--> Display at 01:00:00:00

--> Display at 01:00:04:28
FUNDING FOR THIS PROGRAM
IS PROVIDED BY ANNENBERG/CPB

--> Display at 01:00:09:02
--> Erase at 01:00:12:23
TO ADVANCE EXCELLENT TEACHING.

--> Display at 01:00:32:27
Narrator: THERE ARE
LIVING THINGS ON THIS PLANET

--> Display at 01:00:35:13
THAT ARE SO BIZARRE
AS TO DEFY THE IMAGINATION --

--> Display at 01:00:39:23
ORGANISMS THAT MATE WITHOUT GETTING
NEAR EACH OTHER,

--> Display at 01:00:43:05
WHOSE YOUNG CAN BE BORN
MILES AWAY FROM ANY PARENT,

--> Display at 01:00:47:00
AND POSSIBLY EVEN
AFTER THE PARENTS ARE LONG DEAD.

--> Display at 01:00:52:11
THEY TRICK OTHER LIVING THINGS INTO
HELPING THEM REPRODUCE.

--> Display at 01:00:56:05
AND SOME EVEN OFFER THEIR OWN OFFSPRING
TO PREDATORS.

--> Display at 01:01:00:16
YET, AS STRANGE AS THEY ARE, THEY ARE NOT
UNCOMMON.

--> Display at 01:01:04:28
IN FACT, THEY ARE ALL AROUND US, HIDING IN
PLAIN SIGHT.

--> Display at 01:01:11:00
THEY ARE, OF COURSE,
FLOWERS AND OTHER PLANTS.

--> Display at 01:01:15:19
THOUGH THEY MAY SEEM COMMONPLACE,

--> Display at 01:01:17:08
THEY LIVE LIVES
FULL OF SURPRISES.

--> Display at 01:01:20:13
THESE QUIET CONQUERORS HAVE COLONIZED
OUR ENTIRE PLANET,

--> Display at 01:01:24:10
INSINUATING THEMSELVES
INTO NEARLY EVERY

--> Display at 01:01:26:15
AVAILABLE ENVIRONMENTAL NICHE,
AND MAKING LIFE

--> Display at 01:01:30:18
POSSIBLE FOR ANIMALS.

--> Display at 01:01:33:22
WHAT MAKES PLANTS
SO UNSTOPPABLE?

--> Display at 01:01:36:29
WHAT'S THE SECRET
TO THEIR INCREDIBLE SURVIVAL?

--> Display at 01:01:41:28
THE CLUES TO THIS MYSTERY
ARE ALL AROUND US,

--> Display at 01:01:46:19
--> Erase at 01:01:49:26
WAITING TO BE DISCOVERED
WHEN WE KNOW HOW TO LOOK.

--> Display at 01:02:12:07
HELLO, AND WELCOME BACK
TO "ESSENTIAL SCIENCE."

--> Display at 01:02:15:01
THIS IS SESSION FOUR
IN THE LIFE SCIENCES SERIES,

--> Display at 01:02:18:00
A CONTENT COURSE FOR
ELEMENTARY SCHOOL TEACHERS.

--> Display at 01:02:21:20
WE LIVE IN A WORLD
OF PLANTS.

--> Display at 01:02:23:25
FROM MOSSES TO MARIGOLDS,
THESE REMARKABLE ORGANISMS

--> Display at 01:02:27:15
ACCOUNT FOR MORE THAN HALF

--> Display at 01:02:29:03
OF ALL LIVING MATTER
ON THE PLANET.

--> Display at 01:02:31:07
YET, DESPITE
THEIR FAMILIARITY,

--> Display at 01:02:33:24
PLANTS ARE
FULL OF MYSTERY.

--> Display at 01:02:36:04
THEY ARE SEXUAL CREATURES
LIKE WE ARE,

--> Display at 01:02:38:18
BUT THEIR LIFE CYCLES
CAN SEEM QUITE ALIEN.

--> Display at 01:02:42:03
THAT'S WHAT WE'RE
HERE TO EXPLORE --

--> Display at 01:02:43:28
THE LIFE CYCLES
OF PLANTS.

--> Display at 01:02:46:18
PLANTING SEEDS TO LEARN
ABOUT PLANT GROWTH IS PROBABLY

--> Display at 01:02:50:07
ONE OF THE MOST COMMON
CLASSROOM SCIENCE ACTIVITIES.

--> Display at 01:02:53:11
IT'S SIMPLE TO DO,
AND IT'S DRAMATIC.

--> Display at 01:02:56:24
CHILDREN LOVE WATCHING
THEIR PLANTS DEVELOP OVER TIME.

--> Display at 01:03:00:26
AND AS WE OBSERVE
THE PLANT LIFE CYCLE UP CLOSE,

--> Display at 01:03:04:18
SOME POWERFUL QUESTIONS
CAN ARISE.

--> Display at 01:03:07:16
FOR EXAMPLE,
WHERE DO SEEDS COME FROM?

--> Display at 01:03:12:09
ARE SEEDS LIKE EGGS?

--> Display at 01:03:15:04
DO PLANTS HAVE PARENTS?

--> Display at 01:03:17:27
JUST HOW ARE THE LIFE CYCLES
OF PLANTS AND ANIMALS ALIKE?

--> Display at 01:03:21:21
AND PERHAPS EVEN
MORE INTERESTING,

--> Display at 01:03:24:02
HOW ARE THEY DIFFERENT?

--> Display at 01:03:25:28
WHAT DO SOME PLANTS HAVE
THAT WE DON'T HAVE?

--> Display at 01:03:29:03
DID YOU EVER STOP AND WONDER
WHY SOME PLANTS HAVE FLOWERS?

--> Display at 01:03:32:27
OR FRUIT?

--> Display at 01:03:34:10
WHAT ROLE DO THESE STRANGE
AND WONDERFUL OBJECTS PLAY,

--> Display at 01:03:37:16
IF ANY,
IN THE LIFE CYCLE OF PLANTS?

--> Display at 01:03:40:18
IT'S A RICH TOPIC, FULL OF CHALLENGES AND
SURPRISES.

--> Display at 01:03:44:22
Narrator: IN THE LAST SESSION, WE EXPLORED
ANIMAL LIFE CYCLES,

--> Display at 01:03:49:15
FROM SPERM AND EGG TO ADULTHOOD.

--> Display at 01:03:52:21
WE EXAMINED DNA AND TOOK
THE FIRST STEPS IN UNDERSTANDING

--> Display at 01:03:57:07
HOW GENES ENSURE
THE CONTINUITY OF LIFE

--> Display at 01:03:59:17
FROM GENERATION TO GENERATION.

--> Display at 01:04:03:01
IN THIS SESSION,
WE'RE GOING TO SUBJECT PLANTS

--> Display at 01:04:05:13
TO THE SAME SCRUTINY,
BEGINNING WITH SEEDS.

--> Display at 01:04:09:04
WE'LL ASK
OUR STUDIO SCIENTISTS,

--> Display at 01:04:12:12
HOW DOES A SEED BECOME A PLANT?

--> Display at 01:04:14:15
HOW ARE SEEDS FORMED?

--> Display at 01:04:17:20
AND WHY IN THE WORLD

--> Display at 01:04:19:08
DO SOME PLANTS PRODUCE EXTRAVAGANT
FLOWERS

--> Display at 01:04:21:15
AND SUCCULENT FRUITS?

--> Display at 01:04:24:05
IT TURNS OUT THAT
THERE MAY BE SOME SURPRISING

--> Display at 01:04:28:07
EVOLUTIONARY STORIES BEHIND
THE SMELLS, SHAPES, COLORS,

--> Display at 01:04:31:11
AND TASTES
OF THESE DELIGHTFUL STRUCTURES.

--> Display at 01:04:34:12
ALONG THE WAY,

--> Display at 01:04:36:07
WE'LL MEET
SOME INTERESTING SCIENTISTS,

--> Display at 01:04:38:10
AND WE'LL CHECK IN
WITH OUR BOTTLE BIOLOGIST,

--> Display at 01:04:40:13
PAUL WILLIAMS.

--> Display at 01:04:43:01
AND AS ALWAYS, WE'LL LET
OUR STUDENTS GUIDE US.

--> Display at 01:04:47:19
THEIR FRESH EYE ON THE WORLD WILL HELP
US AS TEACHERS

--> Display at 01:04:50:21
TO EXAMINE OUR OWN IDEAS

--> Display at 01:04:53:09
AS WE PUZZLE OUT THIS GREAT MYSTERY OF
LIFE CYCLES.

--> Display at 01:04:57:22
Zook: LET'S THINK ABOUT SEEDS.

--> Display at 01:05:01:04
THEY SEEM AS NONLIVING AS ROCKS.

--> Display at 01:05:02:27
BUT IN THE RIGHT CONDITIONS,

--> Display at 01:05:04:29
A SEED WILL EXPLODE
INTO NEW LIFE.

--> Display at 01:05:06:25
IT'S A REMARKABLE TRANSFORMATION THAT
WE, AS ADULTS,

--> Display at 01:05:10:00
SOMETIMES SIMPLY
TAKE FOR GRANTED.

--> Display at 01:05:12:23
ELEMENTARY SCHOOL STUDENTS
HAVE AN ADVANTAGE.

--> Display at 01:05:15:20
THEIR IDEAS ARE STILL FORMING.

--> Display at 01:05:17:27
AND AS WE LISTEN TO THEM
GRAPPLE WITH TOUGH QUESTIONS,

--> Display at 01:05:21:00
WE'RE OFTEN CHALLENGED
TO RETHINK OUR OWN IDEAS.

--> Display at 01:05:24:21
AND KIDS' IDEAS ABOUT SEEDS

--> Display at 01:05:26:22
OFFER US A GREAT PLACE TO
BEGIN OUR OWN EXPLORATION.

--> Display at 01:05:30:13
THAT'S THE APPROACH TAKEN

--> Display at 01:05:31:23
BY THE BIOLOGICAL SCIENCES CURRICULUM
STUDY.

--> Display at 01:05:34:23
WE VISITED NANCY LANDES,
PROJECT DIRECTOR AND AUTHOR,

--> Display at 01:05:37:29
FOR SCIENCE TRACKS.

--> Display at 01:05:40:01
Landes: IN BSCS SCIENCE TRACKS, WE THOUGHT
A LOT ABOUT CHILDREN,

--> Display at 01:05:45:02
AND WE THOUGHT A LOT ABOUT,

--> Display at 01:05:47:26
WHAT LIFE EXPERIENCES
HAVE THEY HAD

--> Display at 01:05:49:09
THAT CHILDREN MIGHT BRING
INTO A SCHOOL CLASSROOM,

--> Display at 01:05:53:03
THAT THEN TEACHERS
CAN HELP THEM WITH

--> Display at 01:05:55:02
AND HELP THEM
UNFOLD THEIR IDEAS.

--> Display at 01:05:57:07
Child: I WONDER HOW THE FIRST FLOWER IN
THE WORLD WAS MADE.

--> Display at 01:06:04:04
Landes: THE CHILDREN
BRING THIS IDEA

--> Display at 01:06:06:23
THAT BECAUSE SEEDS DON'T MOVE,

--> Display at 01:06:08:17
AND THEY APPEAR
JUST TO SIT THERE,

--> Display at 01:06:10:03
THAT THEY'RE NOT ALIVE,
THAT THEY'RE NOT REALLY LIVING.

--> Display at 01:06:14:10
ONE OF THE THINGS
THAT THE STUDENTS DO

--> Display at 01:06:15:26
IS THEY ACTUALLY DO

--> Display at 01:06:17:02
SOAK A LIMA BEAN SEED

--> Display at 01:06:18:25
AND TAKE IT APART
AND TAKE OFF THE SEED COAT,

--> Display at 01:06:20:28
AND ACTUALLY FIND THE PLANT EMBRYO
INSIDE THE SEED.

--> Display at 01:06:24:15
SO WE'RE TRYING TO STRUCTURE THINGS
WITHIN THE CURRICULUM

--> Display at 01:06:27:22
TO GIVE TEACHERS NOT JUST

--> Display at 01:06:29:25
CONTENT BACKGROUND INFORMATION,
BUT WAYS TO APPROACH THESE IDEAS

--> Display at 01:06:32:13
WITH CHILDREN,
SO THAT THE TEACHERS

--> Display at 01:06:34:23
CAN FIGURE THEM OUT, TOO.

--> Display at 01:06:36:18

THE FLOWERS,
WHEN THEY LOSE THEIR PETALS,

--> Display at 01:06:38:22
THAT'S WHAT MAKES
THE NEW SEED.

--> Display at 01:06:41:29
Teacher: THE PETALS?

--> Display at 01:06:43:21
Zook: IN OUR LAST SESSION TOGETHER,

--> Display at 01:06:45:11
WE EXPLORED
THE LIFE CYCLE OF ANIMALS.

--> Display at 01:06:47:10
WE ASKED OUR STUDIO SCIENTISTS SOME
QUESTIONS

--> Display at 01:06:50:09
ABOUT THE STAGES

IN ANIMAL REPRODUCTION.

--> Display at 01:06:53:15
Grisham: SOME OF OUR QUESTIONS SEEMED TO
STUMP THEM.

--> Display at 01:06:55:19
ESPECIALLY, "WHAT WAS IT
BEFORE IT WAS AN EGG?"

--> Display at 01:06:58:20
OR "DO EGGS NEED A FATHER?"

--> Display at 01:07:01:04
THIS TIME,
WE'RE GOING TO ASK OUR STUDENTS

--> Display at 01:07:03:08
THE SAME SORTS OF QUESTIONS ABOUT
PLANTS,

--> Display at 01:07:05:26
SPECIFICALLY, FLOWERING PLANTS.

