

CHARLIE BALDWIN



A MACROSCOPIC STUDY OF CONIFERS

This article explores a number of different images that look closely at the anatomy of the world's oldest trees.



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CONIFERS

CONIFEROPHYTA

THE TERM "CONIFER" COMES FROM LATIN, COMBINING *CONUS* (MEANING "CONE") AND *FERRE* (MEANING "TO BEAR"), TRANSLATING TO "ONE THAT BEARS CONES."

CONIFERS ARE GYMNOSPERM PLANTS, INCLUDING PINES, SPRUCES, FIRS, AND CEDARS. THEY ARE KNOWN FOR:

- NEEDLE-LIKE LEAVES.
- WOODY CONES.
- MOSTLY EVERGREEN FOLIAGE (THOUGH SOME SHED THEIR NEEDLES SEASONALLY).

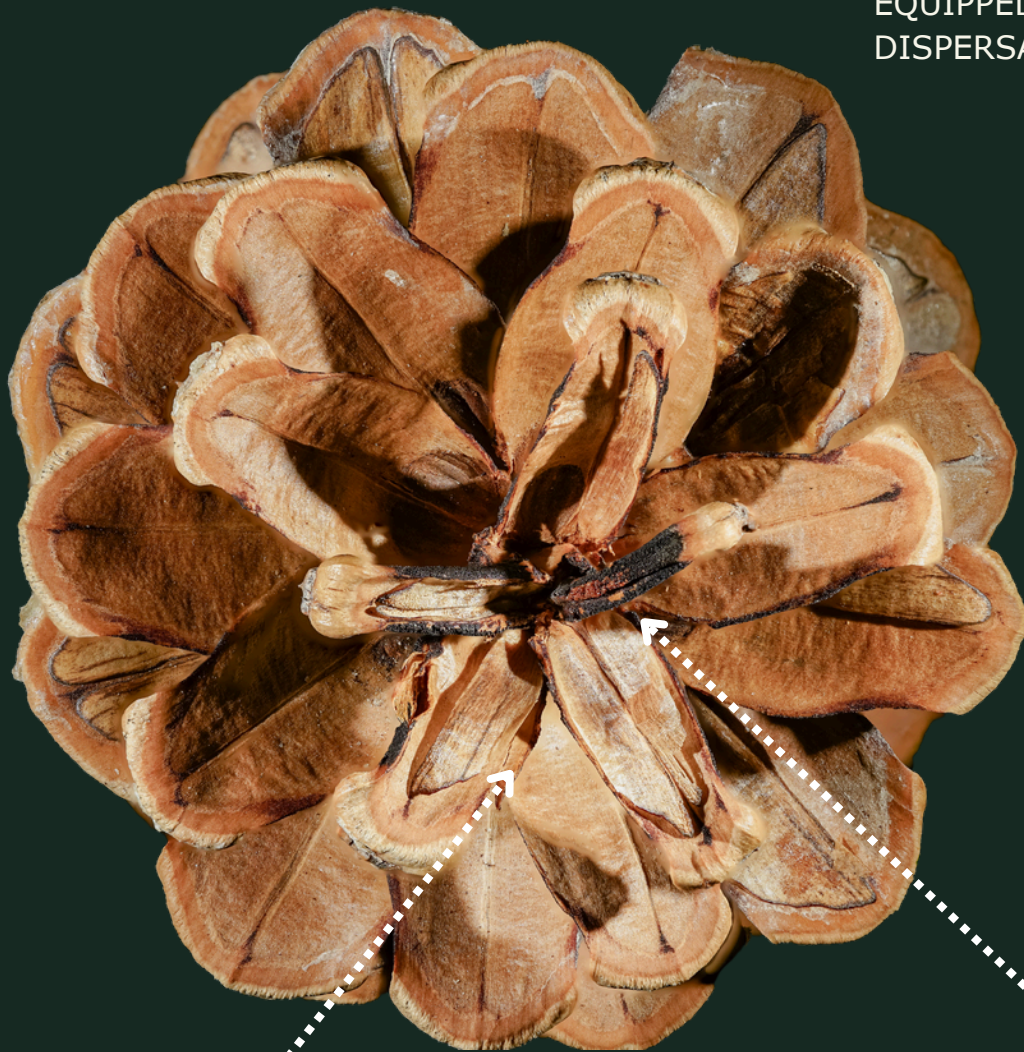
ADAPTATIONS:

- THRIVE IN HARSH ENVIRONMENTS, INCLUDING:
 - COLD CLIMATES.
 - NUTRIENT-POOR SOILS.
 - ARID REGIONS.
- FEATURES LIKE WAXY NEEDLES AND WATER-CONSERVING DESIGNS ENSURE SURVIVAL.

