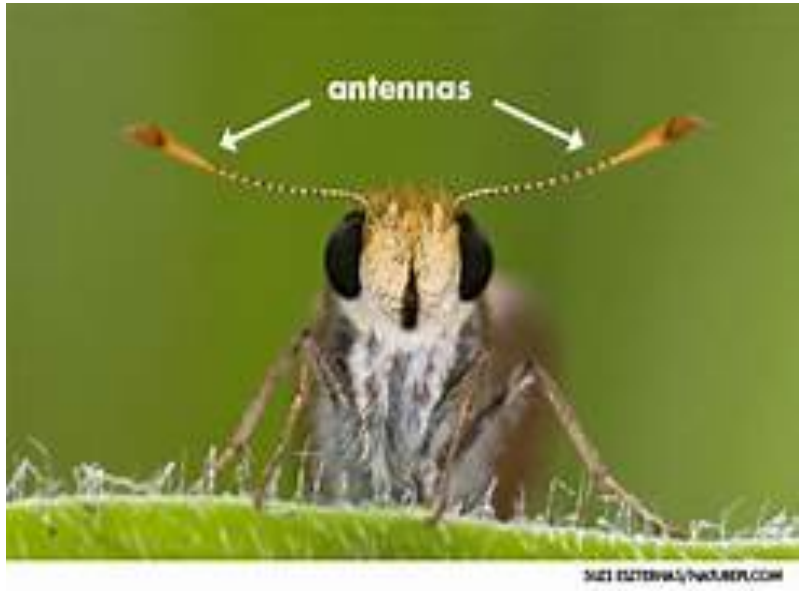


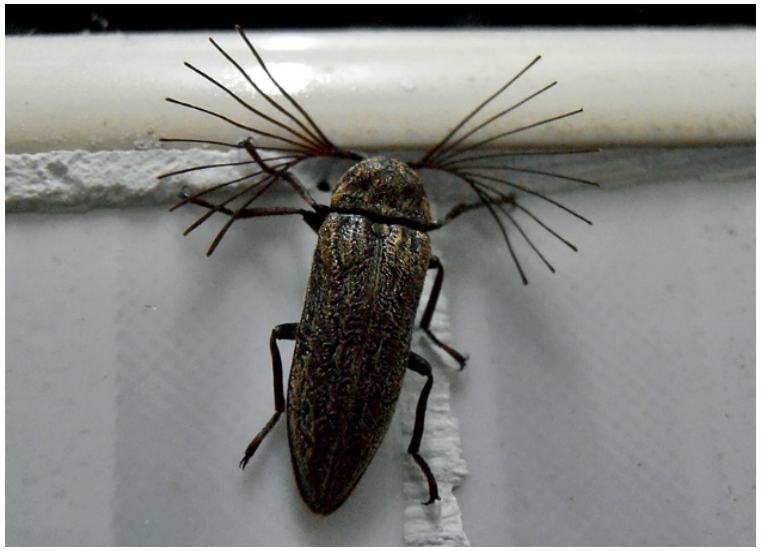
# Compound Eyes

- Mosaic-like, closely-packed mini-eyes
- Allow spotting fast movements & seeing wide angles
- Each “eye” independent so brain pieces together light
- Can see from ultraviolet to yellow (but not red)
- dragonflies have over 25,000 lens so see detailed images & sense small movements
- Most spiders have 8 simple eyes