--> Display at 01:07:08:15
REMEMBER, ALTHOUGH THE SETTING
RESEMBLES A CLASSROOM, IT'S NOT.

--> Display at 01:07:12:24
THERE IS NO LESSON PLAN
OR TEACHING OBJECTIVE.

--> Display at 01:07:15:08
OUR PURPOSE IS
TO GIVE THE CHILDREN A CHANCE

--> Display at 01:07:17:15
TO EXPRESS *THEIR* IDEAS.

--> Display at 01:07:19:14
--> Erase at 01:07:21:19
WE'RE THE ONES
WHO HAVE COME TO LEARN.

--> Display at 01:07:34:19
Narrator:
IN THE SCIENCE STUDIO,

--> Display at 01:07:36:10
WE ASKED EACH PAIR OF STUDENTS

--> Display at 01:07:38:12
TO EXAMINE SEVERAL PARTS
OF PLANTS

--> Display at 01:07:40:12
AND TO ANSWER
SOME BASIC QUESTIONS ABOUT THEM.

--> Display at 01:07:43:01
TO BEGIN, WE GAVE
THE CHILDREN SOME SEEDS

--> Display at 01:07:46:07
AND ASKED THEM WHAT THEY ARE

--> Display at 01:07:50:23
AND WHAT THEY THINK
THEY WILL BECOME.

--> Display at 01:07:55:13
AND IF YOU PUT THEM IN WATER, AND IF YOU
HAVE SOIL,

--> Display at 01:07:59:18
AND IF YOU PUT THE SOIL
ON TOP OF THEM

--> Display at 01:08:02:06
AND THEN WATER THEM, THEY
WILL PROBABLY START GROWING.

--> Display at 01:08:07:15
Girl: BUT I THINK IT'S KIND
OF AMAZING HOW IT COULD HAVE

--> Display at 01:08:11:09
THAT SPROUT IN HERE,
AND THEN GROW A LITTLE,

--> Display at 01:08:12:27
AND HAVE IT COME OUT.

--> Display at 01:08:14:12
Boy: I KNOW, 'CAUSE IT
HAS JUST A TINY SEED!

--> Display at 01:08:16:17
I THINK THERE MIGHT BE MINERALS

--> Display at 01:08:20:02
INSIDE THE PLANT
TO MAKE THE PLANT GROW.

--> Display at 01:08:26:19
NO, IT, NO, LIKE, THEY'VE,

--> Display at 01:08:29:09
THERE'S LIKE THINGS INSIDE IT,

--> Display at 01:08:31:25
LIKE, LIKE, IT'S
LIKE AN INGREDIENT,

--> Display at 01:08:35:28
HOW TO MAKE IT, AND SO LIKE,
YOU PUT IT IN, AND THEN

--> Display at 01:08:41:04
WHEN IT GETS THE SUN AND WATER,

--> Display at 01:08:44:27
THEN IT WILL GROW TO THAT PLANT.

--> Display at 01:08:47:22
MAYBE LIKE INGREDIENTS.
I DON'T KNOW.

--> Display at 01:08:50:11
I DON'T KNOW IF I QUITE
AGREE WITH THAT.

--> Display at 01:08:54:01
I DON'T QUITE AGREE
WITH THAT.

--> Display at 01:08:56:17
I JUST THINK IF YOU GIVE IT WATER AND SUN,

--> Display at 01:08:59:23
ALL OF A SUDDEN, THE SEED,
ALL OF A SUDDEN BREAKS OPEN,

--> Display at 01:09:02:05
AND THE PLANT COMES OUT.

--> Display at 01:09:04:07
THAT'S HOW IT MAKES IT GROW.

--> Display at 01:09:05:19
BECAUSE IT GETS SO BIG,
THE SEED CAN'T HOLD IT,

--> Display at 01:09:07:29
AND THE SEED BREAKS APART
AND THE ROOTS COME OUT.

--> Display at 01:09:11:29
IF AN ANIMAL HAS AN EGG
AND IT MAY HATCH OUT,

--> Display at 01:09:15:14
SO LIKE THAT --

--> Display at 01:09:18:11
LIKE, IF IT'S A BABY CHICK,
AND SO THEN IT,

--> Display at 01:09:23:02
THEN WHEN IT COMES OUT,
IT'S LIKE THAT,

--> Display at 01:09:25:09
BUT INSIDE,
IT'S JUST A LITTLE THING.

--> Display at 01:09:28:27
LIKE IT'S JUST
BEING MADE, BORN.

--> Display at 01:09:33:07
Narrator:
THE CHILDREN UNDERSTAND

--> Display at 01:09:36:04
THAT SEEDS LEAD TO PLANTS,

--> Display at 01:09:38:06
BUT THEY DON'T UNDERSTAND
THE PROCESS.

--> Display at 01:09:40:26
SOME BELIEVE
THAT THE SEED PROVIDES FOOD

--> Display at 01:09:44:03
FOR THE GROWING PLANT.

--> Display at 01:09:47:01
NEXT, WE ASKED THE STUDENTS
TO LOOK AT A SEED

--> Display at 01:09:49:17
THAT HAS JUST BEGUN TO SPROUT,

--> Display at 01:09:51:22
AND TO TELL US
HOW THEY THINK

--> Display at 01:09:53:12
IT FITS INTO THE COMPLETE
LIFE CYCLE OF THE PLANT.

--> Display at 01:09:58:10
UM, "HOW IS THIS STAGE DIFFERENT
FROM THE ONE BEFORE?"

--> Display at 01:10:02:02
WELL, IT'S FROM IT,
AND IT'S LIKE --

--> Display at 01:10:05:18
IT'S *MAKING*
ANOTHER PLANT.

--> Display at 01:10:08:21
WELL, IT MIGHT GROW AND MAKE ANOTHER
SEED AND GROW AGAIN?

--> Display at 01:10:14:10
OR IT MIGHT ROT.

--> Display at 01:10:16:12
BECAUSE, UNLESS AN ANIMAL
CAME AND OPENED IT.

--> Display at 01:10:21:22
Alison: YEAH, THAT,
IF THAT HAPPENED.

--> Display at 01:10:24:00
BUT IF LIKE,

--> Display at 01:10:26:14
SOIL WENT OVER IT,

--> Display at 01:10:28:10
AND IT GOT WATERED
ONCE IN A WHILE,

--> Display at 01:10:29:28
IT PROBABLY WOULD GROW.

--> Display at 01:10:31:03
YEAH.

--> Display at 01:10:32:12
IT'S BASICALLY NEAR THE END
OF THE LIFE CYCLE --

--> Display at 01:10:36:01
NO, IT COULDN'T BE.

--> Display at 01:10:37:16
BECAUSE MAYBE LIKE WHEN THE PEAS COME
OUT, IF YOU DON'T EAT THEM,

--> Display at 01:10:40:29
YOU PLANT THEM AGAIN,
AND THEY BECOME NEW.

--> Display at 01:10:46:18
MAYBE THE PEA, IF YOU DON'T
EAT IT, IS KIND OF LIKE A SEED.

--> Display at 01:10:54:02
I THINK IT'S INTERESTING THAT ONE GROUP
SAID THAT THE SEED

--> Display at 01:10:57:19
WAS PART OF BOTH THE BEGINNING AND THE
END OF THE LIFE CYCLE,

--> Display at 01:11:01:02
BECAUSE THEY HAD SEEN SEEDS
COMING OUT OF ADULT PLANTS.

--> Display at 01:11:04:24
ONE CHILD WONDERED
IF SEEDS WERE LIKE EGGS,

--> Display at 01:11:07:18
AND HE WONDERED IF A PLANT
WAS BEING MADE INSIDE THE SEED,

--> Display at 01:11:11:04
JUST AS AN ANIMAL
DEVELOPS INSIDE AN EGG.

--> Display at 01:11:14:12
THAT RAISES SOME
CHALLENGING QUESTIONS.

--> Display at 01:11:17:02

JUST WHAT IS A SEED?

--> Display at 01:11:19:08
IS IT LIKE AN EGG?

--> Display at 01:11:21:04
IS IT ALIVE?

--> Display at 01:11:22:29
HOW DOES SOMETHING THAT CAN SEEM SO
DRY AND LIFELESS

--> Display at 01:11:25:21
--> Erase at 01:11:27:28
TURN INTO AN ADULT PLANT?

--> Display at 01:11:40:16
Narrator: SEEDS,
AND THE POTENTIAL THEY CONTAIN,

--> Display at 01:11:44:07
ARE VITAL TO THE LIFE CYCLE
OF PLANTS.

--> Display at 01:11:45:27
BUT WE DEPEND UPON THEM AS WELL.

--> Display at 01:11:49:06
AS EVERY FARMER KNOWS,
PLANTING A SEED

--> Display at 01:11:52:06
IN THE RIGHT PLACE
AT THE RIGHT TIME

--> Display at 01:11:54:17
CAN RESULT IN A BOUNTY
OF FRESH PRODUCE --

--> Display at 01:11:56:29
MAKING SEEDS

--> Display at 01:11:58:11
ONE OF THE MOST IMPORTANT COMMERCIAL
PRODUCTS

--> Display at 01:12:00:23
IN THE WORLD.

--> Display at 01:12:02:07
WE PAID A VISIT TO WILSON FARMS

--> Display at 01:12:05:14
IN LEXINGTON, MASSACHUSETTS,

--> Display at 01:12:07:28
A FAMILY BUSINESS THAT HAS PROSPERED FOR
ALMOST 150 YEARS,

--> Display at 01:12:12:11
THANKS, IN PART, TO SEEDS.

--> Display at 01:12:15:08
Computer voice:
WATER OFF, CONTINUE.

--> Display at 01:12:19:16
Narrator: MUCH OF THE OPERATION IS
AUTOMATED,

--> Display at 01:12:22:06
BUT DON'T LET THAT FOOL YOU.

--> Display at 01:12:23:28
MACHINES COULD NEVER

--> Display at 01:12:25:06
TAKE THE PLACE
OF A DEDICATED GROWER

--> Display at 01:12:27:23
WITH A FEEL
FOR THE LIFE CYCLE OF PLANTS.

--> Display at 01:12:32:17
Man: HI, I'M DAN COUSINS.

--> Display at 01:12:33:28
I'M THE HEAD GROWER
AT WILSON FARMS.

--> Display at 01:12:35:22
AT WILSON FARMS,
WE TAKE SEEDS AND USE THEM

--> Display at 01:12:38:10
TO PRODUCE PACK PLANTS,
OR BEDDING PLANTS,

--> Display at 01:12:40:11
THAT PEOPLE PLANT IN THEIR
FRONT YARDS FOR DECORATION.

--> Display at 01:12:43:06
WE PRODUCE ABOUT HALF A MILLION OF
THOSE A YEAR,

--> Display at 01:12:45:12
AND THAT PUTS US IN THE CATEGORY

--> Display at 01:12:46:21
OF BEING
ABOUT A MID-SIZED GROWER.

--> Display at 01:12:48:07
Narrator: THE SUCCESS OF THIS AND EVERY
OTHER FARM

--> Display at 01:12:51:25
DEPENDS ON THE SEED'S ABILITY
TO RESIST HARSH CONDITIONS

--> Display at 01:12:55:00
AND THEN BEGIN GROWING

--> Display at 01:12:56:18
WHEN CONDITIONS ARE RIGHT.

--> Display at 01:12:59:28
THIS ABILITY TO "LAY LOW"
CAN GIVE THE IMPRESSION

--> Display at 01:13:03:24
THAT SEEDS ARE NOT ALIVE.

--> Display at 01:13:06:00
BUT NOTHING COULD BE FARTHER FROM THE
TRUTH.

--> Display at 01:13:09:13
Cousins: EVEN THOUGH IT MAY LOOK LIKE IT'S
NOT ALIVE,

--> Display at 01:13:11:24
INSIDE EACH SEED IS A SMALL LIVING PLANT
THAT'S JUST

--> Display at 01:13:15:11
WAITING FOR SOMETHING TO TRIGGER IT TO
SPRING TO FULL LIFE

--> Display at 01:13:20:05

AND THEN COME OUT AND CREATE
THE PLANT THAT WE WILL SELL.

--> Display at 01:13:23:01
Narrator: WHEN IT'S TIME
TO PRODUCE NEW PLANTS,

--> Display at 01:13:26:20
SEEDS ARE BROUGHT FROM STORAGE,

--> Display at 01:13:28:24
AND THE PROCESS BEGINS
WITH A MACHINE

--> Display at 01:13:31:16
CALLED A SEEDER.

--> Display at 01:13:34:11
AND WHAT I WOULD DO IS PUT THESE UP IN
HERE, IN THE SEEDER --

--> Display at 01:13:40:22
THIS IS AN OLD MILL SEEDER,
AND WHAT IT'S GOING TO DO,

--> Display at 01:13:43:08
WHEN I TURN IT ON, IT'S GOING TO GO
THROUGH AND ACTUALLY COUNT --

--> Display at 01:13:46:04
IT'S DROPPING SEEDS THROUGH
A TUBE HERE AND COUNTING THEM,

--> Display at 01:13:50:10
AND AS IT COUNTS OUT A ROW,

--> Display at 01:13:51:22
IT THEN DROPS THEM
INTO THE SEED TRAY.

--> Display at 01:13:55:03
THIS SAVES US HAVING
TO HANDLE EACH SEED

--> Display at 01:13:59:14
INDIVIDUALLY BY HAND.

--> Display at 01:14:02:05
BECAUSE, YOU KNOW,
WHEN YOU'RE GOING TO PRODUCE

--> Display at 01:14:03:23
--> Erase at 01:14:06:19
HALF A MILLION PLANTS IN A YEAR, YOU NEED
SOMETHING LIKE THIS.

--> Display at 01:14:14:22
SO HERE WE HAVE A TRAY
OF SEEDLINGS THAT'S GERMINATING.

