ECOLOGY STORIES

THE ART & SCIENCE OF ECOLOGY

EPISODE ONE: WHAT IS BIODIVERSITY?

DIVERSITY IS A BASIC FEATURE OF LIFE. WHEN WE GET UP IN THE MORNING, WE CHOOSE AMONG OUR ASSORTMENT OF SOCKS; WE MAY CHOOSE AMONG A NUMBER OF KINDS OF BREAKFAST CEREAL; WE CHOOSE THE ROUTE TO WORK OR SCHOOL. DIVERSITY IS ALSO A KEY PART OF PLAY: WE ASSEMBLE MUSIC PLAY LISTS, ADMIRE HOW DIFFERENT POSITIONS ON A FOOTBALL TEAM PLAY, COLLECT STAMPS AND POKEMON CARDS. THERE IS A REASON WE USE THE WORDS "RICHNESS" AND "DIVERSITY" IN SIMILAR WAYS, AND THAT ZOOS, PARKS, AND FRONT YARDS WITH A RICH VARIETY OF PLANTS AND ANIMALS CATCH YOUR EYE .

WHAT IS BIOPHILIA?

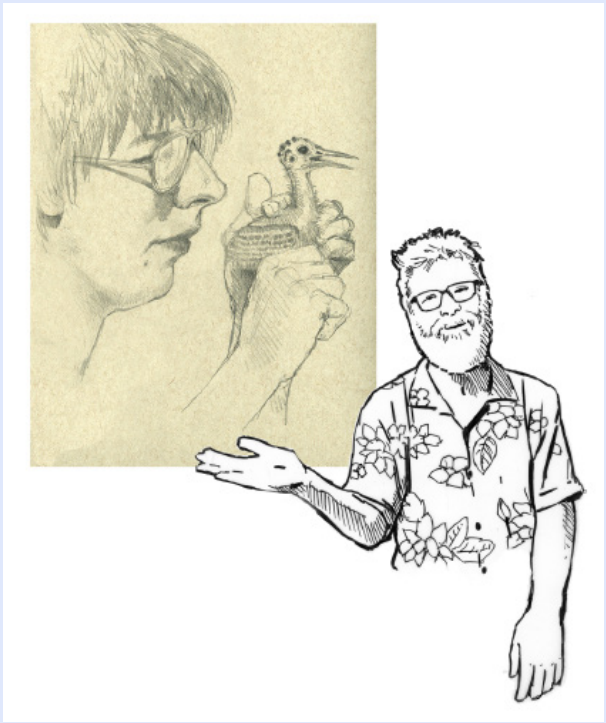
THE ANT ECOLOGIST DR. E. O. WILSON WROTE THAT WE HUMANS WERE BORN WITH A FASCINATION WITH DIVERSITY. HE CALLED THIS FASCINATION *BIOPHILIA*. WILSON--AN ECOLOGIST WITH A POET'S HEART--DESCRIBED BIOPHILIA AS "THE INNATE TENDENCY TO FOCUS ON LIFE AND LIFE LIKE PROCESSES...TO EXPLORE AND AFFILIATE WITH LIFE IS A DEEP AND COMPLICATED PROCESS...OUR EXISTENCE DEPENDS ON THIS PROPENSITY, OUR SPIRIT IS WOVEN FROM IT, HOPE RISES ON ITS CURRENTS." GROWING UP, WILSON'S BIOPHILIA HAD HIM CHASING SNAKES AND LIZARDS IN MOBILE, ALABAMA. INCREASINGLY, HIS BIOPHILIA TURNED TO ANTS AND OTHER INSECTS THAT HE CALLED "THE LITTLE THINGS THAT RUN THE WORLD".

WILSON, E. O. 1984. BIOPHILIA. HARVARD UNIVERSITY PRESS, CAMBRIDGE, MASS.

WELCOME TO THE ART & SCIENCE OF BIODIVERSITY

BIODIVERSITY IS SO WOVEN INTO OUR LIVES AND OUR FUTURE, EVERY CITIZEN OF PLANET EARTH SHOULD KNOW SOMETHING ABOUT HOW WE RECOGNIZE IT, HOW IT WORKS, AND THE TEAM OF SCIENTISTS WHO MAKE IT THEIR LIFE'S WORK. BUT BEFORE WE GET AHEAD OF OURSELVES, WE'D LIKE TO INTRODUCE OURSELVES...

YOUR HOSTS: DEBBY & MIKE



MIKE

I'M AN ECOLOGIST. I STUDY THE WAY PLANTS, ANIMALS, AND MICROBES LIVE IN THEIR ENVIRONMENTS. GROWING UP IN THE HEART OF THE SUBURBS, MY BIOPHILIA STARTED WITH MODELS OF SPACE SHIPS AND PLASTIC DINOSAURS. SOON I WAS CHASING AFTER GRASSHOPPERS AND WATCHING ANT COLONIES. LUCKILY, I HAD TEACHERS THAT LOVED BIRDS (HERE I'M HOLDING A BABY UPLAND SANDPIPER). SOON I WAS COUNTING THE BIRDS IN OUR NEIGHBORHOOD OF NEAT LITTLE HOUSES AND TIDY GREEN LAWNS. AT FIRST THERE WERE ONLY FIVE SPECIES: HOUSE SPARROWS, STARLINGS, BLUE JAYS, ROBINS, AND CROWS. WHEN THE FIRST BALTIMORE ORIOLE SHOWED UP, NEIGHBORHOOD BIRD BIODIVERSITY INCREASED BY 20%!

DEBBY

I'M AN ARTIST WITH A LIFELONG FASCINATION WITH BIODIVERSITY. I SPENT MY CHILDHOOD TURNING OVER ROCKS AND CATCHING LIZARDS, SNAKES, AND BUGS, KEPT PET CHICKENS, AND OBSESSIVELY WATCHED AND DREW BIRDS. EARLY ON, I ASPIRED TO BE AN ORNITHOLOGIST, BUT SENSIBLY MIGRATED TO THE ARTS, BUILDING A CAREER IN ILLUSTRATION. HERE I AM AT AGE 12, TEACHING MYSELF TAXIDERMY BY SKINNING A ROADKILLED MEADOWLARK. TO THEIR CREDIT, MY PARENTS DIDN'T OBJECT WHEN I DID STUFF LIKE THIS.