# Antennae

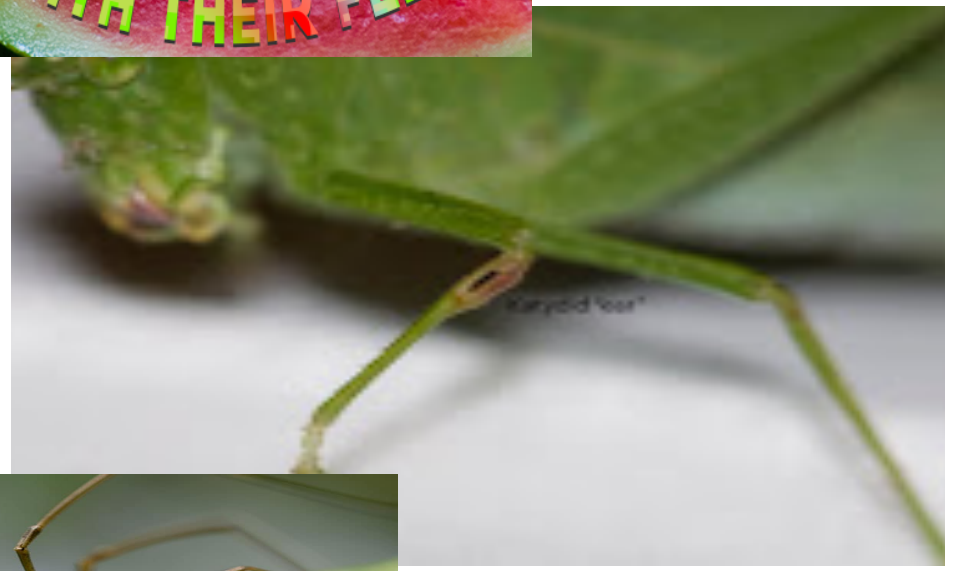
- On Head
- Main sense organs
- Used for sensing
  - smell or taste
  - touch
  - air motion
  - heat
  - vibration (sound)




# Legs
# 3 Pair on Thorax

- “Brush-foot” butterflies have 4 feet
- Butterflies taste with feet
- Katydid has ears on front legs

- Daddy Longlegs (harvestman) – not spider
  - related to scorpion
  - 8 legs
  - 2 body parts
  - lacks silk
  - Lacks venom glands

# Wings
# 2 Pair on Thorax

- Indicates adult stage
  - Small insects  will not “grow up”
  - Juvenile nymphs or larvae molt
  - Final molt - metamorphosis
- Flies
  - One pair
  - 2nd pair - Halteres (like gyroscopes)

# Habitat

- Every corner of world – glaciers, tropical jungles, deserts, ocean surface, dark caverns, streams and mountain peaks
    - Antarctica – Antarctica midge
        - ✓ only indigenous insect
        - ✓ Wingless
        - ✓ 2-6 cc long
        - ✓ Uses antifreeze to protect eggs

- Decomposers on land live in soil, leaf litter, rotting logs
    - control weeds
    - kill crop pests
    - pollinate
    - farm fungus and
    - disperse seeds
    - control large animal populations thru diseases & sucking blood

- In water - caddisflies, stoneflies, mayflies, dragonflies & damselflies
    - benthic macroinvertebrates – as bottom dwellers, early part of life in fresh water


# Behavior

**Some prefer specific plants and/or have important relationship with specific plant**

**Many have specialized roles in ecosystems & role so specific its extinction might tip balance of ecosystem**

- **Monarch caterpillar relies on milkweed – provides toxins**
- **The red disa orchid relies on mountain pride butterfly for pollination**
- **Gopher tortoise moth *(tincid)* caterpillar –relies exclusively on the shells (keratin) of gopher tortoises**
    - **constructs mass of silk tubes on underside, acting as anchors**
    - **feeds and pupates in tubes**
    - **species in decline because gopher tortoise is under threat**

# More Behavior
# Parental Care

- Some insects form relationships & care for young
- Stink bug mothers guard their eggs until they hatch and stay with young nymphs to protect from predators
- Giant water bug fathers carry eggs on backs, keeping them oxygenated and hydrated
- Decomposer Bess beetles form family units
  - Excavate rooms in logs for family
  - Both parents work together to feed and rear young
  - Have own vocabulary and communicate by squeaking
  - Feed on wood and fly only once to create colony

# Defense Mechanism
# Camouflage

- Shale grasshopper
- Lichen-mimic katydid
- Lantern fly
- Geometer moth caterpillar

# Defense Mechanism Mimicry

- Hawk moth caterpillar looks like snake head
- Peacock fruit fly with “tattooed ants” on wings
- Mad hatterpillar keeps outer shell on head when molts