--> Display at 01:14:18:26
THESE WERE SEEDED
A FEW DAYS AGO, AND YOU CAN SEE,

--> Display at 01:14:21:27
SOME OF THEM ARE LITTLE, AND OTHERS HAVE
ACTUALLY OPENED UP

--> Display at 01:14:24:27
TO SHOW THEIR COTYLEDONS.

--> Display at 01:14:27:11
THEY'RE NOT ACTUALLY LEAVES --

--> Display at 01:14:29:13
THEY WERE PART OF WHAT
WAS INSIDE THE SEED,

--> Display at 01:14:31:21
AND WHEN THE SEED GERMINATED, THEY
SWELLED UP,

--> Display at 01:14:34:20
OPENED THE SEED COAT,
AND UNFURLED TO START PRODUCING

--> Display at 01:14:37:23
A LITTLE BIT OF ENERGY WITH
THE CHLOROPHYLL THAT THEY HAD.

--> Display at 01:14:39:29
BUT MOSTLY, THEIR JOB WAS
TO STORE ENERGY

--> Display at 01:14:42:16
--> Erase at 01:14:45:24
FROM LAST YEAR INSIDE THE SEED.

--> Display at 01:14:50:11
SO HERE, WE HAVE THE NEXT STAGE.

--> Display at 01:14:53:06
THESE ARE FAIRLY CLOSE TO BEING PLANTED
AND HAVE BEEN GERMINATED

--> Display at 01:14:56:11
NOW PROBABLY THREE WEEKS,
MAYBE FOUR.

--> Display at 01:14:59:01
AND IF YOU LOOK CLOSELY
AT THE PLANTS, YOU CAN SEE

--> Display at 01:15:01:02
THE COTYLEDONS HAVE STARTED
TO FALL AWAY.

--> Display at 01:15:03:21
THEIR JOB IS DONE,
THERE'S NO MORE NEED FOR THEM.

--> Display at 01:15:06:13
AND THE FIRST REAL LEAVES

--> Display at 01:15:08:01
HAVE COME OUT
AND ARE STARTING

--> Display at 01:15:09:21
--> Erase at 01:15:12:07
TO FEED THE PLANT
AND MAKE IT GROW.

--> Display at 01:15:20:00
SO HERE WE HAVE AN ADULT PLANT.

--> Display at 01:15:24:12
AND YOU CAN SEE,
IT'S STARTED FLOWERING,

--> Display at 01:15:28:01
AND DOING QUITE
A LOT OF FLOWERING.

--> Display at 01:15:30:19
AND THE FLOWERING, OF COURSE,
IS TO PRODUCE THE SEEDS.

--> Display at 01:15:34:09
IF YOU LOOK VERY CLOSELY
HERE AT THIS FLOWER,

--> Display at 01:15:36:29
YOU CAN SEE A SMALL SEED RIGHT AT THE CENTER OF THE FLOWER.

--> Display at 01:15:40:19
BUT THAT'S

--> Display at 01:15:43:16
ALL THIS PLANT IS TRYING TO DO

--> Display at 01:15:44:29
IS PRODUCE ANOTHER SEED,
SO THAT NEXT YEAR,

--> Display at 01:15:47:07
--> Erase at 01:15:49:07
THERE WILL BE ANOTHER PLANT
JUST LIKE THIS.

--> Display at 01:15:51:18
SO HERE AT WILSON FARMS, BASICALLY, WE TAKE SEEDS,

--> Display at 01:15:55:11
AND USING
THEIR NORMAL LIFE CYCLE,

--> Display at 01:15:57:11
JUST DOING IT A LITTLE SOONER THAN THEY WOULD OUTSIDE,

--> Display at 01:16:00:21
WE ARE ABLE TO PROVIDE
A BLOOMING PLANT

--> Display at 01:16:03:11
FOR SOMEONE TO PLANT
IN THEIR FRONT YARD.

--> Display at 01:16:06:13
Narrator:
MUCH OF THE PLANT LIFE CYCLE

--> Display at 01:16:09:04
IS VISIBLE TO THE NAKED EYE.

--> Display at 01:16:11:20
FROM THE FIRST SPROUT
TO THE YOUNG PLANT,

--> Display at 01:16:15:11
TO THE FLOWER, AND FINALLY,
BACK TO THE SEED,

--> Display at 01:16:19:17
WHERE THE WHOLE CYCLE
STARTS OVER AGAIN.

--> Display at 01:16:22:27
BUT THAT'S NOT THE WHOLE STORY.

--> Display at 01:16:25:29
BECAUSE THERE ARE OTHER PROCESSES IN THE LIFE CYCLE

--> Display at 01:16:28:16
THAT ARE NOT EASILY OBSERVED.

--> Display at 01:16:31:15
FOR EXAMPLE, WHAT EXACTLY HAPPENS TO A SEED

--> Display at 01:16:34:18
WHEN IT'S PLANTED?

--> Display at 01:16:36:15
TO FIND OUT
WHAT MAKES A SEED TICK,

--> Display at 01:16:38:28
LET'S TAKE A LOOK INSIDE.

--> Display at 01:16:42:02
LIKE ALL LIVING THINGS,
SEEDS ARE MADE UP OF PARTS.

--> Display at 01:16:46:15
AND IN SOME WAYS,

--> Display at 01:16:47:24
SEEDS RESEMBLE EGGS.

--> Display at 01:16:51:03
JUST AS AN EGG HAS A SHELL,

--> Display at 01:16:53:15
A SEED HAS
A PROTECTIVE OUTER LAYER.

--> Display at 01:16:56:04
IT'S CALLED THE SEED COAT.

--> Display at 01:16:59:12
INSIDE IS LIVING TISSUE,

--> Display at 01:17:01:14
A BABY PLANT THAT SCIENTISTS CALL AN EMBRYO.

--> Display at 01:17:06:23
TO FUEL THE INITIAL GROWTH

--> Display at 01:17:08:17
AND DEVELOPMENT OF THE EMBRYO,

--> Display at 01:17:10:08
THE SEED ALSO CONTAINS

--> Display at 01:17:12:10
A SMALL AMOUNT OF FOOD.

--> Display at 01:17:15:11
IN SOME PLANTS,
THE FOOD IS STORED

--> Display at 01:17:17:25
IN WHAT LOOK LIKE TINY LEAVES

--> Display at 01:17:19:25
THAT APPEAR
WITH THE FIRST SPROUT.

--> Display at 01:17:22:22
BOTANIST AND PROFESSOR
JUDITH SUMNER

--> Display at 01:17:26:04
HAS HER OWN UNIQUE WAY
OF THINKING

--> Display at 01:17:28:01
ABOUT WHAT'S INSIDE A SEED.

--> Display at 01:17:31:16
Sumner: I LIKE THE DEFINITION
OF A SEED AS A BABY PLANT

--> Display at 01:17:34:04
IN A BOX WITH ITS LUNCH.

--> Display at 01:17:35:22
THIS LITTLE FELT MODEL

SHOWS THIS PRETTY WELL.

--> Display at 01:17:38:26
THIS IS A LITTLE STUFFED SEED, ESSENTIALLY,

--> Display at 01:17:42:01
WHERE THE OUTSIDE
IS MADE OF FELT.

--> Display at 01:17:44:07
AND LET'S JUST PRETEND
THAT THE WATER HAS BEGUN

--> Display at 01:17:46:02
TO COME DOWN
IN THE FORM OF SPRING RAIN.

--> Display at 01:17:49:00
AND THE VERY FIRST THING
THAT YOU SEE WHEN A SEED

--> Display at 01:17:52:02
BEGINS TO GERMINATE IS THAT
THE YOUNG ROOT BEGINS TO EMERGE,

--> Display at 01:17:55:15
AND IT ACTUALLY HELPS TO ESTABLISH THE
PLANT IN THE SOIL

--> Display at 01:17:58:07
BY ABSORBING WATER
AND NUTRIENTS.

--> Display at 01:18:00:24
AND ONCE THE SEED IS PRETTY WELL
ESTABLISHED BY THE ROOT,

--> Display at 01:18:04:27
YOU START TO SEE
THE YOUNG STEM EMERGING,

--> Display at 01:18:07:24
AND AS IT SEES THE SUNLIGHT,
IT BEGINS TO TURN GREEN,

--> Display at 01:18:10:28
AND CHLOROPHYLL
MOLECULES DEVELOP

--> Display at 01:18:13:00
AND PHOTOSYNTHESIS BEGINS,

--> Display at 01:18:14:19
AND OF COURSE,
IT'S VERY IMPORTANT

--> Display at 01:18:16:04
THAT THROUGH NATURAL SELECTION,

--> Display at 01:18:18:18
SEED GERMINATION
ALWAYS SEEMS TO OCCUR

--> Display at 01:18:20:23
WITH THE BACK OF THE STEM
COMING OUT FIRST

--> Display at 01:18:23:21
IN SORT OF A HOOK, AND THAT PROTECTS THE
GROWING POINT.

--> Display at 01:18:26:29
AND AT THIS POINT, THE YOUNG SEEDLING
STANDS UPRIGHT,

--> Display at 01:18:31:15
AND IS GROWING TOWARD THE SUN, AND THE
GROWING POINT

--> Display at 01:18:34:26
IS RIGHT HERE BETWEEN

--> Display at 01:18:36:00
THESE TWO MASSIVE LEAVES.

--> Display at 01:18:38:02
AND YOU MIGHT WONDER, WHAT IS
SUPPORTING ALL THIS GROWTH?

--> Display at 01:18:40:16
BECAUSE WHEN A SEED IS BELOW
THE SOIL'S SURFACE, IN FACT,

--> Display at 01:18:44:17
IT'S NOT RECEIVING ANY SUNLIGHT,

--> Display at 01:18:45:25
AND THE PLANT ISN'T PHOTOSYNTHESIZING
YET.

--> Display at 01:18:47:27
AND THAT'S WHERE THIS IDEA
OF THE LUNCH COMES IN,

--> Display at 01:18:50:17
THAT A BABY PLANT, IN FACT,
HAS A SUPPLY OF FOOD.

--> Display at 01:18:53:29
NOW, THIS LITTLE MODEL
ACTUALLY IS A BEAN SEED,

--> Display at 01:18:58:23
A MODEL OF A BEAN SEED,
WITH VERY LARGE

--> Display at 01:19:02:00
COTYLEDONS, AND THE FOOD IS ACTUALLY
STORED

--> Display at 01:19:05:01
IN THESE COTYLEDONS
IN A BEAN SEED,

--> Display at 01:19:07:07
AND IT'S THE COTYLEDONS

--> Display at 01:19:08:22
THAT ACTUALLY SUPPORT
THE GROWTH OF THE BABY PLANT.

--> Display at 01:19:11:29
Narrator: SEEDS HAVE THE ABILITY TO REMAIN
DORMANT

--> Display at 01:19:14:22
FOR LONG PERIODS OF TIME.

--> Display at 01:19:17:12
THIS ADAPTATION CAN PROVE CRUCIAL TO
SURVIVAL,

--> Display at 01:19:21:06
BECAUSE IF A SEED WERE

--> Display at 01:19:22:18
TO SPROUT TOO SOON
AFTER LEAVING THE PARENT PLANT,

--> Display at 01:19:25:20
THE EMBRYO COULD FACE
DEADLY CONDITIONS,

--> Display at 01:19:27:09
SUCH AS THE ONSET OF FREEZING
TEMPERATURES DURING WINTER.

--> Display at 01:19:34:05
THE ABILITY TO LAY LOW,

--> Display at 01:19:35:18
TO REMAIN DORMANT UNTIL CONDITIONS ARE
JUST RIGHT,

--> Display at 01:19:39:00
GIVES SEEDS AN ADVANTAGE, BECAUSE WHILE
DORMANT,

--> Display at 01:19:42:02
THE PLANT EMBRYO REMAINS ALIVE,

--> Display at 01:19:44:26
BUT IN A KIND
OF SUSPENDED ANIMATION.

--> Display at 01:19:49:05
THEN, WHEN CONDITIONS ARE RIGHT,

--> Display at 01:19:51:12
THE SEED ABSORBS WATER,
AND GERMINATION BEGINS.

--> Display at 01:19:56:05
DURING THIS GROWTH PHASE,
THE SEED COAT OPENS,

--> Display at 01:19:59:26
AND THE ROOT EXTENDS.

--> Display at 01:20:02:04
THE ROOT CAN SENSE
THE PULL OF GRAVITY,

--> Display at 01:20:04:20
AND IT SLOWLY REACHES DOWNWARD,

--> Display at 01:20:06:27
KEEPING THE SEED
PROPERLY ORIENTED.

--> Display at 01:20:09:23
NEXT, THE SPROUT APPEARS.

--> Display at 01:20:12:18
NOTICE THE BENT STEM.

--> Display at 01:20:15:08
THIS HOOKED SHAPE,
WHICH COMMONLY FORMS,

--> Display at 01:20:18:09
IS WELL SUITED TO THE PLANT'S UPWARD
THRUST THROUGH THE SOIL,

--> Display at 01:20:22:04
BECAUSE IT SPARES THE FRAGILE LEAF-LIKE
STRUCTURES BELOW.

--> Display at 01:20:27:01
FINALLY, WHEN THE SPROUT
CLEARS THE SURFACE

--> Display at 01:20:29:17
AND SUNLIGHT STRIKES THE LEAVES,
PHOTOSYNTHESIS BEGINS.

--> Display at 01:20:34:24
THE BEST WAY TO UNDERSTAND
THE POTENTIAL LOCKED IN A SEED

--> Display at 01:20:38:17
AND TO UNDERSTAND HOW SEEDS FIT INTO
THE LIFE CYCLE OF PLANTS

--> Display at 01:20:42:00
IS TO PLANT ONE
AND WATCH WHAT HAPPENS.