MIKE'S BIOPHILIA SENT HIM TO THE UNIVERSITY OF NEBRASKA AND THEN TO THE UNIVERSITY OF ARIZONA TO TRAIN TO BECOME A SCIENTIST. DEBBY'S BIOPHILIA SENT HER TO THE CALIFORNIA COLLEGE OF THE ARTS, AND THEN TO PARKS AND NATURE PRESERVES IN THE BAY AREA WITH BINOCULARS AND A SKETCHBOOK. WE ALL FIND OUR BIOPHILIA IN OUR OWN WAY. EVERYONE'S PATH IS DIFFERENT.

BIODIVERSITY DEFINED

EACH PERSON'S PURSUIT OF BIOPHILIA LEADS TO A DISCOVERY: SOME PLACES ARE RICHER IN ANIMALS AND PLANTS AND MICROBES, OTHERS LESS SO. THIS DISCOVERY IS CAPTURED IN THE WORD "BIODIVERSITY". IN BIODIVERSITY, WE COUNT AND COMPARE THE KINDS OF LIVING THINGS IN A PLACE. THE RESULTING NUMBER IS A MEASURE OF A PLACE'S BIODIVERSITY. TO GET TO THAT NUMBER REQUIRES CAREFUL STUDY. FOR EXAMPLE, GENERATIONS OF ANT SCIENTISTS ON BARRO COLORADO ISLAND IN PANAMA HAVE, ALTOGETHER, COUNTED ABOUT 400 SPECIES OF ANTS LIVING IN ITS RAINFORESTS. BOTH OF US HAVE SEEN 102 SPECIES OF BIRDS AROUND OUR HOUSE IN NORMAN OKLAHOMA. MICROBIOLOGISTS ESTIMATE THERE MAY BE 50,000 SPECIES OF BACTERIA IN A GRAM OF SOIL*. BIODIVERSITY CAN VARY A LOT DEPENDING ON WHAT YOU ARE COUNTING, AND WHERE.

SO, BIODIVERSITY BEGINS WITH COUNTS OF SPECIES. WHICH LEADS TO THE NEXT QUESTION, WHAT IS A SPECIES AND HOW DO WE RECOGNIZE DIFFERENT SPECIES?

ROESCH LF AND COLLEAGUES, ISME J. 2007 AUG; 1(4):283-90.* ***WHAT IS THIS?* *ITS THE SCIENTIFIC JOURNAL WHERE THE MICROBIOLOGIST LF ROESCH AND COLLEAGUES MADE THIS ESTIMATE ABOUT BACTERIAL BIODIVERSITY. SCIENTISTS GIVE CREDIT WHERE CREDIT IS DUE!*

TAXONOMISTS DEFINE SPECIES

TAXONOMISTS ARE SCIENTISTS WHOSE JOB IT IS TO RECOGNIZE AND NAME SPECIES, BUILDING A CATALOGUE OF BIODIVERSITY. THEY DO SO BY BECOMING SO FAMILIAR WITH A GROUP--BE IT ANTS, BIRDS, GRASSES, OR MICROBES--THAT THEY RECOGNIZE CONSISTENT DIFFERENCES AMONG THEM. DIFFERENCES USED TO TELL APART SPECIES ARE CALLED ***CHARACTERS***.

TAXONOMISTS OFTEN TRAVEL TO REMOTE PLACES TO FIND SPECIES NO ONE HAS SEEN BEFORE. THEY WORK IN MUSEUMS--BIODIVERSITY STOREHOUSES--WHERE THEY COMPARE SPECIMENS THAT WERE COLLECTED ALL OVER THE WORLD, AND IN DOING SO, DISCOVER AND NAME NEW SPECIES.

MEET ANDREA LUCKY-PORTRAIT OF A TAXONOMIST

DR. ANDREA LUCKY IS A BIODIVERSITY SCIENTIST AT THE UNIVERSITY OF FLORIDA WHO SPECIALIZES ON ANTS. WE TALKED TO HER ABOUT HER JOB AS A TAXONOMIST WORKING ON THESE TINY CREATURES.

"ANTS ARE OFTEN A DELIGHT TO WORK ON BECAUSE OF THE SHEER DIVERSITY OF FORMS THEY PRESENT. USING A MICROSCOPE, MANY VISUAL CHARACTERS ARE USEFUL TO TELL ANT SPECIES APART. WE USE THE SIZE OF THEIR ANTENNAE, THE SPINES AND HAIRS THAT COVER BODIES, EVEN THEIR RIDGES, WRINKLES, AND NUBBLY TEXTURES ARE OFTEN SPECIFIC TO INDIVIDUAL SPECIES."

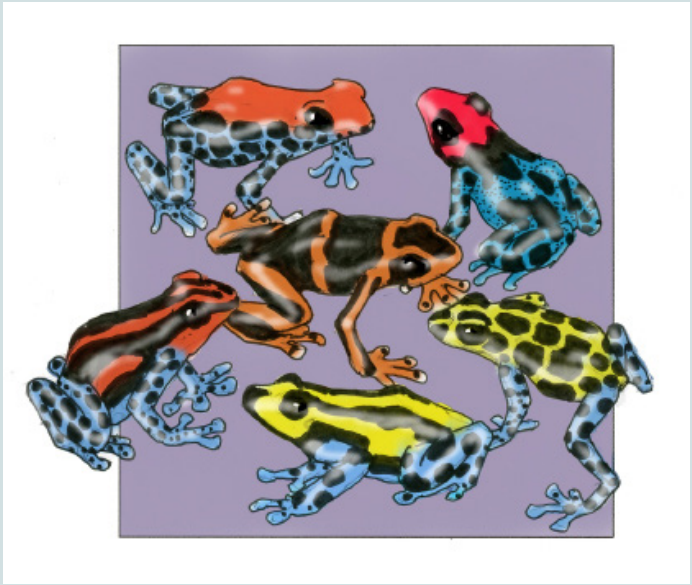
TAXONOMISTS GIVE EVERY CRITTER TWO NAMES: *GENUS* AND *SPECIES*

ALL CRITTERS--PLANT, ANIMAL, OR MICROBE--HAVE A FIRST NAME AND LAST NAME. THE *GENUS* GROUPS ALL CRITTERS THAT DESCENDED FROM A COMMON ANCESTOR AND THAT SHOW SOME UNIQUE, DEFINING FEATURE. THE *GENUS* IS SORT OF AN EXTENDED FAMILY OF CLOSELY RELATED SPECIES.