# Defense Mechanism Other

- Create stink thru horns – swallowtail caterpillar
- Spray or release irritants – bombardier beetle
- Spines or poisonous hairs
- Wear red warning
- Play dead
- Sting

# Most Incredible Insects Beetles

- Most diverse with 400,000 known species (estimate over 1.5 million still unidentified)
- 25% of ALL known plant AND animal species (more kinds of beetles than all plants)
- Have armored forewings (elytra)
- Ladybugs & fireflies are beetles
- Have antlers, large mandibles or bioluminescent lights to impress mate

# Most Incredible Insects

- Shortest lifespan – Adult Mayfly at 24 hours
- Longest lifespan - Termite queens up to 50 years
- Biggest – Weta up to 70 grams
- Smallest - Fairyfly wasp -- .0067” in length
- Heaviest – Goliath beetle larvae over 3.5 oz
- Most beautiful – Sunset Moth from Madagascar


# Most Incredible Insects Cont.

- Most bizarrely-shaped– treehoppers with structures that resemble thorns and bars on their backs. Also, violin beetles and giraffe weevils
- Strongest - Hercules beetles can lift 850 times their weight (like humans lifting 10 elephants)
- Fastest runner - Australian tiger beetle can reach speeds of close to 6 mph when chasing prey
- Fastest flyer – Dragonfly at 35 mph



# Benefits

- Pollination - 75%+ flowering plants need help with pollination
- Food source for animals  amphibians, reptiles, fish, birds and mammals
- Food for humans
  - Rich in protein, vitamins and minerals
  - Beetles, cicadas, locusts, grasshoppers mantises, grubs, caterpillars, rickets, ants, mealworms & wasps

# Benefits – Cont.

- Decomposers
  - break down waste, dead animals & plants
  - release nutrients, aerate soil, retain nitrogen, store carbon and remove disease-causing organisms in carcasses
  - museums use hide beetles to clean skeletons of mammals
- Natural and biological control
  - by parasites and predators – lady beetles consumer mites, caterpillar, termites, aphids, etc.
- Products
  - Red dye, wax, lacquer, ink