--> Display at 01:20:45:04
THAT'S WHAT THE STUDENTS

--> Display at 01:20:46:18
IN SALLY FLORKIEWICZ'S THIRD-GRADE CLASS
ARE DOING.

--> Display at 01:20:50:00
THEY'VE BEEN GIVEN SEEDS
OF FAST-GROWING PLANTS,

--> Display at 01:20:52:22
AND THEY'RE STUDYING
THE ENTIRE LIFE CYCLE FIRSTHAND.

--> Display at 01:20:55:24
Zook: THEY'VE ALREADY SEEN
THE TRANSFORMATION

--> Display at 01:20:58:16
FROM SEED TO PLANT.

--> Display at 01:21:00:04
NOW THEY'RE ON THE LOOKOUT
FOR THE NEXT STEP --

--> Display at 01:21:02:10
THE PRODUCTION OF SEEDS.

--> Display at 01:21:04:06
IT'S A BIT
DIFFICULT TO OBSERVE,

--> Display at 01:21:05:22
BECAUSE SEEDS ARE NOT ALWAYS LARGE AND
EASY TO SPOT.

--> Display at 01:21:10:05
WHERE ON THE PLANT WOULD *YOU* EXPECT
SEEDS TO DEVELOP?

--> Display at 01:21:14:08
SO THE BIG QUESTION TODAY IS,

--> Display at 01:21:15:25
HOW DOES THE PLANT
LIFE CYCLE CONTINUE?

--> Display at 01:21:18:19
WHERE DOES THAT SEED COME FROM?

--> Display at 01:21:21:14
OKAY, SO, MANAGERS,
YOU NEED TO GET TWO THINGS --

--> Display at 01:21:24:15
YOUR FAST PLANT AND YOUR MAGNIFYING
GLASSES, RIGHT?

--> Display at 01:21:27:15
MANAGERS, YOU MAY GO.

--> Display at 01:21:29:06
OKAY, SO FIRST, BOYS AND GIRLS,
I WANT YOU TO LOOK AT YOUR PLANT

--> Display at 01:21:33:02
VERY CAREFULLY,
AND LOOK FOR ANY CHANGES.

--> Display at 01:21:38:00
AND THEN YOU DO NEED TO START

--> Display at 01:21:40:21
--> Erase at 01:21:43:13
SKETCHING YOUR OBSERVATION
FOR TODAY.

--> Display at 01:21:46:16
Florkiewicz: WHILE THE STUDENTS
ARE IN GROUPS,

--> Display at 01:21:49:08
THE BIG QUESTION WILL BE,

--> Display at 01:21:51:12
WHERE DID THE SEED COME FROM?

--> Display at 01:21:52:23
RIGHT NOW, THE CLASS IS
KIND OF IN THE MIDDLE

--> Display at 01:21:55:08
OF DISCOVERING
THE PLANT LIFE CYCLE.

--> Display at 01:21:56:19
WE'VE WATCHED THE SEEDS
DEVELOP INTO A PLANT,

--> Display at 01:22:00:22
AND WHAT WE'LL BE DOING NEXT IS

--> Display at 01:22:03:13
WE'LL BE GETTING TOGETHER
IN A BIG GROUP

--> Display at 01:22:05:19
AND DISCUSSING
THE ACTUAL LIFE CYCLE,

--> Display at 01:22:07:29
AND MAKING SOME OF THE LIFE CYCLE PLATES
FOR PLANTS.

--> Display at 01:22:14:15
OKAY, THE FLOWER
HITS THE GROUND --

--> Display at 01:22:16:15
ONCE IT DIES.

--> Display at 01:22:17:21
AND THEN THE SEED --
YEAH, ONCE IT DIES.

--> Display at 01:22:19:06
AND ONCE IT'S --
WHILE IN MY DIRT,

--> Display at 01:22:21:13
AND THEN THE SEEDS
FALL INTO THE GROUND,

--> Display at 01:22:25:13
AND THEN BY SPRING,
IT SPRINGS UP AGAIN.

--> Display at 01:22:28:23
OKAY, SO THE SEEDS ARE
IN THE FLOWER WHEN IT FALLS?

--> Display at 01:22:31:04
YEAH.

--> Display at 01:22:32:09
--> Erase at 01:22:33:11
OKAY, I GOTCHA.
ALL RIGHT.

--> Display at 01:22:35:26
SEEDS FALL OFF
OF THE FLOWER?

--> Display at 01:22:38:27
WELL, THAT'S
WHAT WE THINK, AT LEAST.

--> Display at 01:22:40:21
THAT'S WHAT I THINK.

--> Display at 01:22:42:10
SEEDS FALL OFF OF THE FLOWER,
THEY GO IN THE GROUND,

--> Display at 01:22:44:12
AND THEN THEY PLANT
A NEW FLOWER.

--> Display at 01:22:47:15
ALL THOSE LINEY THINGS, THOSE THINGS THAT
ARE STICKING OUT,

--> Display at 01:22:50:01
YOU THINK THERE ARE
SOME SEEDS IN THERE?

--> Display at 01:22:52:02
YEAH, IN THOSE THINGS.

--> Display at 01:22:53:14
HMM...OH, I SEE WHAT
YOU'RE TALKING ABOUT.

--> Display at 01:22:55:00
OKAY, SO YOU THINK THOSE
JUST FALL OUT,

--> Display at 01:22:56:26
AND THEN THAT'S
WHERE THE SEED IS --

--> Display at 01:22:58:17
THAT'S HOW THE NEXT
GENERATION OF FLOWER STARTS?

--> Display at 01:23:02:11
OR A PLANT STARTS?

--> Display at 01:23:03:11
YEAH.

--> Display at 01:23:04:22
Florkiewicz: THE BIG IDEA
THAT STUDENTS SHOULD UNDERSTAND

--> Display at 01:23:06:24
ONCE WE'RE DONE WITH THE LIFE CYCLES
UNITS WITH PLANTS

--> Display at 01:23:09:23
IS THAT PLANTS DO HAVE
A LIFE CYCLE,

--> Display at 01:23:11:18
THEY START AS A SEED,
THEY HAVE THEIR, THEY SPROUT,

--> Display at 01:23:16:17
THEY START TO GROW LEAVES,
SOME START TO HAVE THE FLOWERS,

--> Display at 01:23:19:26
AND THEN THEY START
TO HAVE THE PODS,

--> Display at 01:23:22:01
AND THEN THAT'S WHERE
THE SEEDS ARE, ARE INSIDE THAT.

--> Display at 01:23:26:08
YOU HAVE THE SEEDS
RIGHT THERE.

--> Display at 01:23:27:18
I THINK YOU
SHOULD, LIKE, CIRCLE THEM.

--> Display at 01:23:29:04
Florkiewicz: BOYS AND GIRLS,
I'D LIKE YOU

--> Display at 01:23:31:01
TO CLEAR OFF YOUR DESKS, PLEASE.

--> Display at 01:23:32:13
LET'S PUT OUR MARKERS AWAY.

--> Display at 01:23:34:27
WE'LL HAVE TIME TO FINISH COLORING THESE
LATER.

--> Display at 01:23:37:14
LET'S SEE, WHO'S THE MANAGER OVER HERE --
AMY?

--> Display at 01:23:41:06
Narrator: AFTER WORKING
WITH THEIR PLANTS,

--> Display at 01:23:43:27
EACH GROUP GIVES THE OTHERS
IN THE CLASS

--> Display at 01:23:46:05
A SNAPSHOT
OF THEIR CURRENT UNDERSTANDING

--> Display at 01:23:48:26
OF THE PLANT LIFE CYCLE.

--> Display at 01:23:50:23
SOME OF THEIR IDEAS
ARE STILL WIDE OF THE MARK,

--> Display at 01:23:52:28
BUT THEIR OBSERVATIONS
ARE NOT YET COMPLETE,

--> Display at 01:23:55:16
AND THEY WILL CONTINUE
TO REFINE THEIR IDEAS

--> Display at 01:23:58:27
AS THE PLANTS MATURE.

--> Display at 01:24:01:25
Girl: FIRST THE PLANT
STARTS OUT IN A SEED,

--> Display at 01:24:04:01
AND THEN IT GOES
TO A LEAF.

--> Display at 01:24:08:04
THE LEAVES
START REAL TINY.

--> Display at 01:24:13:08
THEN THEY GROW
ONTO MANY, MANY FLOWERS.

--> Display at 01:24:19:22
AND THEN IT DIES,

--> Display at 01:24:22:02
AND THE SEED COMES
OUT OF THE FLOWER --

--> Display at 01:24:25:01
[Whispering]
Inside the flower.

--> Display at 01:24:26:16
COMES OUT OF THE INSIDE
OF THE FLOWER,

--> Display at 01:24:28:07
THEN IT FORMS
ANOTHER ONE.

--> Display at 01:24:29:27
[Whispering]
This is how the life
cycle goes.

--> Display at 01:24:31:17
--> Erase at 01:24:34:13
THIS IS HOW
THE LIFE CYCLE GOES.

--> Display at 01:24:38:19
FIRST,
THEY'RE SEEDS.

--> Display at 01:24:43:21
[Whispering]
Here.

--> Display at 01:24:46:18
THEN IT TURNS
INTO A STEM.

--> Display at 01:24:50:10
AND THEN IT
STARTS TO BLOOM.

--> Display at 01:24:55:02
AND THEN IT'S
FULLY BLOOMED.

--> Display at 01:25:01:21
AND THEN THE FLOWER,

--> Display at 01:25:05:09
THE SEEDS START TO
COME OUT OF THE FLOWER,

--> Display at 01:25:08:04
AND WE THINK WHERE THE SEEDS COME FROM
IS INSIDE THE STEM.

--> Display at 01:25:13:19
Florkiewicz:
INSIDE THE STEM?

--> Display at 01:25:15:13
YEAH.

--> Display at 01:25:16:22

SO THIS TEAM THINKS IT COMES FROM INSIDE
THE STEM,

--> Display at 01:25:18:20
NOT THE FLOWER?

--> Display at 01:25:19:20
UH-UH.

--> Display at 01:25:20:20
OKAY.
VERY INTERESTING.

--> Display at 01:25:22:03
SO THAT'S A LITTLE DIFFERENT THAN OUR
OTHER TEAMS.

--> Display at 01:25:24:01
SO I'M GOING TO
COLLECT YOUR POSTERS.

--> Display at 01:25:25:12
Florkiewicz: ONE GROUP
DID NOTICE THE POD,

--> Display at 01:25:28:26
BUT THEY WERE CALLING IT,

--> Display at 01:25:31:05
SOME OF THEM WERE CALLING IT
THE STEM,

--> Display at 01:25:33:05
SOME OF THEM
WERE CALLING IT A ROOT,

--> Display at 01:25:35:01
SO THEY WEREN'T QUITE SURE
WHAT IT WAS,

--> Display at 01:25:37:02
BUT THEY BELIEVED THAT THE SEED WAS
INSIDE THERE.

--> Display at 01:25:40:28
THEY'RE NOT QUITE THERE YET,

--> Display at 01:25:43:11
AND I THINK WE STILL HAVE A LOT OF
OBSERVATIONS TO DO.

--> Display at 01:25:49:22
THE SEEDS *WERE* LOCATED
IN THE FLOWER,

--> Display at 01:25:52:11
IN A STRUCTURE
CALLED THE OVARY,

--> Display at 01:25:54:13
NOT IN THE STEM.

--> Display at 01:25:56:25
ONE GROUP MISTOOK
THE MALE REPRODUCTIVE ORGANS

--> Display at 01:25:59:00
THAT PRODUCE POLLEN
FOR THE DEVELOPING SEED PODS.

--> Display at 01:26:02:11
I CAN SYMPATHIZE.

--> Display at 01:26:04:12
IT'S NOT ALWAYS EASY
TO IDENTIFY PLANT STRUCTURES.

--> Display at 01:26:07:23
JUST THINK OF THE TREMENDOUS VARIETY OF
SPECIES

--> Display at 01:26:10:08
IN THE PLANT WORLD,
EACH WITH ITS OWN ANATOMY.

--> Display at 01:26:14:23
WELL, THERE'S MORE
TO PLANT LIFE CYCLES

--> Display at 01:26:16:15
THAN WE CAN UNDERSTAND

--> Display at 01:26:18:00
THROUGH THE KIND
OF DIRECT OBSERVATION,

--> Display at 01:26:19:15
ESPECIALLY IF WE WANT
TO UNDERSTAND

--> Display at 01:26:21:24
NOT ONLY WHERE SEEDS ARE MADE, BUT HOW
SEEDS ARE MADE.

--> Display at 01:26:25:25
AND THAT MAY BE THE MOST INCREDIBLE
PART OF THE STORY.

--> Display at 01:26:29:10
EARLIER, WE MADE AN ANALOGY COMPARING
SEEDS TO EGGS.

--> Display at 01:26:33:11
BUT JUST HOW FAR DOES
THAT COMPARISON EXTEND?

--> Display at 01:26:36:19
EGGS ARE THE PRODUCT
OF SEXUAL REPRODUCTION.

--> Display at 01:26:40:02
WE CAN ASK, IF A SEED IS
LIKE AN EGG, DOES THAT MEAN

--> Display at 01:26:43:15
THAT SEEDS ARE ALSO THE PRODUCT OF
SEXUAL REPRODUCTION?

--> Display at 01:26:47:04
DO PLANTS HAVE PARENTS?

--> Display at 01:26:49:06
WHAT *ARE* THE SIMILARITIES
AND DIFFERENCES

--> Display at 01:26:51:02
BETWEEN THE LIFE CYCLES
OF PLANTS AND ANIMALS?