THESE POISON DART FROGS--SO NAMED FOR THE POISONS ON THEIR SKIN THAT NATIVE AMERICANS USED TO TIP THEIR ARROWS--ALL BELONG TO THE GENUS *RANITOMEYA*. ON THE LEFT WE SEE SIX SPECIES FROM THIS GENUS--EACH DISTINCT IN ITS OWN WAY. TO THE RIGHT ARE SIX INDIVIDUALS FROM THE GENUS *RANITOMEYA*. ALL BELONG TO THE SPECIES *RANITOMEYA SIRENSIS*. THE SPECIES IS THE END OF THE TAXONOMIC LINE--THERE IS NO SMALLER GROUP. MOST TAXONOMISTS THINK THAT MEMBERS OF A SPECIES GENERATE HEALTHY, VIABLE OFFSPRING WHEN THEY MATE WITH EACH OTHER, BUT ***NOT*** WITH DIFFERENT SPECIES FROM THE SAME GENUS.

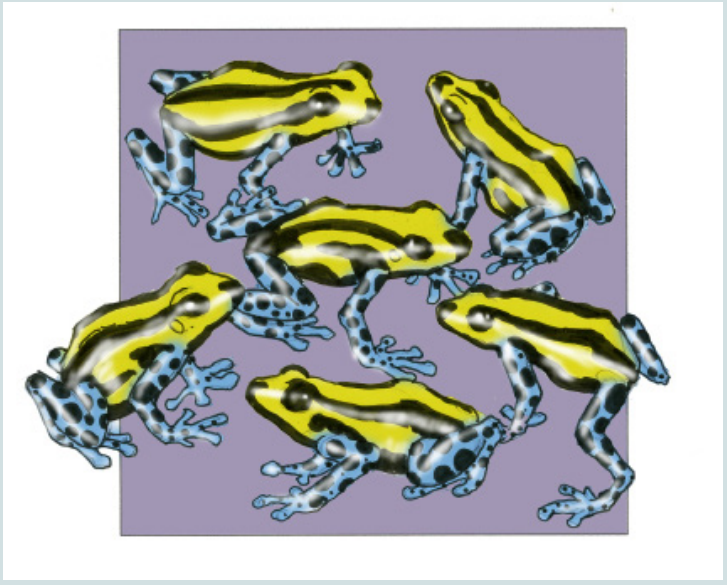
BY NOW YOU MAY HAVE NOTICED IN THE CAPTION BELOW ANOTHER RULE TAXONOMISTS USE (AND TAXONOMISTS CAN BE ***VERY*** FUSSY): WHEN REFERRING TO A PARTICULAR SPECIES, THE GENUS IS CAPITALIZED, THE SPECIES IS NOT, AND BOTH ARE PRINTED IN *ITALICS*.

GENUS



Six species from the genus *Ranitomeya*

GENUS + SPECIES

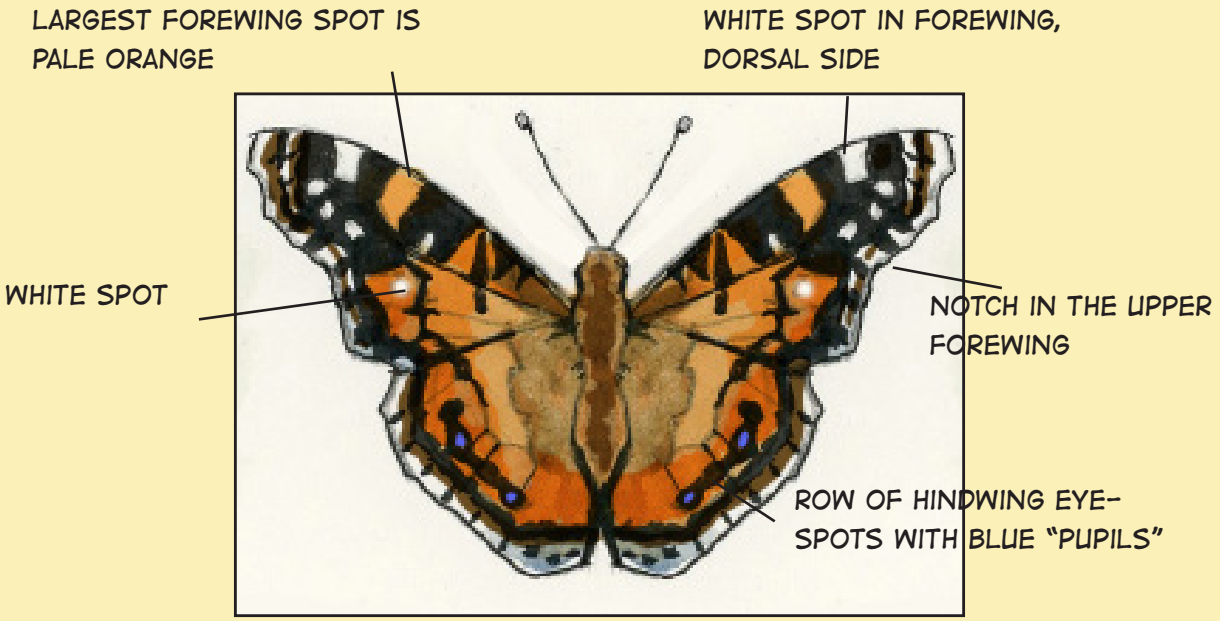


Six frogs from the species *Ranitomeya sirensis*

ALL THIS MEANS THAT WHEN YOU MEASURE BIODIVERSITY IN YOUR YARD, A LOCAL PARK, OR A POND, YOU NEED TO PRACTICE LEARNING HOW TO IDENTIFY THE SPECIES THAT LIVE THERE. THAT LEADS TO A SECOND JOB OF TAXONOMISTS, TRANSLATING *THEIR* STUDIES OF A GROUP OF ORGANISMS AND HOW TO TELL THEM APART (THEY ARE, AFTER ALL, EXPERTS) SO THAT NON SPECIALISTS, LIKE YOU AND WE TWO, CAN RECOGNIZE THEM.