# Benefits – Cont.

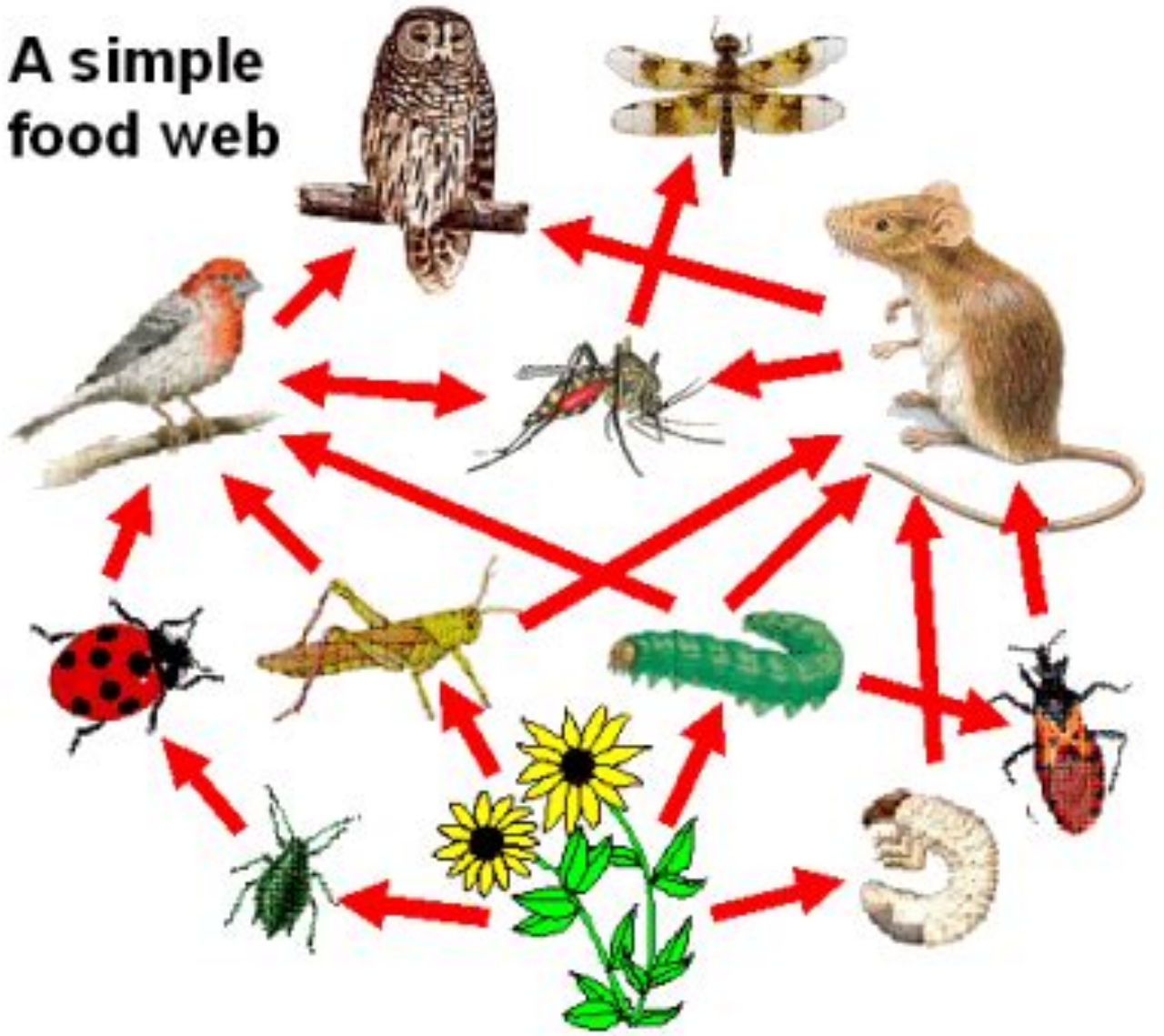
**Medicine**

- **Fly maggots treat wounds to stop gangrene**
- **Honey bee venom treats rheumatoid arthritis**
- **Spider silk as skin graft & stitch nerves**
- **Spider poison treats muscular dystrophy**
- **Fruit flies used in genetics**