--> Display at 01:26:54:09
LET'S FIND OUT
WHAT THE CHILDREN

--> Display at 01:26:56:02
IN OUR SCIENCE
STUDIO THINK.

--> Display at 01:26:57:23
LISTEN CAREFULLY
TO THEIR ATTEMPTS

--> Display at 01:26:59:17

TO COMPARE PLANT
AND ANIMAL LIFE CYCLES.

--> Display at 01:27:02:25
DO YOU THINK THAT PLANT
AND ANIMAL REPRODUCTION

--> Display at 01:27:05:08
HAVE ANYTHING IN COMMON?

--> Display at 01:27:07:18
ANIMALS NEED A MOMMY AND A DADDY TO
HAVE BABIES.

--> Display at 01:27:11:02
DO PLANTS NEED A MOMMY
AND A DADDY

--> Display at 01:27:12:21
TO HAVE BABIES?

--> Display at 01:27:14:23
NO, THEY JUST NEED
THE SEEDS.

--> Display at 01:27:16:23
AND THEN THEY START TO GROW
IN THE LIFE CYCLE OF A PLANT.

--> Display at 01:27:21:26
WELL, I DON'T THINK IT,
LIKE, NEEDS A FATHER --

--> Display at 01:27:25:24
WELL, IT'S NOT REALLY
A HIM OR A HER --

--> Display at 01:27:28:06
BUT IT DOESN'T NEED A FATHER

--> Display at 01:27:29:23
BECAUSE IT DOESN'T NEED
ANYTHING TO FERTILIZE IT,

--> Display at 01:27:32:24
BECAUSE IT DOESN'T HAVE
AN EGG.

--> Display at 01:27:36:12
SEEDS ARE DIFFERENT,
ARE KIND OF LIKE EGGS,

--> Display at 01:27:38:17
BUT THEY'RE
DIFFERENT THAN EGGS.

--> Display at 01:27:40:27
Man: HOW SO?

--> Display at 01:27:43:09
WELL, THEY DON'T
HAVE BABIES IN THEM.

--> Display at 01:27:46:12
THEY HAVE --

--> Display at 01:27:49:14
Man: BUT WHAT --
I THOUGHT YOU SAID

--> Display at 01:27:51:00
THAT THE SEEDS
WERE THE BABIES.

--> Display at 01:27:52:15
WELL, I'M NOT,
LIKE, REALLY SAYING

--> Display at 01:27:54:07
THEY'RE LIKE HUMAN BABIES
OR ANIMAL BABIES --

--> Display at 01:27:57:22
I'M SAYING LIKE THEY'RE
JUST THE BABY,

--> Display at 01:28:00:11
THEY'RE THE BEGINNING
OF THE LIFE, KIND OF.

--> Display at 01:28:04:19
PLANTS DON'T REALLY
HAVE PARENTS.

--> Display at 01:28:06:17
THEIR PARENTS ARE LIKE,
SEEDS' PARENTS ARE LIKE,

--> Display at 01:28:09:28
THE PLANTS THAT CAME BEFORE THEM, LIKE
THE BIG, BIG PLANTS,

--> Display at 01:28:13:25
THE ONES THAT MADE THE SEEDS.

--> Display at 01:28:15:23
BUT YOU'D HAVE TO HAVE
A MALE AND A FEMALE,

--> Display at 01:28:18:00
AND YOU CAN'T REALLY TELL BETWEEN
PLANTS

--> Display at 01:28:19:19
WHETHER IT'S A MALE OR A FEMALE, BECAUSE
THERE'S NO WAY TO TELL.

--> Display at 01:28:23:04
Narrator:
THE CHILDREN DON'T THINK

--> Display at 01:28:25:04
THAT PLANTS HAVE PARENTS
IN THE SAME WAY THAT ANIMALS DO.

--> Display at 01:28:28:16
AND THEY DON'T BELIEVE
THAT PLANTS CAN BE CLASSIFIED

--> Display at 01:28:31:09
AS EITHER MALE OR FEMALE.

--> Display at 01:28:33:17
DO YOU AGREE?

--> Display at 01:28:35:14
WHAT EVIDENCE DO *YOU*
THINK THERE IS

--> Display at 01:28:37:13
THAT CAN TELL US
HOW PLANTS REPRODUCE?

--> Display at 01:28:42:08
YEAH, THEY NEED --
THE BEES COME AND DO IT,

--> Display at 01:28:47:04
AND THEY COME AND POLLINATE.

--> Display at 01:28:49:14
Eleanor:

WHAT DOES THAT MEAN?

--> Display at 01:28:50:18
THAT'S A GREAT WORD.
WHAT'S THAT MEAN?

--> Display at 01:28:52:11
LIKE, TO SUCK UP,
LIKE THE NECTAR

--> Display at 01:28:56:22
AND POLLEN AND LIKE --
Toby: YEAH.

--> Display at 01:28:58:23
EAT THE POLLEN,
AND THEN GO TO ANOTHER FLOWER

--> Display at 01:29:01:27
AND POLLINATE THAT ONE,
AND THEN GO ALL OVER TO LIKE --

--> Display at 01:29:05:26
Toby: LIKE, WHEN IT'S SATISFIED, IT GOES BACK
TO THE BEEHIVE.

--> Display at 01:29:10:02
YEAH.

--> Display at 01:29:11:22
OKAY, SO A BEE CAME, AND HE PICKS UP
NECTAR AND POLLEN.

--> Display at 01:29:14:19
MM-HMM.

--> Display at 01:29:15:29
AND THEN HE GOES
TO THIS PLANT FLOWER.

--> Display at 01:29:18:10
HE LEAVES, UM --

--> Display at 01:29:20:29
HE LEAVES
POLLEN THERE.
YEAH, POLLEN
FROM HIS LEGS.

--> Display at 01:29:25:10
YEAH.

--> Display at 01:29:26:24
MANY OF THE CHILDREN
HAD HEARD OF POLLEN,

--> Display at 01:29:29:16
AND SOME BELIEVED
THAT IT PLAYS A ROLE

--> Display at 01:29:31:15
IN THE LIFE CYCLE OF PLANTS,
BUT THEY WEREN'T SURE HOW.

--> Display at 01:29:35:23
POLLEN IS A GOOD PLACE
TO BEGIN OUR EXPLORATION

--> Display at 01:29:38:09
OF PLANT REPRODUCTION.

--> Display at 01:29:40:05
EVEN THOUGH IT'S FAMILIAR,

--> Display at 01:29:41:18
THERE'S A LOT MORE TO IT
THAN YOU MIGHT THINK.

--> Display at 01:29:44:05
ANYWHERE THERE ARE FLOWERS, THERE'S
POLLEN,

--> Display at 01:29:46:25
AS ANYONE WITH ALLERGIES
WILL TELL YOU.

--> Display at 01:29:49:19
HOW MUCH DO WE KNOW
ABOUT POLLEN?

--> Display at 01:29:52:00
YOU MAY KNOW THAT PLANT GROWERS USE
POLLEN TO BREED FLOWERS,

--> Display at 01:29:55:16
AND SOMETIMES,
TO CREATE NEW VARIETIES.

--> Display at 01:29:58:11
BUT YOU MAY NOT REALIZE
HOW MUCH

--> Display at 01:29:59:25
THIS PROCESS HAS IN COMMON
WITH ANIMAL REPRODUCTION.

--> Display at 01:30:03:05
IT SURPRISED ME TO LEARN
THAT THE POLLEN GRAINS,

--> Display at 01:30:06:06
SUCH AS THESE HERE, ORANGE,

--> Display at 01:30:10:07
THAT MAKE YOU SNEEZE
IN THE SPRINGTIME,

--> Display at 01:30:12:25
ARE ACTUALLY TINY, MICROSCOPIC SPERM
CELL FACTORIES

--> Display at 01:30:16:28
RELEASED BY PLANTS DURING
THEIR REPRODUCTIVE CYCLE.

--> Display at 01:30:20:22
WE PAID A VISIT
TO DR. DANIEL SCHEIRER,

--> Display at 01:30:23:29
A PROFESSOR
AT NORTHEASTERN UNIVERSITY,

--> Display at 01:30:26:02
TO LEARN MORE

--> Display at 01:30:27:12
--> Erase at 01:30:29:23
ABOUT THE REPRODUCTIVE SYSTEM
OF PLANTS.

--> Display at 01:30:41:16
Narrator: DAN SCHEIRER
IS A FORENSIC BOTANIST.

--> Display at 01:30:44:28
IN HIS WORK, HE USES

--> Display at 01:30:46:11
PLANT PARTS TO SOLVE MYSTERIES FROM THE
DISTANT PAST.

--> Display at 01:30:50:26
AND ONE OF HIS MOST
IMPORTANT TOOLS IS POLLEN.

--> Display at 01:30:54:18
Scheirer: A POLLEN GRAIN
HAS AN OUTER COVERING

--> Display at 01:30:57:08
THAT IS VERY
RESISTANT TO DECAY.

--> Display at 01:30:59:19
IT IS SO RESISTANT THAT IT'S BEEN FOUND IN
FOSSIL RECORD,

--> Display at 01:31:04:19
IN THE FOSSIL RECORD,
MILLIONS OF YEARS AGO,

--> Display at 01:31:07:27
AND IT HAS BEEN PRESERVED AS IF
IT HAD BEEN PRODUCED YESTERDAY.

--> Display at 01:31:12:03
Narrator: ANCIENT POLLEN
HAS HELPED SCIENTISTS UNDERSTAND

--> Display at 01:31:15:26
HOW THE EARTH'S ENVIRONMENT
HAS CHANGED OVER THE CENTURIES.

--> Display at 01:31:18:04
AND POLLEN HAS EVEN HELPED
TO ANSWER A QUESTION

--> Display at 01:31:22:01
ABOUT THE GEOLOGICAL HISTORY
OF NORTH AMERICA.

--> Display at 01:31:24:14
HOW LONG DID IT TAKE
FOR TREES AND PLANTS TO RECOVER,

--> Display at 01:31:28:12
FOLLOWING THE LAST DEVASTATING

--> Display at 01:31:30:00
ICE AGE, THAT CARVED A PATH
OF DESTRUCTION

--> Display at 01:31:33:09
ACROSS MOST OF THE CONTINENT?

--> Display at 01:31:35:25
15,000 YEARS AGO,
NORTHERN UNITED STATES

--> Display at 01:31:40:07
WAS COVERED IN AN ICE SHEET.

--> Display at 01:31:41:23
AND AS THAT ICE RECEDED,
PLANTS COLONIZED THAT LAND.

--> Display at 01:31:46:06
AND WE ARE ABLE
TO LOOK AT POLLEN GRAINS

--> Display at 01:31:49:08
THAT HAVE ACCUMULATED
IN LAKE SEDIMENTS,

--> Display at 01:31:51:15
AND RECONSTRUCT
WHAT PLANTS RE-COLONIZED,

--> Display at 01:31:55:09
HOW LONG IT TOOK,
WHERE THEY OCCURRED,

--> Display at 01:31:58:27
ALL FROM EVIDENCE

--> Display at 01:32:02:00
OF THE POLLEN.

--> Display at 01:32:04:17
Narrator: AS THE ICE
THAT COVERED THE CONTINENT

--> Display at 01:32:06:12
SLOWLY RECEDED,
OAKS AND OTHER HARDY TREES

--> Display at 01:32:09:19
SPREAD NORTH
TO CREATE VAST FORESTS

--> Display at 01:32:12:04
WHERE ONLY BARREN WASTELAND
HAD BEEN BEFORE.

--> Display at 01:32:15:15
WITHOUT POLLEN,

--> Display at 01:32:17:06
WE MIGHT NEVER APPRECIATE
HOW RESILIENT

--> Display at 01:32:19:03
PLANTS AND TREES CAN BE.

--> Display at 01:32:22:14
BUT WHY IS POLLEN SO TOUGH?

--> Display at 01:32:25:08
A FINE POWDER RELEASED
BY DELICATE FLOWERS,

--> Display at 01:32:27:28
AND SOMEHOW ABLE TO REMAIN INTACT FOR
MILLIONS OF YEARS?

--> Display at 01:32:31:09
IT DOESN'T MAKE SENSE --
OR DOES IT?

--> Display at 01:32:34:23
TO UNDERSTAND,
WE NEED TO KNOW

--> Display at 01:32:36:13
MORE ABOUT THE ROLE THAT POLLEN PLAYS
IN PLANT REPRODUCTION.

--> Display at 01:32:40:13
FLOWERS HAVE
BOTH MALE AND FEMALE

--> Display at 01:32:43:21
REPRODUCTIVE STRUCTURES.

--> Display at 01:32:45:22
MALE REPRODUCTIVE STRUCTURES PRODUCE
POLLEN,

--> Display at 01:32:48:15
AND EACH POLLEN GRAIN
CONTAINS A COPY

--> Display at 01:32:50:28

OF HALF OF THE PARENT PLANT'S
CHROMOSOMES.

--> Display at 01:32:54:09
IN THIS WAY,

--> Display at 01:32:55:28
IT IS SIMILAR TO SPERM
PRODUCED BY MALE ANIMALS.

--> Display at 01:32:58:27
BUT THERE IS A DIFFERENCE.

--> Display at 01:33:01:16
UNLIKE SPERM, POLLEN IS NOT ABLE TO
DIRECTLY FERTILIZE AN EGG.

--> Display at 01:33:06:03
INSTEAD, POLLEN IS
AN INTERMEDIATE STRUCTURE

--> Display at 01:33:09:00
THAT TRAVELS TO THE FEMALE PART OF
ANOTHER PLANT.

--> Display at 01:33:12:13
THERE, IT MANUFACTURES THE SPERM CELLS
WHERE THEY ARE NEEDED.