TAXONOMY USING VISIBLE CHARACTERS

TAKE, FOR EXAMPLE THIS COMMON BUTTERFLY OF NORTH AMERICA, *VANESSA VIRGINIENSIS*, (ALSO KNOW BY THE ENGLISH NAME 'AMERICAN LADY'). A TAXONOMIST CAN TELL THIS SPECIES FROM ANY OTHER BY THEIR UNIQUE SET OF CHARACTERS: COLLECTIONS OF FEATURES THAT ALLOW ANYONE TO IDENTIFY THAT SPECIES. NO OTHER KNOWN SPECIES HAS THE EXACT LIST OF CHARACTERS OF OUR *VANESSA VIRGINIENSIS*, INCLUDING TINY THINGS LIKE THAT WHITE SPOT ON THE FRONT WING. TAXONOMISTS SPEND A GOOD DEAL OF THEIR WORKING LIVES LOOKING FOR THESE UNIQUE SETS OF CHARACTERS (WE *TOLD* YOU THEY WERE FUSSY).

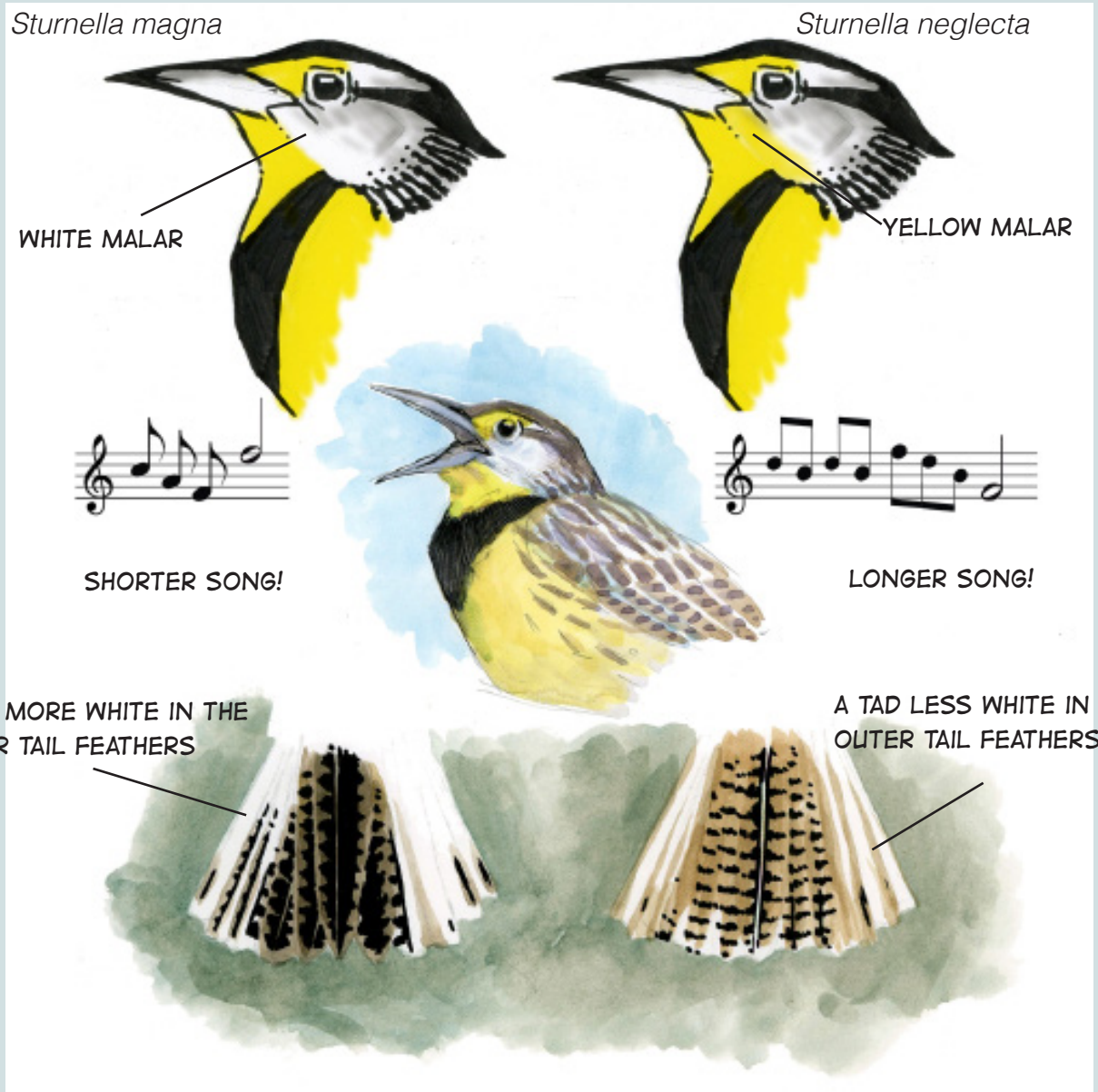


AMERICAN LADY BUTTERFLY
Vanessa virginiensis

OK, LET'S TRY ANOTHER EXAMPLE. NOW WE NEED TO TELL APART TWO SPECIES FROM THE GENUS *STURNELLA*: THE EASTERN MEADOWLARK (*STURNELLA MAGNA*) AND THE WESTERN MEADOWLARK (*STURNELLA NEGLECTA*). MEADOWLARKS ARE CHUNKY BIRDS OF NORTH AMERICAN GRASSLANDS. THEIR ENGLISH NAME CAPTURES SOMETHING ABOUT WHERE THEY'RE FOUND, *MAGNA* IN THE EASTERN GRASSLANDS AND *NEGLECTA* IN THE WESTERN GRASSLANDS. BOTH CAN BE FOUND LIVING TOGETHER IN THE MIDDLE OF THE CONTINENT. THE STORY BEHIND THE NAMES? *STURNELLA MAGNA* WAS FOUND FIRST BY EUROPEAN TAXONOMISTS WHO NAMED IT IN 1758 AFTER ITS SIZE (ITS NAME TRANSLATES TO "LARGE LITTLE STARLING"). *STURNELLA NEGLECTA* WAS DISCOVERED AND NAMED SECOND (1844), BUT ONLY AFTER A TAXONOMIST STARTED TO NOTICE CHARACTERS THAT DIFFERED FROM THE EASTERN MEADOWLARK. SMALL DIFFERENCES, THAT HAD, UP TO THAT POINT, BEEN... WELL..."NEGLECTA'ED".