CONIFER CONE (FEMALE)

FEMALE CONES (SEED CONES):
LARGER AND WOODY, RESPONSIBLE
FOR SEED PRODUCTION.

SEEDS: FOUND BENEATH THE SCALES, OFTEN
EQUIPPED WITH SMALL WINGS TO AID IN WIND
DISPERSAL.



SCALES: OVERLAPPING, WOODY PLATES
ARRANGED SPIRALLY AROUND A CENTRAL AXIS.
EACH SCALE PROTECTS ONE OR MORE SEEDS
LOCATED AT ITS BASE.

CENTRAL AXIS: THE STURDY CORE
THAT PROVIDES SUPPORT AND
SERVES AS THE ATTACHMENT POINT
FOR SCALES.



PURPOSE OF A FEMALE CONIFER CONE

- **REPRODUCTION:** PROTECTS SEEDS DURING THEIR DEVELOPMENT AND ASSISTS IN THEIR DISPERSAL.
- **ADAPTATION:** SCALES OPEN TO RELEASE SEEDS WHEN CONDITIONS ARE FAVORABLE (DRY AND WARM) AND CLOSE TO PROTECT SEEDS IN WET OR COLD CONDITIONS.
- **SURVIVAL MECHANISM:** PROTECTS SEEDS FROM ENVIRONMENTAL STRESS AND PREDATORS.

CONIFER CONE (MALE)

MALE CONES (POLLEN CONES):
SMALLER AND SOFTER, PRODUCING
AND RELEASING POLLEN.

CENTRAL AXIS:

THE CORE STRUCTURE OF THE CONE,
PROVIDING SUPPORT AND SERVING AS THE
ATTACHMENT POINT FOR MICROSPOROPHYLLS.

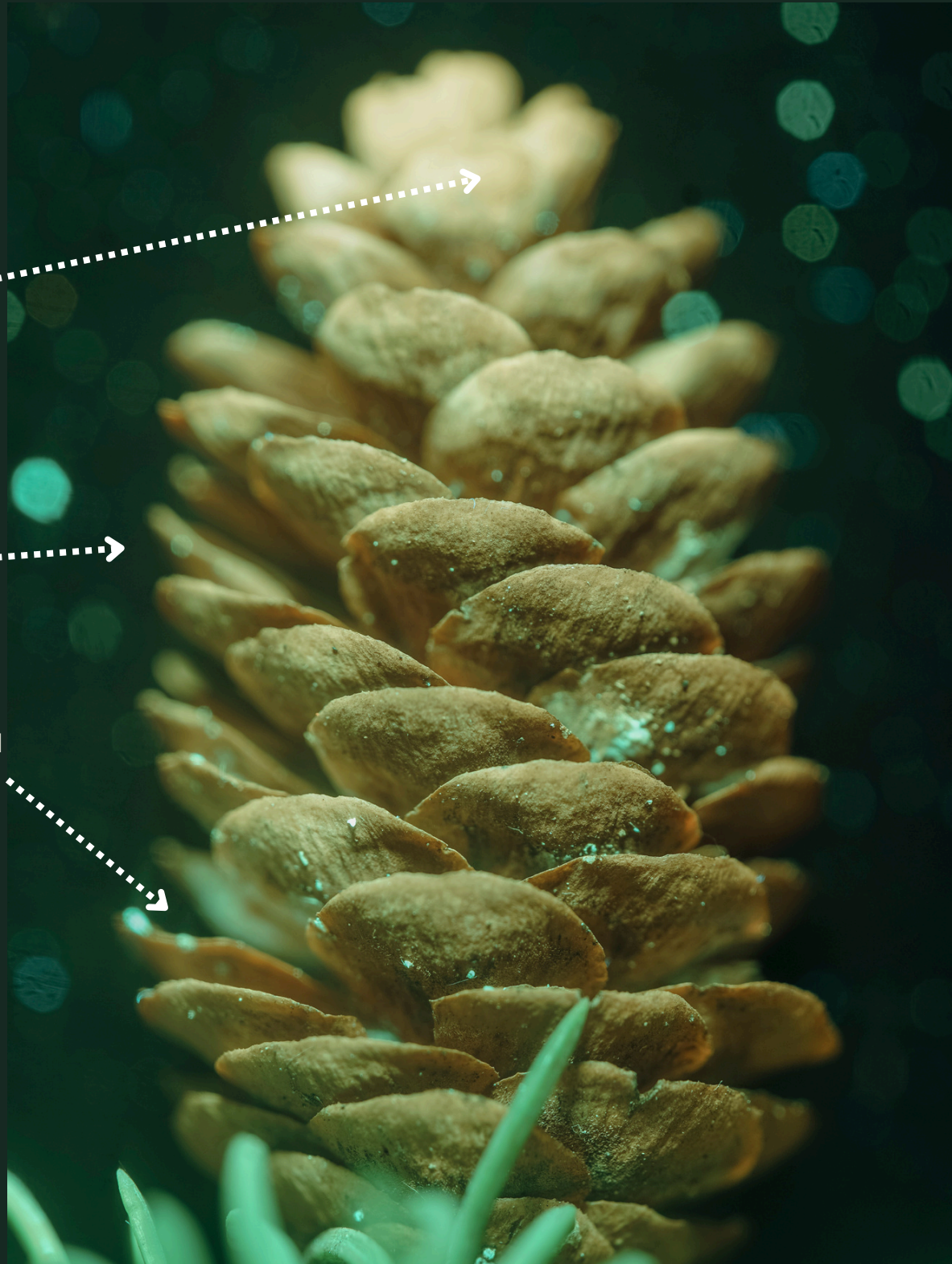
MICROSPOROPHYLLS:

SPECIALIZED, SCALE-LIKE STRUCTURES
SPIRALLY ARRANGED AROUND THE CENTRAL
AXIS. EACH MICROSPOROPHYLL CONTAINS:

MICROSPORANGIA: SMALL SACS LOCATED ON
THE UNDERSIDE OF THE MICROSPOROPHYLLS,
WHICH PRODUCE AND STORE POLLEN GRAINS.

POLLEN GRAINS:

TINY, DUST-LIKE STRUCTURES THAT CARRY THE
MALE GAMETES. OFTEN EQUIPPED WITH AIR
SACS TO AID IN WIND DISPERSAL, MAKING
THEM LIGHTWEIGHT AND AERODYNAMIC. (CAN
BE SEEN THROUGHOUT THE IMAGE)



PURPOSE OF MALE PINE CONES

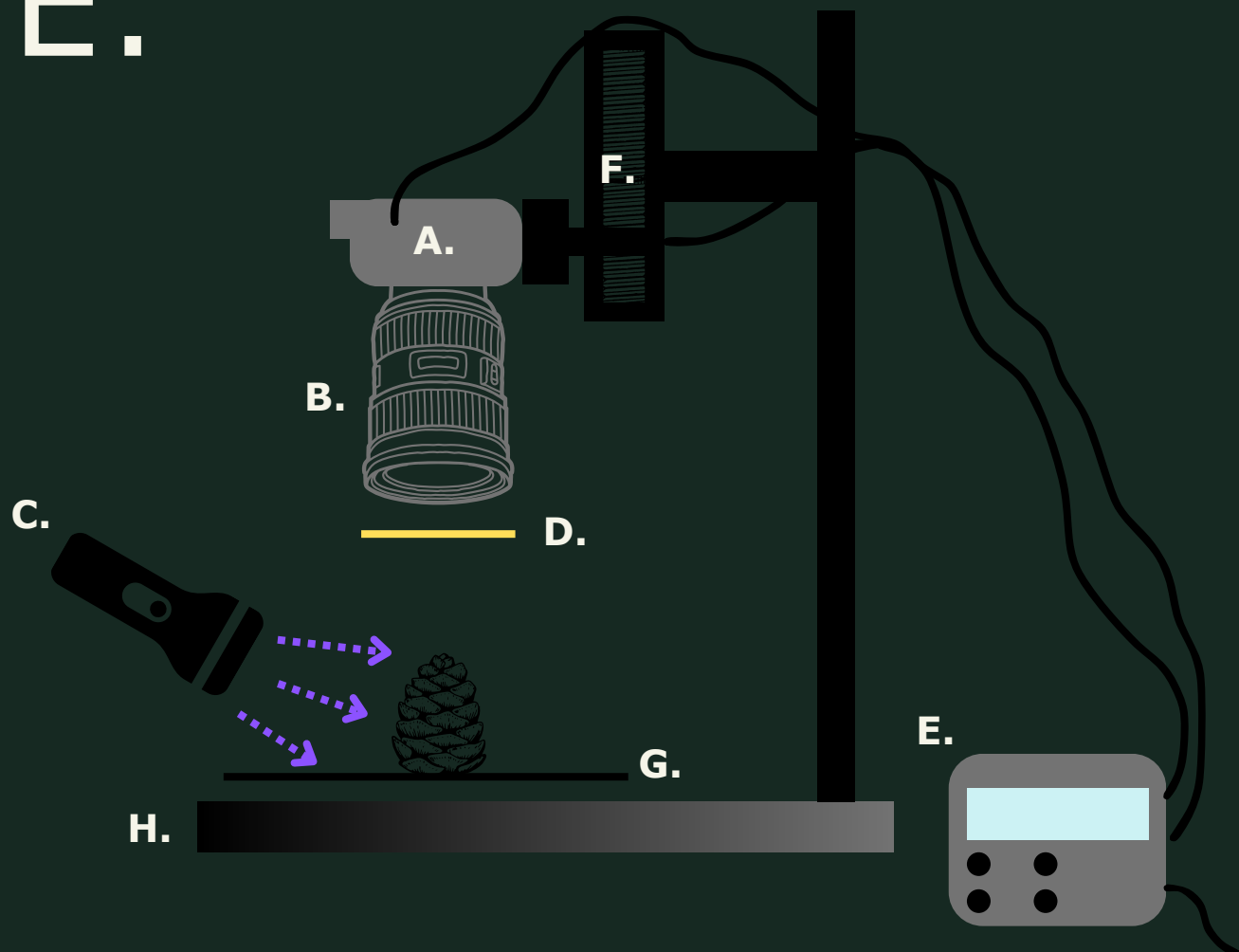
- POLLEN PRODUCTION:
- MALE CONES GENERATE VAST QUANTITIES OF POLLEN, ENSURING A HIGHER CHANCE OF FERTILIZING FEMALE CONES.
- POLLEN DISPERSAL:
- DESIGNED TO RELEASE POLLEN INTO THE AIR, RELYING ON WIND TO CARRY IT TO RECEPTIVE FEMALE CONES.
- SHORT LIFE SPAN:
- MALE CONES ARE TYPICALLY SEASONAL AND DISINTEGRATE AFTER RELEASING THEIR POLLEN, AS THEY ARE NOT NEEDED FOR LONG-TERM SEED PROTECTION.



PHOTOGRAPHIC TECHNIQUE:

EQUIPMENT:

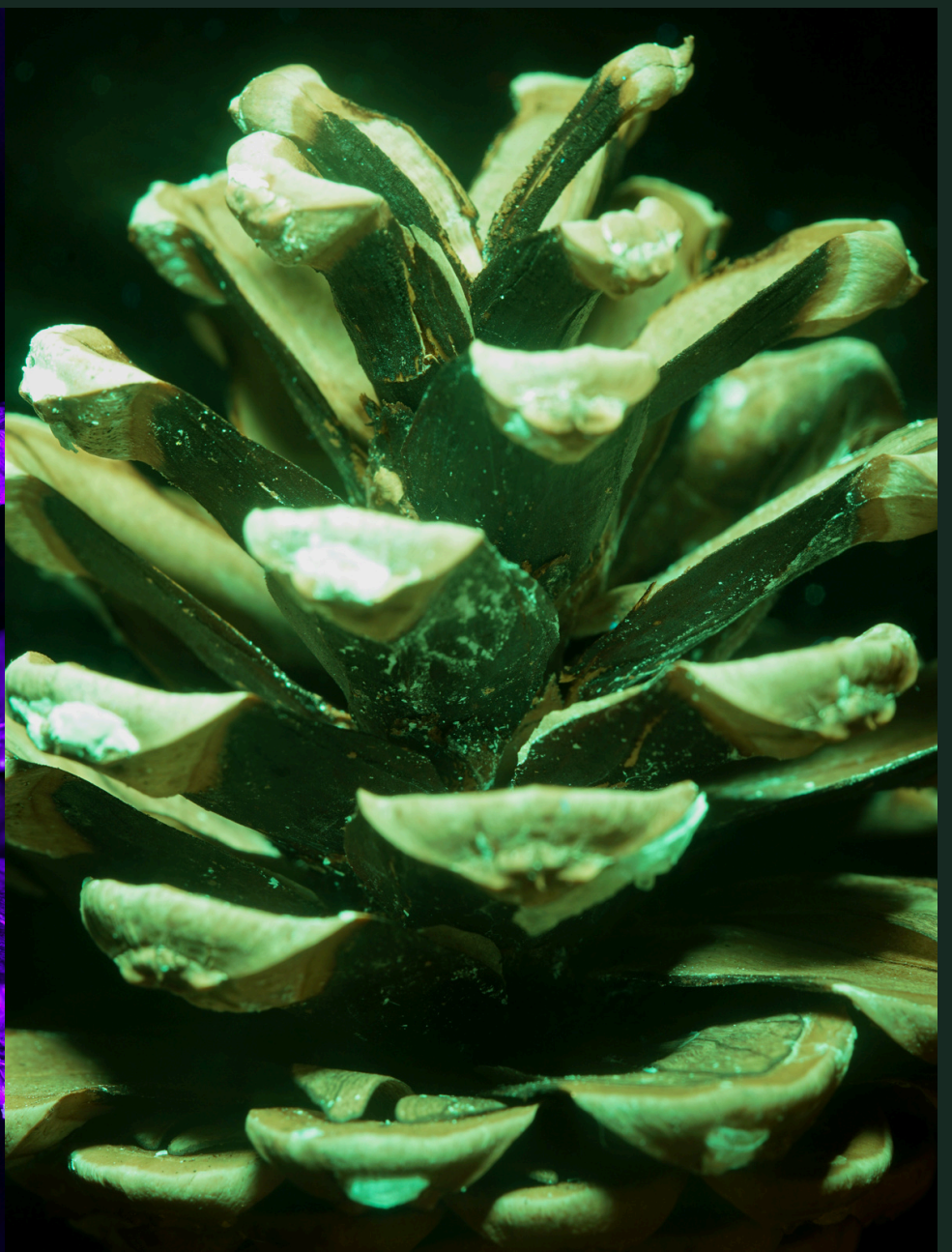
- [A] SONY A7RII CAMERA BODY
- [B] VENUS OPTICS LAOWA 100MM F/2.8 2X ULTRA MACRO APO LENS FOR NIKON F
- [C] UV FLASHLIGHT BLACK LIGHT, 51 LED BLACKLIGHT
- [D] TIFFEN 67MM YELLOW 2 #8 GLASS FILTER (BARRIER FILTER)
- [E] STACKSHOT CONTROLLER
- [F] STACKSHOT MACRO RAIL
- [G] BLACK FELT (BACKGROUND)
- [H] KAISER 205411 COPY STAND RS 2-XA



A STUDY IN FLUORESCENCE



UV ILLUMINATION WITHOUT BARRIER FILTER



UV ILLUMINATION WITH BARRIER FILTER

WHY POLLEN AND SAP ARE MORE VISIBLE UNDER UV ILLUMINATION

- FLUORESCENCE:
 - POLLEN AND SAP CONTAIN COMPOUNDS LIKE SPOROPOLLENIN, FLAVONOIDS, AND TERPENES THAT FLUORESCCE UNDER UV LIGHT, EMITTING VISIBLE GLOW.
- ENHANCED CONTRAST:
 - UV SELECTIVELY HIGHLIGHTS FLUORESCENT MATERIALS, MAKING POLLEN GRAINS AND SAP DROPLETS STAND OUT SHARPLY AGAINST NON-FLUORESCENT BACKGROUNDS.
- REVEALING HIDDEN DETAILS:
 - THE UV ILLUMINATION UNCOVERS FINE TEXTURES IN POLLEN AND EXPOSES EVEN TINY SAP DROPLETS AND FLOW PATTERNS.