--> Display at 01:33:15:22
IT'S A PROCESS UNIQUE
TO FLOWERING PLANTS

--> Display at 01:33:19:08
AND IS CALLED POLLINATION.

--> Display at 01:33:23:05
Scheirer:
POLLINATION IS THE PROCESS

--> Display at 01:33:24:16
OF TRANSFERRING POLLEN
FROM THE MALE FLOWER PART

--> Display at 01:33:28:00
TO THE FEMALE FLOWER PART.

--> Display at 01:33:30:02
WHEN POLLEN STICKS
ONTO THE FEMALE FLOWER PART,

--> Display at 01:33:33:13
THE POLLEN GERMINATES
AND SENDS A TUBE

--> Display at 01:33:36:07
THAT GROWS DOWN
TOWARDS THE EGG CELL.

--> Display at 01:33:39:00
AS THIS TUBE IS GROWING,
POLLEN PRODUCES TWO SPERM CELL

--> Display at 01:33:43:15
THAT WILL BE DELIVERED

--> Display at 01:33:44:25
RIGHT INTO THE VICINITY
OF THE EGG CELL.

--> Display at 01:33:49:07
Narrator: EACH POLLEN GRAIN FACES LONG
ODDS

--> Display at 01:33:52:05
IN ITS JOURNEY
FROM ONE PLANT TO ANOTHER.

--> Display at 01:33:55:19
AND PLANTS RELY ON AN IMPORTANT
REPRODUCTIVE STRATEGY --

--> Display at 01:33:59:04
SHEER QUANTITY.

--> Display at 01:34:02:08
IN THE SPRINGTIME, WE ARE ALL FAMILIAR
WITH THE POLLEN COUNTS

--> Display at 01:34:04:13
THAT WE HEAR
ON THE WEATHER REPORTS.

--> Display at 01:34:06:17
PLANTS RELEASE LOTS OF POLLEN

--> Display at 01:34:09:03
BECAUSE REALLY, REPRODUCTION
IS A GAME OF CHANCE.

--> Display at 01:34:12:02
THERE'S NO GUARANTEE THAT
THAT POLLEN GRAIN

--> Display at 01:34:14:13
IS GOING TO FERTILIZE
THE EGG CELL.

--> Display at 01:34:18:02
SO PLANTS PRODUCE
MUCH MORE POLLEN THAN THEY NEED.

--> Display at 01:34:21:29
Narrator: NOT ONLY THAT,
BUT EACH POLLEN GRAIN HAS TO BE

--> Display at 01:34:25:11
TOUGH ENOUGH TO SURVIVE
WHILE AWAY FROM THE PARENT PLANT

--> Display at 01:34:28:06
IF IT HAS ANY HOPE

--> Display at 01:34:29:22
OF FULFILLING ITS MISSION.

--> Display at 01:34:32:16
MAGNIFIED 1,000 TIMES
USING AN ELECTRON MICROSCOPE,

--> Display at 01:34:36:14
WE CAN SEE POLLEN IN ALL
ITS STRUCTURAL COMPLEXITY.

--> Display at 01:34:39:24
POLLEN HAS AS MANY SHAPES
AS THERE ARE SPECIES OF PLANT.

--> Display at 01:34:44:24
BUT THEY ALL SHARE
SOME THINGS IN COMMON,

--> Display at 01:34:47:24
FEATURES THAT HELP THEM
IN THEIR JOURNEY.

--> Display at 01:34:51:17
Scheirer: THERE'S SUCH A VARIETY OF SHAPES
TO POLLEN GRAINS,

--> Display at 01:34:54:27
AND THESE VARIOUS SHAPES

MAY ASSIST THE POLLEN

--> Display at 01:34:57:12
IN STICKING TO THE FUR
OF AN ANIMAL

--> Display at 01:35:00:29
OR TRAVELING
THROUGH THE AIR BETTER,

--> Display at 01:35:04:14
OR IN ANY VARIETY
OF OTHER MECHANISMS

--> Display at 01:35:07:04
THAT GIVE IT BETTER SURVIVAL.

--> Display at 01:35:11:19
Narrator: SO THE TOUGHNESS
OF POLLEN AND THE FACT

--> Display at 01:35:14:01
THAT SO MUCH VARIETY EXISTS
IN THE WAY POLLEN GRAINS LOOK

--> Display at 01:35:17:23
MAKE POLLEN
AN IDEAL INVESTIGATIVE TOOL.

--> Display at 01:35:21:29
POLLEN REALLY IS AMAZING.

--> Display at 01:35:24:10
LOOKING AT THOSE
ELECTRON MICROGRAPHS

--> Display at 01:35:26:13
IS LIKE LOOKING
AT AN ALIEN WORLD.

--> Display at 01:35:28:20
BUT THERE'S STILL MORE

--> Display at 01:35:30:05
TO SEXUAL REPRODUCTION
IN PLANTS

--> Display at 01:35:31:20
FOR US TO EXPLORE.

--> Display at 01:35:33:11
BUT BEFORE WE DO, LET ME
JUST SAY THAT THIS TOPIC

--> Display at 01:35:36:01
IS DIFFICULT TO TEACH
USING OBSERVATION ALONE.

--> Display at 01:35:39:20
OBSERVATION WOULD TELL US
THAT SEEDS ARE PRODUCED

--> Display at 01:35:42:14
BY A SINGLE PARENT PLANT,

--> Display at 01:35:44:03
BECAUSE THAT'S
WHAT WE SEE HAPPENING.

--> Display at 01:35:46:17
BUT BIOLOGISTS HAVE OBSERVED
THAT THE PROCESS

--> Display at 01:35:48:29
IS MUCH MORE COMPLEX.

--> Display at 01:35:50:22
JUST AS POLLEN IS
AN INTERMEDIATE STAGE

--> Display at 01:35:53:06
THAT PRODUCES THE SPERM,
THE FEMALE SIDE OF THE EQUATION

--> Display at 01:35:56:14
--> Erase at 01:36:00:07
IS ALSO A BIT MORE COMPLICATED THAN YOU
MIGHT EXPECT.

--> Display at 01:36:12:12
Narrator: FLOWERS REPRODUCE
WHEN SPERM AND EGG

--> Display at 01:36:17:07
JOIN DURING FERTILIZATION.

--> Display at 01:36:19:22
BUT DESPITE
THE EVIDENT SIMILARITIES

--> Display at 01:36:22:09
BETWEEN PLANT AND ANIMAL REPRODUCTION,

--> Display at 01:36:24:16
THERE IS A CRUCIAL DIFFERENCE.

--> Display at 01:36:26:29
PLANTS DO NOT PRODUCE
SPERM AND EGG CELLS DIRECTLY.

--> Display at 01:36:30:21
THE PLANT
REPRODUCTIVE CYCLE DEPENDS

--> Display at 01:36:33:22
ON INTERMEDIATE STRUCTURES
TO PRODUCE THE SEX CELLS.

--> Display at 01:36:39:13
THE MALE REPRODUCTIVE PART, CALLED THE
STAMEN,

--> Display at 01:36:42:07
PRODUCES AN INTERMEDIATE STRUCTURE,
CALLED POLLEN.

--> Display at 01:36:48:00
THE FEMALE REPRODUCTIVE PART, CALLED
THE OVARY,

--> Display at 01:36:52:01
ALSO PRODUCES
AN INTERMEDIATE STRUCTURE.

--> Display at 01:36:55:00
IT IS CALLED
THE FEMALE SPORE.

--> Display at 01:36:59:08
IN FLOWERING PLANTS,
THE FEMALE SPORE IS MICROSCOPIC,

--> Display at 01:37:03:17
BUT IT PERFORMS
A VITAL FUNCTION.

--> Display at 01:37:06:05
IT PRODUCES THE EGG.

--> Display at 01:37:11:19
POLLINATION OCCURS

--> Display at 01:37:13:07
WHEN POLLEN REACHES THE FEMALE
REPRODUCTIVE STRUCTURE.

--> Display at 01:37:18:23
FERTILIZATION OCCURS WHEN
THE SPERM CELL AND THE EGG CELL

--> Display at 01:37:23:07
JOIN TO PRODUCE THE SEED.

--> Display at 01:37:26:29
SCIENTISTS CALL THIS UNIQUE TWO-STEP
APPROACH

--> Display at 01:37:30:14
TO REPRODUCTION
"ALTERNATION OF GENERATIONS."

--> Display at 01:37:36:08
SO ALTERNATION OF GENERATIONS
IS A KIND OF INTERMEDIATE STAGE

--> Display at 01:37:40:04
BETWEEN PARENT AND CHILD.

--> Display at 01:37:42:17
IT'S NOT FOUND AT ALL
IN THE ANIMAL WORLD.

--> Display at 01:37:45:19
FOR BIOLOGISTS
LIKE JUDITH SUMNER,

--> Display at 01:37:47:10
IT'S ONE OF THE MOST FASCINATING ASPECTS
OF THE PLANT LIFE CYCLE.

--> Display at 01:37:51:10
IN PLANTS, THERE'S AN EXTRA LITTLE
GENERATION THAT GETS

--> Display at 01:37:54:00
TUCKED IN THERE, THAT MANY PEOPLE AREN'T
EVEN AWARE OF.

--> Display at 01:37:57:05
WHAT HAPPENS IN PLANTS
IS THAT MEIOSIS

--> Display at 01:37:59:15
ACTUALLY PRODUCES SPORES,
AND THOSE SPORES

--> Display at 01:38:03:29
ACTUALLY MAKE ANOTHER VERY, VERY, VERY
TINY LITTLE PLANT.

--> Display at 01:38:07:24
AND IT'S THAT LITTLE PLANT
THAT ACTUALLY

--> Display at 01:38:10:20
EITHER MAKES THE EGGS
OR THE SPERM.

--> Display at 01:38:13:09
AND THEN THOSE ARE THE EGGS
AND SPERM THAT EVENTUALLY FUSE

--> Display at 01:38:17:01
TO MAKE THE EMBRYO
THAT WE FIND INSIDE THE SEED.

--> Display at 01:38:20:05
NOW, IN A FLOWERING PLANT,
WHERE ACTUALLY ARE

--> Display at 01:38:22:28
THESE EXTRA LITTLE PLANTS?

--> Display at 01:38:26:03
WELL, ONE OF THEM IS ACTUALLY INSIDE THE
IMMATURE SEED.

--> Display at 01:38:30:18
AND THE OTHER ONE
IS INSIDE THE POLLEN GRAIN.

--> Display at 01:38:34:07
IT'S QUITE UNLIKE ANYTHING WE FIND IN AN
ANIMAL LIFE CYCLE.

--> Display at 01:38:39:19
ALTERNATION OF GENERATIONS IS ONE OF
THOSE HIDDEN PHENOMENA

--> Display at 01:38:43:07
THAT MAKES THE NATURAL WORLD
SO SURPRISING

--> Display at 01:38:46:04
WHEN YOU FINALLY SEE
HOW IT ALL FITS TOGETHER.

--> Display at 01:38:48:27
DON'T FORGET, THERE ARE A COUPLE MORE
PIECES OF THE PUZZLE

--> Display at 01:38:52:05
WE STILL HAVE TO EXPLORE.

--> Display at 01:38:54:17
YOU COULD SAY, PERHAPS, THAT WE'VE SAVED
THE BEST FOR LAST.

--> Display at 01:38:57:29
BECAUSE NOW THAT
WE'VE TALKED ABOUT SEEDS

--> Display at 01:38:59:23
AND HOW SEEDS ARE FORMED
BY SEXUAL REPRODUCTION,

--> Display at 01:39:03:01
WE'RE IN A MUCH BETTER POSITION TO
APPRECIATE THE AMAZING ROLE

--> Display at 01:39:06:18
THAT BOTH FLOWERS AND FRUIT
PLAY IN PLANT LIFE CYCLES.

--> Display at 01:39:10:27
THERE'S PLENTY OF MYSTERY HERE.

--> Display at 01:39:13:05
AND THE FIRST
ON MY LIST OF QUESTIONS IS

--> Display at 01:39:15:01
WHAT'S THE ADVANTAGE?

--> Display at 01:39:17:04
WHY DO SOME PLANTS
GO TO SO MUCH TROUBLE

--> Display at 01:39:19:10
TO MAKE
THESE ELABORATE STRUCTURES?

--> Display at 01:39:22:03
LET'S START WITH FLOWERS.

--> Display at 01:39:24:02
WE'LL CHECK IN ONE LAST TIME WITH OUR
STUDIO SCIENTISTS,

--> Display at 01:39:27:08
AND SEE WHAT THEY THINK.

--> Display at 01:39:29:06
LISTEN TO THEIR IDEAS ABOUT
THE ROLE THAT FLOWERS PLAY

--> Display at 01:39:32:04
IN THE LIFE CYCLE OF PLANTS --
WITH THE HELP OF ANIMALS.

--> Display at 01:39:36:00
I THINK, LIKE,
THE FLOWER'S PROBABLY THERE

--> Display at 01:39:41:24
BECAUSE IT HAS FOOD,
BECAUSE IT MAKES ITS OWN FOOD.

--> Display at 01:39:46:05
MM-HMM.

--> Display at 01:39:48:01
AND IT MAKES THE FOOD
INTO SUGAR.

--> Display at 01:39:51:06
AND THAT HAPPENS
IN THE FLOWERS?

--> Display at 01:39:53:09
YEP, BUT I THINK
THAT IT STARTS GROWING

--> Display at 01:39:56:16
MORE COMPLICATED STUFF
THAN JUST LEAVES,

--> Display at 01:40:00:14
AND MAYBE THE FLOWERS
ARE TO LIKE,

--> Display at 01:40:05:23
MAYBE, JUST THE BE --
LIKE TO SHOW

--> Display at 01:40:08:14
IT'S LIKE THE BEGINNING
OF ITS GROWING.