TRADITIONAL TAXONOMY USING INVISIBLE CHARACTERS

THESE DIFFERENCES, AS WE DEMONSTRATE, CAN BE FOUND IN THE WHITE OF THE TAIL, AND WHETHER THE MALAR "MUSTACHE" IS WHITE (=*MAGNA*) OR YELLOW (=*NEGLECTA*). BOTH, AS YOU CAN IMAGINE, WOULD BE DIFFICULT TO TELL APART WHEN THE MEADOWLARK IS SITTING ON A FENCE POST 100 METERS AWAY. WHICH LEADS US TO THE THIRD CHARACTER: THE BIRD'S SONG. DEBBY THE ARTIST, IS ALSO DEBBY THE MUSICIAN, AND TRANSCRIBED THE SONGS OF BOTH SPECIES INTO MUSICAL NOTES FOR US. *STURNELLA MAGNA* HAS A SHORT SONG THAT SOUNDS LIKE A RUSTY GATE HINGE (CREEEKK!). *STURNELLA NEGLECTA*'S SONG IS LONGER AND BUBBLIER. YOU CAN IMAGINE EUROPEAN ORNITHOLOGISTS WANDERING THE PRAIRIES OF NEBRASKA, AND SEEING WHAT LOOKED TO BE THE SAME BIRD SPECIES SINGING VERY DIFFERENT SONGS AND WONDERING "WHY WOULD THEY DO THAT?".



TAXONOMISTS ***LOVE*** REPRODUCTIVE CHARACTERS--THOSE USED BY INDIVIDUALS OF THE SAME SPECIES TO FIND EACH OTHER WHEN THEY ARE READY TO MATE. THESE CHARACTERS ACCOMPLISH TWO OF THE TAXONOMIST'S BIGGEST GOALS: TO RELIABLY TELL SPECIES APART, AND TO ENSURE THAT THE SPECIES FIND OTHER MEMBERS OF THE SAME SPECIES.

REPRODUCTIVE CHARACTERS ARE OFTEN USED TO DEFINE SPECIES.