NEEDLE STRUCTURE

JUNIPER NEEDLES



CUTICLE LAYER:

- A THICK, WAXY COATING ON THE NEEDLE SURFACE THAT MINIMIZES WATER LOSS AND PROTECTS AGAINST UV DAMAGE AND PATHOGENS.

STOMATA:

- TINY PORES PRIMARILY LOCATED ON THE UNDERSIDE OF THE NEEDLES.
- REGULATE GAS EXCHANGE AND WATER VAPOR RELEASE.

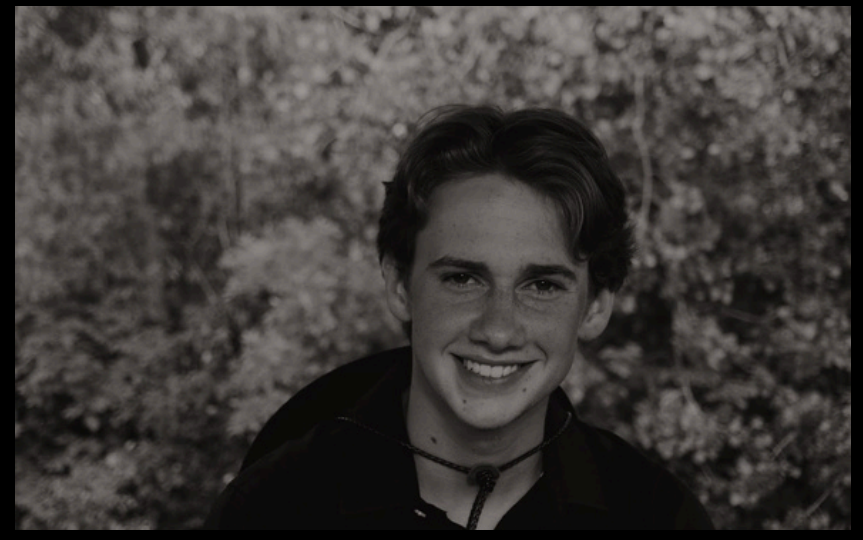
NEEDLES:

- SCALE-LIKE AND CLOSELY PRESSED AGAINST THE TWIG.
- OVERLAP TO FORM A DENSE, SCALE-COVERED APPEARANCE.



ABOUT ME:

I AM A SENIOR AT RIT MAJORING IN IMAGING SCIENCE WITH A MINOR IN PHOTOGRAPHIC SCIENCES. I HAVE A PASSION FOR OPTICS AND THE HUMAN VISUAL SYSTEM, BUT WHEN NOT STUDYING; I LOVE TO HIKE. BEING FROM A SMALL TOWN SURROUNDED BY DENSE FOREST, I GREW UP AROUND THESE GIGANTIC AND BEAUTIFUL TREES. WHEN DECIDING A SUBJECT FOR THIS ARTICLE, I COULDN'T THINK OF A MORE PERFECT SUBJECT TO ENCAPSULATE MY INTERESTS.



DIFFICULTIES ENCOUNTERED:

- FLUORESCENCE: THE ADDITION OF FLUORESCENCE, WHILE A GREAT WAY TO SHOW THE FINER DETAILS IN THE SAP AND POLLEN, CAUSED A FEW ISSUES.
 - THE STACKSHOT IMAGES HAD VARIATIONS IN ILLUMINATION DUE TO THE FREQUENCY OF THE LEDS IN THE UV FLASHLIGHT.
- SUBJECTS:
 - IT WAS DIFFICULT TO FIND A GOOD AMOUNT OF VIABLE SUBJECTS FOR THE SHOTS I WAS TAKING, LEADING TO DOING THE BEST WITH THE PINECONES AND NEEDLES I WAS ABLE TO FIND NATURALLY.

REPLICATION:

- DESPITE SOME OF THE COMPLICATIONS I ENCOUNTERED, I WOULD SAY THIS TYPE OF IMAGE IS PRETTY EASY TO REPLICATE WITH THE RIGHT EQUIPMENT AND PATIENCE. A HELPFUL TIP I HAVE WOULD BE TO INCREASE THE SETTLE TIME BETWEEN EACH IMAGE IN THE STACKSHOT SERIES OF IMAGES TO HELP MITIGATE EXPOSURE AND FOCUS ISSUES.

THANK YOU,

CHARLIE BALDWIN