# Benefits - Summary

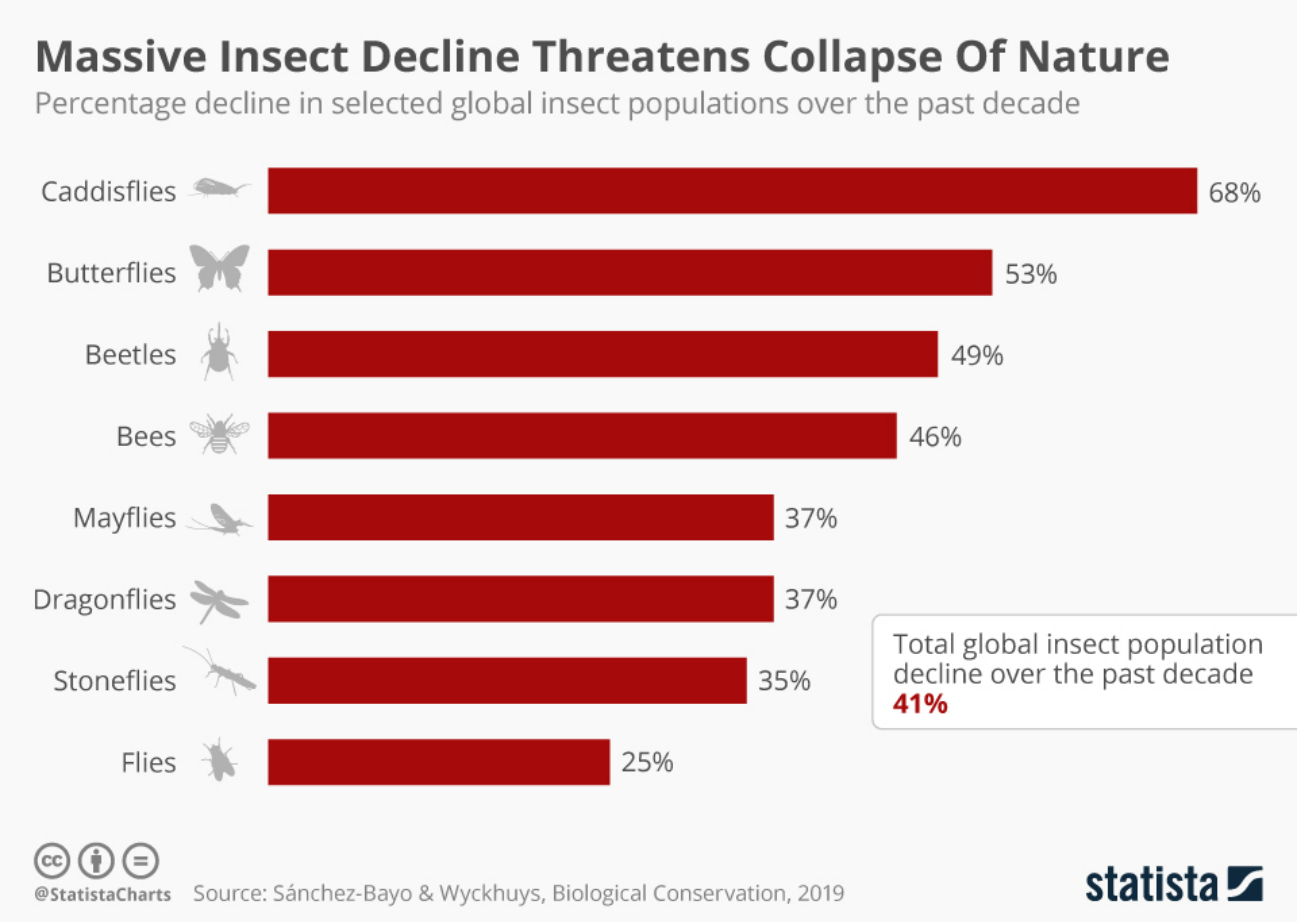
**Insects:**

- **Pollinate world's food**
- **Keep soil healthy**
- **Recycle nutrients**
- **Control pests**
- **Get rid of waste**
- **Crucial to food chain**



# Future - Insect Apocalypse?

- Kingdom 2% smaller each year
- 40% threatened with extinction & 30% endangered
- Extinction rate 8 times faster than for mammals & birds
  - Butterflies down 58% in England
  - Bumble bees – 28% threatened in NA
  - Honeybees – colonies down 58% since 1947
  - Flying insects - German biomass decrease by 70%



# Reasons for Loss

- **People Hate Bugs!**
  - **Only 84 species listed as endangered**
  - **Depicted as**
    - ✓ **Devourer of crops**
    - ✓ **disease vector**
    - ✓ **symbol of poor sanitation**

- **“The world has spent the last 30 years spending billions of dollars finding new ways to kill insects and mere pennies working to preserve them.” Doug Tallamy, Entomologist and author of *Bringing Nature Home***