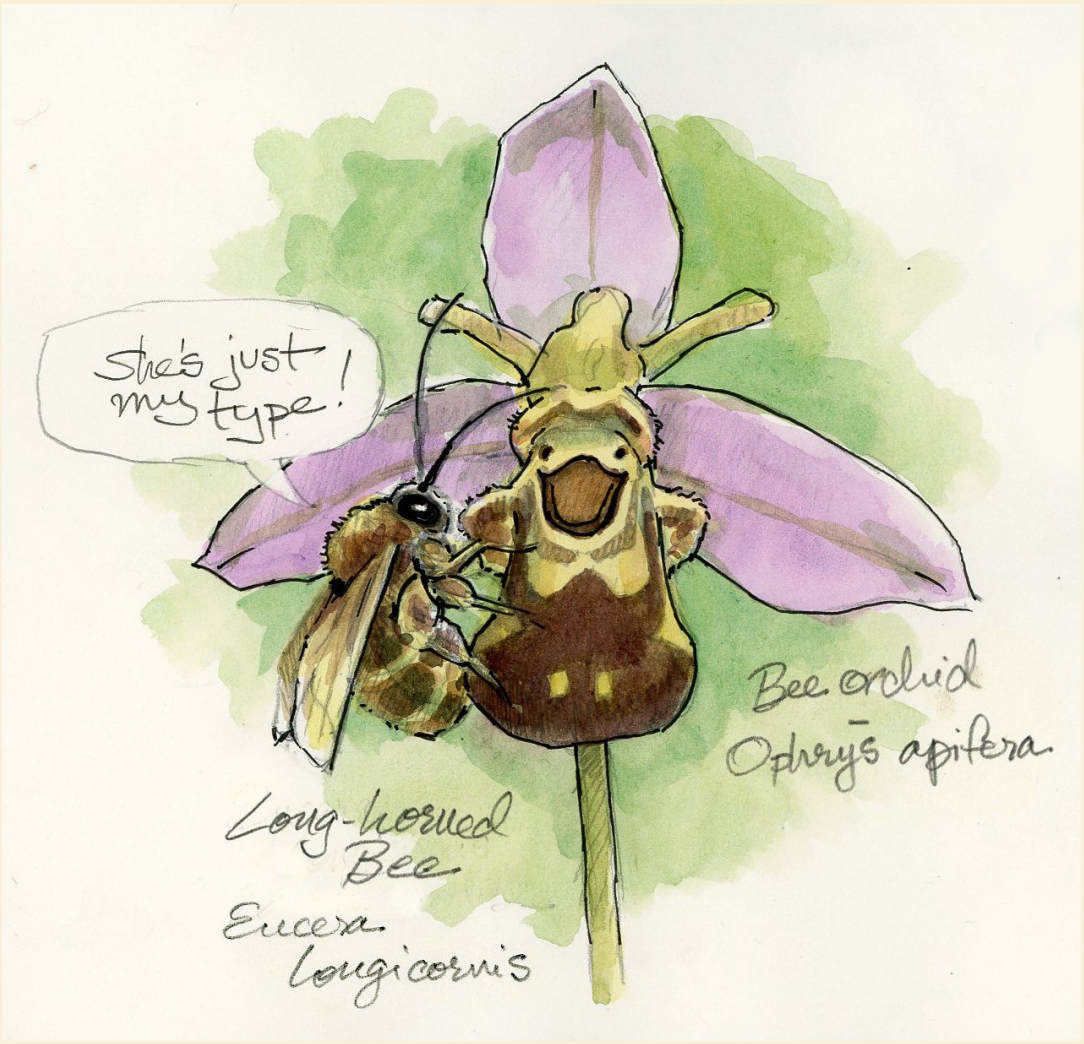
Butterfly Genitalia

SO, TAXONOMISTS WORKING TO DEFINE A SPECIES, OFTEN SEARCH FOR THE SAME CHARACTERS THAT ALLOW THEIR STUDY ORGANISM MATE WITH OTHER MEMBERS OF THE SAME SPECIES. IN INSECTS, THIS OFTEN MEANS LOOKING AT <BLUSH> PARTS OF THEIR GENITALIA, WHICH CAN BE REMARKABLY DIFFERENT AMONG SPECIES IN THE SAME GENUS.

ANDREA LUCKY (CONTINUED)

"AND OF COURSE, LIKE OTHER TAXONOMISTS, WE TAKE 3D PICTURES OF THEIR GENITALIA."

MORE REPRODUCTIVE CHARACTERS: ORCHIDS AND THEIR POLLINATORS



THE ORCHIDS ARE A FAMILY OF PLANTS FOUND ALL AROUND THE WORLD. TAXONOMISTS RECKON ORCHIDS ARE MADE UP OF AT LEAST 28,000 SPECIES. TAXONOMISTS DISCOVER MANY OF THEIR CHARACTERS FROM AN ORCHID'S FLOWERS. FOR THOSE WHO THINK "TULIP" OR "DAISY" WHEN THEY IMAGINE FLOWERS, ORCHID FLOWERS ARE A SURPRISE. IN ORCHIDS, COMMON FLOWER PARTS, LIKE PETALS AND ANTHERS, ARE MODIFIED TO FORM BIZARRE STRUCTURES PAINTED WITH A VARIETY OF COLORS AND THAT RELEASE A VARIETY OF SCENTS. ALL OF THESE MODIFICATIONS COMBINE TO ATTRACT INSECTS WHO, AFTER THEY VISIT THE FLOWER, LEAVE WITH A DOSE OF POLLEN FROM THE ORCHID. THE ORCHID HOPES *ITS* POLLEN WILL BE DEPOSITED IN ANOTHER FLOWER OF THE SAME SPECIES, WHERE IT WILL FERTILIZE WHAT WILL BECOME *THAT* FLOWER'S OFFSPRING.

ONE WAY ORCHIDS DO THIS IS BY PRODUCING FLOWERS THAT IMITATE THE REPRODUCTIVE CHARACTERS--THE COLOR, SHAPE, SCENT--OF ITS PREFERRED SPECIES OF POLLINATOR--A BEE, FLY, BEETLE, OR BUTTERFLY. SNEAKY! MEANWHILE, OUR POLLINATOR (WHO, AFTER ALL, JUST WANTS TO FIND *ITS* MATE!) IS FOOLED INTO A CLOSE ENCOUNTER WITH AN ORCHID FLOWER. THE POLLINATOR LEAVES UNSATISFIED, BUT NOT BEFORE THE ORCHID HAS DISCRETELY ATTACHED SOME POLLEN.

WHEN A SPECIES' CHARACTERS RESIDE IN ITS GENES

FEATURING THE ECOLOGISTS DAN JANZEN AND WINNIE HALLWACHS

THE TEAM OF DR. DAN JANZEN AND DR. WINNIE HALLWACHS LEAD A LARGE CREW OF NATURALISTS IN GUANACASTE, COSTA RICA. ONE OF THEIR GOALS IS TO REVEAL THE BUTTERFLY BIODIVERSITY OF THIS DRY TROPICAL FOREST.