--> Display at 01:40:13:02
AND MAYBE
THE FLOWER'S PETALS

--> Display at 01:40:14:23
ARE FOR BREATHING
OUT ITS -- ITS OXYGEN.

--> Display at 01:40:20:12
BUT I THINK -- YEAH,
I THINK THESE FLOWERS,

--> Display at 01:40:23:07
THEY ABSORB
ALL THE SUNLIGHT THEY GET,

--> Display at 01:40:25:15
AND GO INTO THE BODY
OF THE PLANT.

--> Display at 01:40:28:20
AND THEN
CREATE THE SEED.

--> Display at 01:40:30:00
YEAH.

--> Display at 01:40:31:07
AND THAT KIND OF HELPS
CREATE THE SEED.

--> Display at 01:40:33:17
Narrator: CHILDREN WHO KNOW
THAT PLANTS REQUIRE SUNLIGHT

--> Display at 01:40:36:24
IN ORDER TO LIVE
NATURALLY ASSUME

--> Display at 01:40:39:09
THAT FLOWERS ARE INVOLVED
IN PHOTOSYNTHESIS.

--> Display at 01:40:42:11
ARE THEY CORRECT?

--> Display at 01:40:44:01
OR DO FLOWERS SERVE
A DIFFERENT FUNCTION?

--> Display at 01:40:47:22
A FLOWER IS KIND OF LIKE
ONE OF THE LAST PARTS --

--> Display at 01:40:51:28
WELL, ACTUALLY, IT ISN'T.

--> Display at 01:40:53:26
BECAUSE WHAT REALLY HAPPENS WHEN IT
GROWS UP TO BE A BIG FLOWER,

--> Display at 01:40:56:27
WHICH IS WHAT I ALSO THINK
IT MIGHT BECOME AFTER,

--> Display at 01:41:00:20
IS THAT, LIKE, SEEDS
COME OUT OF IT,

--> Display at 01:41:04:08
AND THEY GO TO ANOTHER PLACE
AND GET PLANTED LIKE THAT.

--> Display at 01:41:07:28
BUT THAT'S THE POINT --

--> Display at 01:41:09:25
WHAT CAME FIRST,
THE FLOWER OR THE SEED?

--> Display at 01:41:12:11
BECAUSE THE SEEDS
COME OUT OF THE FLOWER,

--> Display at 01:41:14:08
BUT THE FLOWER
COMES OUT OF THE SEED.

--> Display at 01:41:16:17
SO WHAT CAME FIRST?

--> Display at 01:41:19:29
Narrator: FLOWERS DO MAKE SEEDS.

--> Display at 01:41:22:14
BUT DOES THAT FUNCTION

--> Display at 01:41:24:00
ACCOUNT FOR THE TREMENDOUS
EXTRAVAGANCE

--> Display at 01:41:26:06
AND COMPLEXITY OF FLOWERS?

--> Display at 01:41:29:07
SOME OF THE CHILDREN
HAVE ALREADY BEGUN TO THINK

--> Display at 01:41:32:06
ABOUT THE RELATIONSHIP BETWEEN FLOWERS
AND THE ANIMAL WORLD.

--> Display at 01:41:37:19
BEES POLLINATE FLOWERS,

--> Display at 01:41:40:16
AND THEY GO FROM
ONE FLOWER TO ANOTHER,

--> Display at 01:41:44:25
AND THEY, FROM ONE FLOWER,
THEY TAKE OUT THE POLLEN.

--> Display at 01:41:49:05
AND ANOTHER THEY
LEAVE SOME BEHIND.

--> Display at 01:41:52:07
YEAH, MAKE, 'CAUSE THE BEES
MAKE HONEY OUT OF IT.

--> Display at 01:41:57:10
AND THE BUTTERFLY, IT STICKS
ITS PROBOSCIS IN THE FLOWER,

--> Display at 01:42:08:04
AND IT SUCKS OUT THE NECTAR.

--> Display at 01:42:10:11
--> Erase at 01:42:12:21
AND THAT'S WHAT IT EATS.

--> Display at 01:42:15:10
FLOWERING PLANTS
EXPEND A LOT OF ENERGY

--> Display at 01:42:17:20
TO CREATE BIG,
BEAUTIFUL FLOWERS.

--> Display at 01:42:20:09
BUT WHY?

--> Display at 01:42:21:23
THE CHILDREN HAVE SOME VERY CLEAR IDEAS
ABOUT FLOWERS.

--> Display at 01:42:25:03
THEY DON'T YET CONNECT
POLLEN WITH SEEDS,

--> Display at 01:42:27:18
BUT THEY DO BELIEVE
THAT FLOWERS MAKE SEEDS,

--> Display at 01:42:30:17
--> Erase at 01:42:32:22
POSSIBLY WITH
THE HELP OF SUNLIGHT.

--> Display at 01:42:46:11
Narrator: FLOWERS --
BEAUTIFUL, SWEET-SMELLING,

--> Display at 01:42:51:03
PRIZED FOR THEIR COLORS,
SHAPES, AND ENDLESS VARIETY.

--> Display at 01:42:55:12
IT'S EASY TO THINK THAT FLOWERS ARE A GIFT
FROM NATURE,

--> Display at 01:42:59:08
DESIGNED TO PROVIDE FOOD

--> Display at 01:43:01:08
AND PERHAPS PLEASURE
TO OTHER LIVING THINGS.

--> Display at 01:43:03:03
BUT SCIENCE ENCOURAGES US
TO LOOK AT THE WORLD

--> Display at 01:43:07:04
SOMEWHAT DIFFERENTLY.

--> Display at 01:43:09:18
WHEN SCIENTISTS LOOK AT FLOWERS,

--> Display at 01:43:11:20
THEY SEE ALL OF THE THINGS
THAT MAKE FLOWERS ATTRACTIVE,

--> Display at 01:43:15:08
BUT THEY SEE
SOMETHING ELSE AS WELL.

--> Display at 01:43:17:11
THEY NOTE THAT FLOWERING PLANTS,

--> Display at 01:43:20:28
AS WELL AS OTHER PLANTS
AND ANIMALS, REPRODUCE SEXUALLY.

--> Display at 01:43:25:09
BUT UNLIKE ANIMALS,
PLANTS ARE ROOTED IN PLACE.

--> Display at 01:43:29:21
THEY CANNOT SEEK EACH OTHER OUT.

--> Display at 01:43:32:03
THAT PRESENTS A CHALLENGE.

--> Display at 01:43:34:17
IN THE LIVING WORLD,
CHALLENGES EITHER END LIFE

--> Display at 01:43:37:10
OR PUSH LIFE IN A NEW DIRECTION,
LEADING TO NEW ADAPTATIONS.

--> Display at 01:43:43:02
AND THAT'S JUST
WHAT PLANTS HAVE DONE

--> Display at 01:43:44:23
OVER MILLIONS OF YEARS
OF EVOLUTIONARY HISTORY.

--> Display at 01:43:49:12
SO ONE WAY TO LOOK AT FLOWERS

--> Display at 01:43:51:04
IS AS A MARVELOUS SOLUTION
TO A TOUGH PROBLEM --

--> Display at 01:43:55:10
HOW DO YOU MATE

WHEN YOU CAN'T MOVE?

--> Display at 01:43:59:16
Sumner: OF COURSE,
IN ANIMAL LIFE CYCLES,

--> Display at 01:44:01:08
WHEN IT'S TIME TO MATE,

--> Display at 01:44:02:28
ANIMALS CAN GO OUT
AND FIND EACH OTHER.

--> Display at 01:44:04:15
AND WHEN THEIR OFFSPRING
ARE PRODUCED,

--> Display at 01:44:06:19
THOSE OFFSPRING CAN GO OFF
ON THEIR OWN.

--> Display at 01:44:08:27
AND THESE ARE THE TWO LITTLE WEAK AREAS,
IF YOU WILL,

--> Display at 01:44:11:28
IN A PLANT LIFE CYCLE.

--> Display at 01:44:13:15
Narrator: FLOWERS CAN BE DESCRIBED AS AN
ADAPTATION

--> Display at 01:44:17:05
THAT SERVES
AS AN EFFECTIVE WORK-AROUND

--> Display at 01:44:19:07
TO THIS CRITICAL RESTRICTION.

--> Display at 01:44:22:09
SINCE PLANTS
CAN'T MOVE ABOUT IN THE WORLD,

--> Display at 01:44:24:21
FLOWERS BRING THE WORLD
TO THE PLANT.

--> Display at 01:44:28:29
Sumner:
THE FUNCTION OF A FLOWER

--> Display at 01:44:31:17
REALLY IS
AS AN ADVERTISING PIECE.

--> Display at 01:44:34:25
FLOWERS ARE THERE
TO ADVERTISE THEMSELVES

--> Display at 01:44:37:22
AS BEING A WONDERFUL PLACE FOR AN INSECT
OR AN ANIMAL TO VISIT.

--> Display at 01:44:41:09
Narrator: A FLOWER IN FULL BLOOM CAN
ATTRACT INSECTS OR BIRDS.

--> Display at 01:44:46:11
THESE VISITORS MAY PICK UP
POLLEN ON THEIR BODIES.

--> Display at 01:44:49:29
AND AS THEY MOVE
FROM BLOSSOM TO BLOSSOM,

--> Display at 01:44:52:22
SOME OF THE POLLEN
THEY PICK UP AT ONE FLOWER

--> Display at 01:44:55:01
MAY BE LEFT BEHIND AT ANOTHER.

--> Display at 01:44:58:09
WITHOUT MEANING TO,

--> Display at 01:45:00:02
THESE ANIMALS HAVE HELPED PLANTS
TO REPRODUCE.

--> Display at 01:45:02:03
THEY DON'T DO THIS IMPORTANT WORK TO BE
KIND OR HELPFUL --

--> Display at 01:45:07:09
THEY ARE SERVING THEIR OWN ENDS,

--> Display at 01:45:09:13
TAKING ADVANTAGE OF THE FOOD THAT
PLANTS PROVIDE.

--> Display at 01:45:14:09
IN THIS WAY,
THE NEEDS OF INSECTS

--> Display at 01:45:16:01
AND THE NEEDS OF PLANTS OVERLAP, AND
BOTH RECEIVE A REWARD

--> Display at 01:45:20:15
FOR THIS UNCONSCIOUS,
BUT COOPERATIVE, BEHAVIOR.

--> Display at 01:45:24:20
Sumner: FLOWERS HAVE EVOLVED THROUGH
NATURAL SELECTION.

--> Display at 01:45:27:13
SO, COINCIDENTALLY,
THE FLOWERS THAT TEND

--> Display at 01:45:30:00
TO ATTRACT MORE POLLINATORS
WILL BE THE PLANTS, THEN,

--> Display at 01:45:34:19
THAT MAKE MORE SEEDS
AND PASS MORE

--> Display at 01:45:37:05
OF THESE PARTICULAR FLORAL TYPES OF
GENES TO THEIR OFFSPRING.

--> Display at 01:45:41:08
SO IT ISN'T BY DESIGN -- IT'S BY A SERIES OF
GRAND COINCIDENCES.

--> Display at 01:45:46:15
Narrator:
AND ACCORDING TO DAN SCHEIRER,

--> Display at 01:45:48:28
THAT UNIQUE RELATIONSHIP
BETWEEN PLANTS AND ANIMALS

--> Display at 01:45:52:09
HAS PROVEN TO BE ONE OF NATURE'S
GREATEST SUCCESS STORIES.

--> Display at 01:45:56:29
Scheirer: THE FLOWERING PLANTS ARE THE
MOST SUCCESSFUL

--> Display at 01:45:59:23
PLANT GROUP ON THE SURFACE
OF THE EARTH TODAY.

--> Display at 01:46:03:03
ONE REASON IS
BECAUSE OF THEIR VARIETY

--> Display at 01:46:05:21
OF REPRODUCTIVE MECHANISMS.

--> Display at 01:46:07:17
THE VARIETY
OF THEIR FLOWER SHAPES,

--> Display at 01:46:09:12
THE VARIETY OF
THEIR POLLINATION MECHANISMS,

--> Display at 01:46:11:26
THE VARIETY OF THEIR SEED-DISPERSAL
MECHANISMS

--> Display at 01:46:14:25
ALL HAVE CONTRIBUTED
TO THE GREAT SUCCESS

--> Display at 01:46:17:26
OF THE FLOWERING PLANTS.

--> Display at 01:46:20:04
IT'S A REALLY SUBTLE IDEA.

--> Display at 01:46:22:27
EVERYTHING IN THE LIVING WORLD SEEMS TO
FIT TOGETHER

--> Display at 01:46:25:10
SO PERFECTLY
THAT IT'S HARD TO IMAGINE

--> Display at 01:46:27:27
THAT CHANCE AND LUCK
PLAY ANY PART AT ALL.

--> Display at 01:46:31:12
THAT'S BECAUSE WE DON'T SEE
ALL THE FAILED EXPERIMENTS.

--> Display at 01:46:34:21
WE DON'T KNOW
HOW MANY DIFFERENT SOLUTIONS

--> Display at 01:46:36:09
TO THE MATING PROBLEM
HAVE EVOLVED

--> Display at 01:46:37:29
OVER TENS
OF MILLIONS OF YEARS

--> Display at 01:46:40:05
AND NOT SURVIVED.

--> Display at 01:46:42:02
THIS IS A TOUGH CONCEPT,
BUT VERY REWARDING,

--> Display at 01:46:45:09
BECAUSE IT HELPS US
TEASE APART THE RELATIONSHIPS

--> Display at 01:46:47:21
BETWEEN PLANTS AND ANIMALS, INCLUDING
US.