# Reasons for Loss Cont.

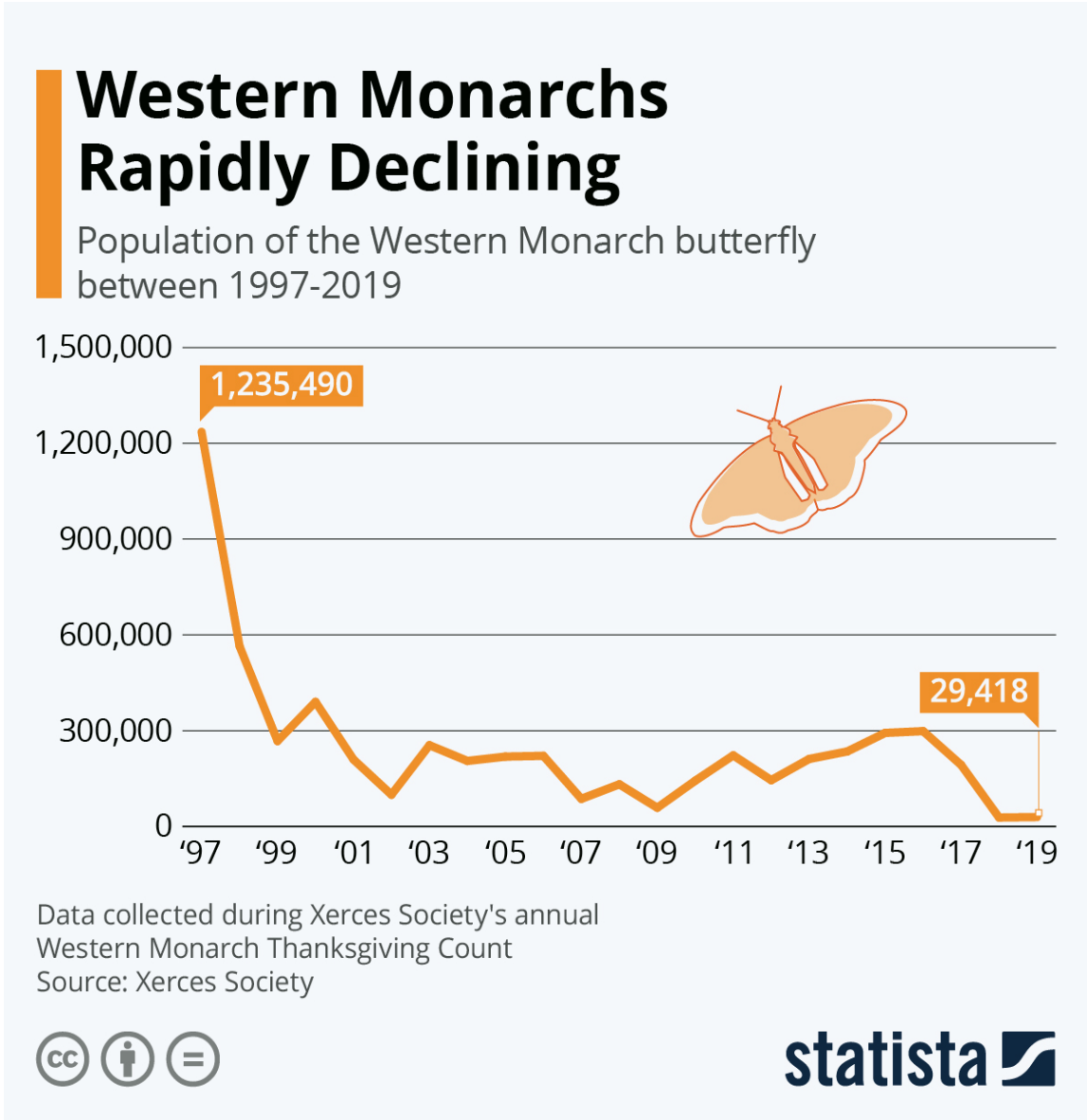
- Climate Change
- Insecticides
- Herbicides
- Light Pollution
- Invasive Species
- Changes in agriculture & land use

**Western Monarch Caterpillar – 99% decrease**

- Drier weather
- Farm herbicides
- Widespread milkweed destruction

**Western Monarch Butterfly –**

- Reduced nectar from woods & flowers due to monoculture & development
- 3,000 wintering in 2020



# Reasons for Loss Cont.

- Loss of plants for food
- Food loss for birds, reptiles, amphibians & fish
  - 60% of birds rely on insects as food
- Habitat destruction and pesticides due to industrialized agriculture/monoculture
  - Create bare field and surroundings and treat with synthetic fertilizer, pesticides & herbicides
  - New neonicotinoids insecticides & glyphosate herbicides like RoundUp, very bad since
    - ✓ Used routinely
    - ✓ Persist in environment
    - ✓ Sterilize soil
    - ✓ Kill grubs
- Rising temperatures due to climate change

# What to Do

- Overhaul agriculture methods
- Reduce pesticides
- Be less tidy
- Mow less
- Buy local
- Watch for stowaways
- Dim lights
- Be Insect Ambassador

- **Enjoy**
- **Respect**
- **Thank**

**Our Creepy Crawlers!**