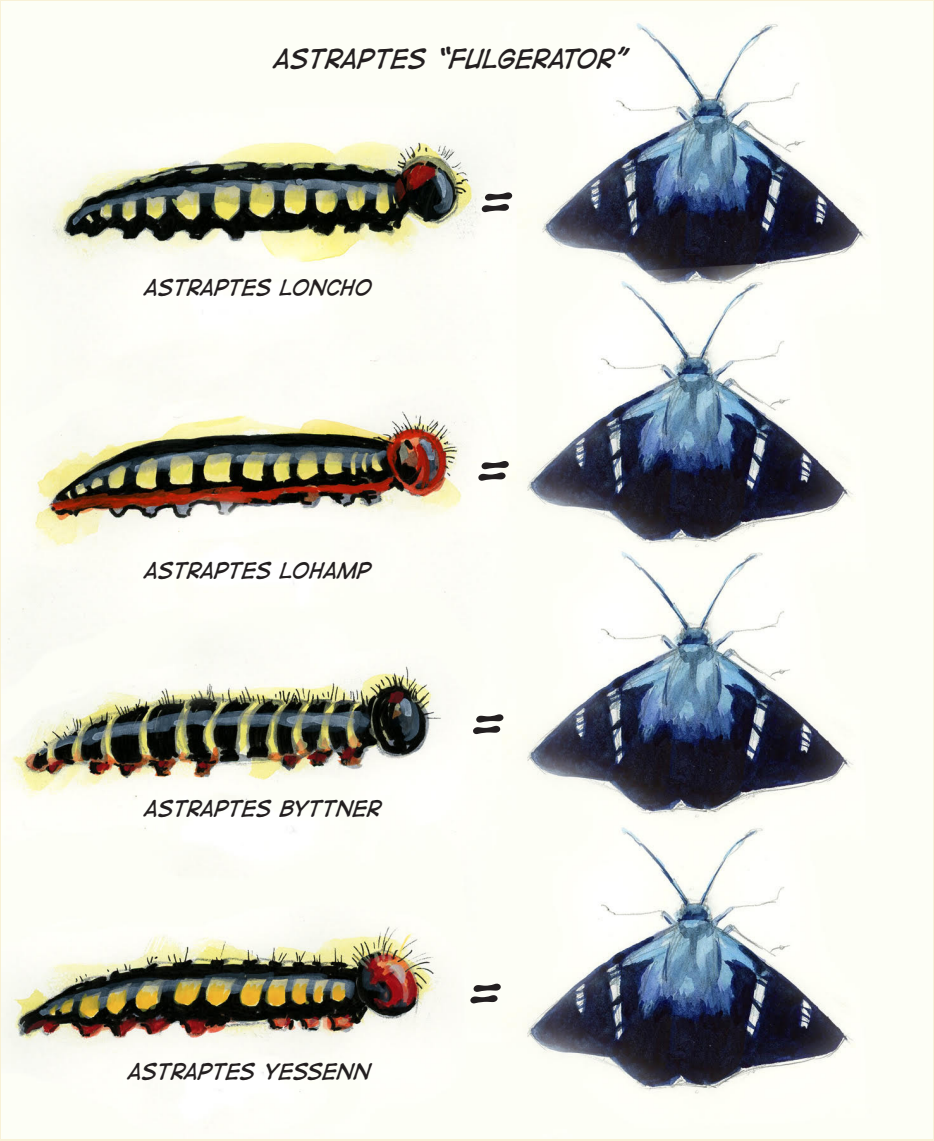
SINCE CATERPILLARS GROW INTO BUTTERFLIES (AND CATERPILLARS ARE EASIER TO CATCH!) HALLWACHS AND JANZEN STUDY NOT JUST THE ADULT BUTTERFLIES, BUT ALSO THEIR CATERPILLARS AND THE PLANTS THEY EAT. THIS PROVIDES IMPORTANT INFORMATION FOR TAXONOMISTS, BECAUSE--LIKE THE MEADOWLARK'S SONG--A KEY CHARACTER IS A BEHAVIOR: WHAT THEIR CATERPILLARS EAT. BUTTERFLY SPECIES OFTEN SEARCH OUT AND LAY THEIR EGGS ON ONLY A HANDFUL OF PLANT SPECIES--THEIR HOST PLANTS--THAT THE CATERPILLARS CAN EAT (LIKE TAXONOMISTS, CATERPILLARS, CAN BE FUSSY).

THE ***CHALLENGE*** FOR BUTTERFLY TAXONOMISTS IS THAT CATERPILLARS LOOK NOTHING LIKE THE ADULTS THEY WILL BECOME. SO, TO UNDERSTAND THE TAXONOMY OF GUANACASTE BUTTERFLIES, JANZEN AND HALLWACHS AND THEIR TEAM DESCRIBE THE ENTIRE LIFE CYCLE OF A BUTTERFLY, STARTING WITH SEARCHING OUT AND CAREFULLY EXAMINING THE HOST PLANT SPECIES FOR CATERPILLARS THAT ARE EATING THEM. JANZEN, HALLWACHS, AND THEIR TEAM HAVE BEEN STUDYING GUANACASTE BUTTERFLIES THIS WAY FOR DECADES.

IN ONE STUDY, THEY COLLECTED AND RAISED 2,500 CATERPILLARS FROM WHAT THEY *THOUGHT* WERE 10 DIFFERENT SPECIES BASED ON THEIR COLOR PATTERNS. HOWEVER WHEN THESE CATERPILLARS GREW TO ADULT BUTTERFLIES, ALL RESEMBLED ***ONE WIDESPREAD BUTTERFLY SPECIES***! *ASTRAPTES FULGERATOR* WAS WELL KNOWN. TAXONOMISTS HAD DESCRIBED THE BUTTERFLY 250 YEARS EARLIER.

JANZEN AND HALLWACH'S TEAM THUS FACED A FASCINATING PUZZLE. WERE THESE CATERPILLARS JUST DIFFERENT COLORS--EACH WITH THEIR OWN PLANT SPECIES FOR FOOD--OF THE ONE BUTTERFLY SPECIES? OR DID THE EARLY TAXONOMISTS GET IT ***WRONG***, AND ALL THE TELLING CHARACTERS WERE IN THE CATERPILLARS, NOT THE BUTTERFLIES THEY WOULD COME TO BE?

TO FIND OUT, THE TEAM STARTED WITH THE IDEA THAT ALL THE MEMBERS OF A SPECIES HAVE GENES THAT ARE MORE SIMILAR TO EACH OTHER THAN TO ANY OTHER SPECIES. WORKING WITH BIODIVERSITY SCIENTIST PAUL HEBERT, THEY PLUCKED A SINGLE LEG (AND THE GENES INSIDE) FROM BUTTERFLIES THEY HAD GROWN FROM EACH OF THE 10 DIFFERENT KINDS OF CATERPILLAR. THEN THEY CHEMICALLY ANALYZED AND READ THE DNA THAT MADE UP THE GENES. ***THIS SOLVED THE MYSTERY:*** THEY FOUND 10 DIFFERENT KINDS OF GENE, EACH WHICH MATCHED THAT FROM ONE OF THE 10 CATERPILLARS TO THAT IN THE ADULT THEY GREW UP TO BE! WHAT HAD LONG APPEARED TO BE ONE SPECIES BASED ON CHARACTERS FROM ADULT BUTTERFLIES, WAS IN FACT ***10 DIFFERENT SPECIES*** WHEN YOU MATCHED GENES OF CATERPILLARS TO ADULTS!



SOMETIMES THE VISIBLE CHARACTERS OF PLANTS AND ANIMALS LEAD YOU TO THEIR SPECIES. BUT SOMETIMES (MAYBE OFTEN) THERE IS MUCH MORE DIVERSITY THAN MEETS THE EYE. ONLY THE GENES WILL TELL US.

HEBERT, P. D. N., E. H. PENTON, J. M. BURNS, D. H. JANZEN, AND W. HALLWACHS. 2004. TEN SPECIES IN ONE: DNA BARCODING REVEALS CRYPTIC SPECIES IN THE NEOTROPICAL SKIPPER BUTTERFLY ASTRAPTES FULGERATOR. PNAS 101:14812-14817.

WHY IT'S IMPORTANT TO TELL SPECIES APART

TAXONOMISTS ARE THE FOLKS THAT DISCOVER AND COMMUNICATE THE DIVERSITY OF LIFE ON EARTH TO THE REST OF THE WORLD. THIS CATALOGUE OF BIODIVERSITY ALLOWS US TO RECOGNIZE ALL THE SPECIES THAT PROVIDE US FOOD, THE PLANTS THAT PROVIDE US MEDICINE, AND TO DISTINGUISH THE USEFUL OR HARMLESS BACTERIA AND FUNGI FROM THOSE THAT CAN CAUSE ILLNESS. FOR EXAMPLE, TAKE A LOOK AT THESE TWO BUGS (INSECTS WITH NEEDLES FOR MOUTHPARTS THEY USE TO PIERCE THEIR PREY). ALTHOUGH THEY LOOK ALIKE, THEIR LIFESTYLES ARE VERY DIFFERENT.

KNOW YOUR BUGS!

ORANGE ASSASSIN BUG
Pseliopus barberi

HARMLESS TO HUMANS. BENEFICIAL PREDATOR OF OTHER GARDEN INSECTS.

EASTERN BLOODSUCKING CONENOSE- A.K.A. "KISSING BUG"
Triatoma sanguisuga

BITES HUMANS AND OTHER WARM-BLOODED VERTEBRATES. TRANSMITS CHAGAS DISEASE.

PSELIOPUS BARBERI SKULKS AROUND ON VEGETATION AND USES ITS NEEDLE-BEAK TO SKEWER AND SUCK OUT THE INSIDES OF CATERPILLARS. IF YOU GROW TOMATOES, YOU LIKE THIS BUG (ALTHOUGH IT HAS A NASTY BITE).

ITS COUSIN *TRIATOMA SANGUISUGA* USES *ITS* NEEDLE-BEAK TO ***DRINK THE BLOOD OF ITS VICTIMS*** (USUALLY WHEN THEY ARE ASLEEP AND USUALLY ON THE FACE, HENCE ITS COMMON NAME "KISSING BUG"). UNFORTUNATELY FOR A HUMAN VICTIM, AS THE BUG FEEDS IT POOPS OUT THE PARASITE *TRYPANOSOMA CRUZI* (YEP, THE STORY GETS WORSE). IF THAT POOP GETS IN THE WOUND (SAY IF THE VICTIM, ON AWAKING, SCRATCHES HER FACE) THE PARASITE INFECTS THE VICTIM CAUSING CHAGAS DISEASE, A SERIOUS ILLNESS THAT CAN DAMAGE THE HEART. THE CONE-NOSED KISSING BUG IS ONE DANGEROUS BUG AMONG A MUCH LARGER GROUP OF HARMLESS AND HELPFUL BUGS.

LUCKILY, TAXONOMISTS DO THE DETAILED WORK THAT HELPS US TELL THEM APART.

WE'LL GIVE DR. LUCKY THE LAST WORD:

"ONE OF OUR FAVORITE GENERA OF ANTS IS *NYLANDERIA*, WHICH IS FULL OF SPECIES THAT RESEMBLE ONE ANOTHER: BROWNISH, MEDIUM SIZED, WITH SMOOTH BODIES AND STOUT HAIRS. LIKE THE CATERPILLARS OF THE BUTTERFLY *ASTRAPTES FULGERATOR*, *NYLANDERIA* ALSO NATURALLY VARY FROM PLACE TO PLACE IN SMALL WAYS MAKING MICROSCOPE-BASED VISUAL TAXONOMY A CHALLENGE. THAT'S WHY WE ALSO USE GENES TO TELL SPECIES APART, AND DETERMINE HOW THEY'RE RELATED.

TAXONOMICALLY CHALLENGING TAXA LIKE *NYLANDERIA* REMIND US HOW MUCH WE DEPEND ON TAXONOMY, BECAUSE WITHOUT A CLEAR CONNECTION BETWEEN INDIVIDUAL ANIMALS AND SPECIES NAME WE CAN'T EASILY STUDY OR PROTECT SPECIES. WE ALSO NEED TAXONOMY TO DISCOVER SPECIES THAT ARE BEING IMPORTED FROM THEIR ORIGINAL HABITAT, SOMETIME CONTINENTS AWAY, WHICH CAN BECOME PROBLEMS TO THEIR INVADED ECOSYSTEMS. AS EXPERTS ON *NYLANDERIA*, WE WORK WITH INSECT IDENTIFIERS WHOSE JOB IT IS TO INSPECT CARGO COMING OFF OF PLANES AND SHIPS, AND HELP THEM DISTINGUISH *NYLANDERIA* THAT ARE NATIVE, FROM THOSE THAT ARE BEING BROUGHT IN."

DO THIS AT HOME!

DO A BIODIVERSITY SURVEY OF YOUR REFRIGERATOR. HOW MANY SPECIES OF PLANTS ARE IN YOUR CRISPERS? IN THE DOORS? IN THE FREEZER? HOW MANY SPECIES DID YOU EAT FOR DINNER LAST NIGHT? AND WHAT'S THAT PURPLE STUFF GROWING ON THE WATERMELON?

MIKE AND DEBBY WOULD LIKE TO THANK ALL THE TAXONOMISTS WHO CATALOGUE BIODIVERSITY ON PLANET EARTH, ESPECIALLY DR. LUCKY. TOM KASPARI AND LAUREN NIEMANN WERE KIND EDITORS. THE NATIONAL SCIENCE FOUNDATION HELPED FUND THE WRITING (DEB 1702426).