--> Display at 01:46:50:29
LIFE CYCLES,
INTERDEPENDENCE, COOPERATION --

--> Display at 01:46:54:14
THESE CONCEPTS
CAN ALL BE OBSERVED

--> Display at 01:46:56:21
FIRSTHAND IN THE CLASSROOM.

--> Display at 01:46:58:26
AND WE'LL TAKE A CLOSER LOOK

--> Display at 01:47:00:12
AT SOME OF THESE IDEAS
IN FUTURE SESSIONS.

--> Display at 01:47:03:13
FOR NOW, LET'S CHECK IN
WITH PAUL WILLIAMS,

--> Display at 01:47:06:05
OUR BOTTLE BIOLOGIST,
AND TAKE A LOOK

--> Display at 01:47:08:04
AT THE BRASSICA
AND BUTTERFLY SYSTEM

--> Display at 01:47:10:04
--> Erase at 01:47:12:15
WITH THESE NEW IDEAS
IN MIND.

--> Display at 01:47:25:04
HELLO AGAIN.

--> Display at 01:47:26:20
A LOT HAS HAPPENED WITH
"BOTTLE BIOLOGY" THIS WEEK.

--> Display at 01:47:30:01
WE'RE AT A GREAT POINT
TO LOOK MORE CLOSELY

--> Display at 01:47:31:27
AT LIFE WITHIN EACH SYSTEM.

--> Display at 01:47:34:16
THE AQUATIC PLANTS
IN THE TERRAQUA AND ECOCOLUMNS

--> Display at 01:47:37:13
PROVIDE FOOD, HABITAT,
AND OXYGEN TO OTHER LIFE FORMS.

--> Display at 01:47:42:18
THESE PLANTS ARE GREAT FOR VIEWING
UNDER THE MICROSCOPE.

--> Display at 01:47:46:06
THIS ELODEA IS PARTICULARLY GOOD
FOR SHOWING PLANT CELL FEATURES.

--> Display at 01:47:50:18
AND THIS TINY LITTLE PLANT, CALLED
DUCKWEED,

--> Display at 01:47:53:28
IS, BELIEVE IT OR NOT,
A FLOWERING PLANT,

--> Display at 01:47:56:02
JUST LIKE BRASSICA.

--> Display at 01:47:58:13
SPEAKING OF FLOWERING PLANTS,

--> Display at 01:48:00:16
THE BRASSICAS HAVE COME
INTO BLOOM

--> Display at 01:48:02:15
IN OUR BRASSICA
AND BUTTERFLY SYSTEM.

--> Display at 01:48:04:19
THIS SIGNALS THE BEGINNING
OF THE ADULTHOOD

--> Display at 01:48:06:27
OF THESE MEMBERS
OF THE MUSTARD FAMILY.

--> Display at 01:48:10:14
THE BUTTERFLY IS NOT YET ADULT,
BUT YOU CAN SEE

--> Display at 01:48:13:10
THAT MOST OF THE LARVAE
HAVE NOW BECOME PUPAE.

--> Display at 01:48:16:28
THEY MAY LOOK QUIET,
BUT INSIDE EACH CHRYSALIS,

--> Display at 01:48:20:05
DRAMATIC CHANGES
ARE TAKING PLACE.

--> Display at 01:48:22:21
THE FIELD POPULATION
IS GROWING NICELY,

--> Display at 01:48:25:05
BUT WE STILL HAVE SOME TIME
BEFORE STARTING OUR EXPERIMENT.

--> Display at 01:48:30:09
WE'LL NEED SOME BUTTERFLY LARVAE
READY JUST AT THE RIGHT TIME.

--> Display at 01:48:34:02
DID YOU KNOW THAT YOU CAN
SPEED UP OR SLOW DOWN

--> Display at 01:48:36:14
THE LIFE CYCLE OF THIS INSECT?

--> Display at 01:48:39:10
--> Erase at 01:48:43:13
FIND OUT HOW BY VISITING
"BOTTLE BIOLOGY" ON OUR WEBSITE.

--> Display at 01:48:48:02
THERE'S ONE LAST TOPIC
WE HAVEN'T TACKLED --

--> Display at 01:48:50:10
FRUIT.

--> Display at 01:48:52:08
WE NEED TO EXPLORE
WHY FRUIT IS IMPORTANT

--> Display at 01:48:54:11
TO THE LIFE CYCLE
OF FLOWERING PLANTS.

--> Display at 01:48:57:04
WHERE DOES FRUIT COME FROM,
AND WHAT ROLE DOES IT PLAY?

--> Display at 01:49:02:04
THINK OF AN APPLE TREE.

--> Display at 01:49:04:00
AN APPLE TREE SPENDS A LOT
OF ITS ENERGY MAKING FRUIT.

--> Display at 01:49:07:02
--> Erase at 01:49:09:21
WHY? WHAT DOES
A PLANT GET OUT OF IT?

--> Display at 01:49:23:04
--> Erase at 01:49:26:06
WHAT IS FRUIT FOR?
WHY DO TREES MAKE FRUIT?

--> Display at 01:49:29:01
WELL, TO NOURISH PEOPLE?

--> Display at 01:49:31:02
WHY DO TREES MAKE FRUIT?
WHY DO TREES MAKE FRUIT?

--> Display at 01:49:37:01
WELL, FOR PRIMITIVE MAN TO EAT,
FOR ANIMALS TO SURVIVE,

--> Display at 01:49:41:17
AND I THINK
JUST TO DETAIL NATURE.

--> Display at 01:49:44:22
GOOD QUESTION, ACTUALLY.
WHY DO TREES MAKE FRUIT?

--> Display at 01:49:48:21
I GUESS PROPAGATION
IS PROBABLY THE MAIN REASON.

--> Display at 01:49:51:01
WELL, PEOPLE HAVE TO HAVE SOMETHING TO
EAT,

--> Display at 01:49:54:17
AND FRUIT IS SUPPOSED
TO BE HEALTHY.

--> Display at 01:49:59:03
SO I ASSUME THAT'S WHY
THE TREE PRODUCES THE FRUIT.

--> Display at 01:50:04:19
--> Erase at 01:50:07:13
TO MAKE SEEDS,
SO YOU GET MORE TREES.

--> Display at 01:50:09:08
Narrator:
THE FRUIT OF A PLANT

--> Display at 01:50:11:03
IS PRODUCED IN THE FEMALE REPRODUCTIVE
ORGAN.

--> Display at 01:50:13:22
A FULLY RIPE FRUIT IS ACTUALLY AN
ENLARGED OVARY,

--> Display at 01:50:17:16
CONTAINING SEEDS.

--> Display at 01:50:20:20
AND NOT ALL FRUIT

IS SWEET AND JUICY.

--> Display at 01:50:23:29
MANY VEGETABLES, LIKE PEAS
AND TOMATOES, ARE PLANT OVARIES,

--> Display at 01:50:28:01
AND THAT MEANS
THEY'RE ACTUALLY FRUIT, TOO.

--> Display at 01:50:31:12
NOT ONLY THAT --
NUTS ARE ALSO FRUIT.

--> Display at 01:50:36:13
ALL SEED PODS
PRODUCED BY FLOWERS,

--> Display at 01:50:38:23
NO MATTER WHAT THEY LOOK LIKE
OR TASTE LIKE, ARE FRUIT.

--> Display at 01:50:42:27
AND SCIENTISTS ASK THE SAME QUESTION
ABOUT FRUITS

--> Display at 01:50:46:04
THAT THEY DO ABOUT FLOWERS.

--> Display at 01:50:47:23
HOW DOES FRUIT HELP TO ENSURE

--> Display at 01:50:50:12
THE CONTINUATION
OF THE PLANT LIFE CYCLE?

--> Display at 01:50:53:18
JUST AS
THE IMMOBILITY OF PLANTS

--> Display at 01:50:56:06
MAY HAVE ENCOURAGED
THE EVOLUTION OF FLOWERS,

--> Display at 01:50:57:26
THE SAME INABILITY TO MOVE

--> Display at 01:51:00:29
MAY HAVE SPURRED
THE EVOLUTION OF FRUIT.

--> Display at 01:51:03:21
AND AS SEED CONTAINERS,

--> Display at 01:51:05:23
THESE STRUCTURES
SOLVE A TRICKY PROBLEM.

--> Display at 01:51:07:16
THEY GIVE PLANTS
A MEANS OF MOVING OFFSPRING

--> Display at 01:51:11:02
AWAY FROM THE PARENT,
ALLOWING THE POPULATION

--> Display at 01:51:14:21
--> Erase at 01:51:18:12
TO SPREAD OUT AND TO REACH
INTO NEW ENVIRONMENTS.

--> Display at 01:51:23:13
FRUIT BEGINS TO APPEAR
AFTER POLLINATION,

--> Display at 01:51:27:05
--> Erase at 01:51:29:09
AS THE MATURE SEEDS DEVELOP.

--> Display at 01:51:36:11
SOME FRUIT ARE FAMILIAR -- APPLES,

--> Display at 01:51:40:03
CHERRIES,

--> Display at 01:51:42:10
ACORNS,

--> Display at 01:51:44:25
WALNUTS.

--> Display at 01:51:47:17
WHEN RIPE,
FRUITS FALL TO THE GROUND,

--> Display at 01:51:50:28
WHERE THEY CAN MAKE A MEAL
FOR A SCAVENGER.

--> Display at 01:51:52:15
THE TASTIER THE OFFERING,
THE MORE LIKELY

--> Display at 01:51:56:12
THAT AN ANIMAL
WILL PICK UP THE FRUIT

--> Display at 01:51:58:21
AND DISPERSE THE SEEDS
INTO THE WIDER WORLD.

--> Display at 01:52:02:25
Sumner: FLESHY FRUITS
HAVE COLORS AND TASTES

--> Display at 01:52:07:01
THAT MAKE THEM ATTRACTIVE

--> Display at 01:52:08:17
AND DELICIOUS,
AND ANIMALS EAT THEM,

--> Display at 01:52:11:05
AND COINCIDENTALLY
INGEST THE SEEDS,

--> Display at 01:52:13:10
AND THEN GO OFF SOMEWHERE

--> Display at 01:52:16:09
AT A DISTANCE FROM
THE PARENT PLANT, AND DEFECATE

--> Display at 01:52:19:28
AND RELEASE THOSE SEEDS
INTO THE ENVIRONMENT.

--> Display at 01:52:22:01
Narrator: BUT MANY KINDS
OF FRUIT DON'T RELY ON ANIMALS

--> Display at 01:52:26:17
TO MOVE THEM AWAY
FROM THE PARENT PLANT.

--> Display at 01:52:29:00
THE FRUIT OF THE MAPLE TREE

--> Display at 01:52:30:28
HELICOPTERS ITS WAY
THROUGH THE AIR,

--> Display at 01:52:33:13
AND THAT ALLOWS A PASSING BREEZE
TO CARRY THE SEEDS

--> Display at 01:52:35:26
AWAY FROM THE PARENT TREE.

--> Display at 01:52:38:19
AND THE TUFTED
FRUIT OF DANDELIONS

--> Display at 01:52:40:28
FLOATS THROUGH THE AIR
LIKE MINIATURE PARACHUTES,

--> Display at 01:52:43:07
FERRYING THEIR SEEDS
FAR AND WIDE.

--> Display at 01:52:48:13
AS THE FINAL STAGE

--> Display at 01:52:50:04
IN THE REPRODUCTIVE CYCLE
OF PLANTS,

--> Display at 01:52:52:25
FRUIT ARE
ONE OF THE MOST REMARKABLE

--> Display at 01:52:54:18
AND CREATIVE ADAPTATIONS
FOUND IN NATURE.

--> Display at 01:52:59:01
WHAT A GREAT WAY
TO END OUR SESSION

--> Display at 01:53:01:12
ON THE LIFE CYCLE
OF PLANTS.

--> Display at 01:53:03:21
WE CERTAINLY TEND TO TAKE
FRUIT FOR GRANTED.

--> Display at 01:53:06:08
BUT ONCE YOU UNDERSTAND
THE RELATIONSHIP

--> Display at 01:53:08:02
BETWEEN FRUIT, FLOWER,
AND SEEDS,

--> Display at 01:53:14:24
YOU MAY FIND YOURSELF
LOOKING AT YOUR FAVORITE FOODS

--> Display at 01:53:17:01
A LITTLE DIFFERENTLY.

--> Display at 01:53:18:19
AND NOT JUST
APPLES AND ORANGES.

--> Display at 01:53:20:16
THINK ABOUT CORN
AND PEANUTS AND PEAS,

--> Display at 01:53:23:29
AND GRAINS
LIKE WHEAT AND RICE.

--> Display at 01:53:25:25
NATURE HAS DEVISED
SOME PRETTY INCREDIBLE WAYS

--> Display at 01:53:28:17
OF DELIVERING PLANT SEEDS
INTO THE WORLD.

--> Display at 01:53:31:13
AND ONE OF MY FAVORITES
IS THE COCONUT,

--> Display at 01:53:34:17
A GREAT BIG SEED
THAT CAN FLOAT,

--> Display at 01:53:36:26
ALLOWING IT TO MOVE FROM ONE TROPICAL
ISLE TO ANOTHER.

--> Display at 01:53:41:14
WELL, BEFORE WE WRAP IT UP,

--> Display at 01:53:43:07
LET'S TAKE A MOMENT
TO PUT IT ALL TOGETHER.

--> Display at 01:53:47:05
Narrator: IN OUR EXPLORATION
OF THE LIFE CYCLE OF PLANTS,

--> Display at 01:53:50:23
WE BEGAN WITH SEEDS.

--> Display at 01:53:53:00
WE OBSERVED
THAT SEEDS ARE PRESENT

--> Display at 01:53:55:09
AT THE BEGINNING AND AT THE END OF THE
PLANT LIFE CYCLE.

--> Display at 01:53:59:29
SEEDS CAN REMAIN DORMANT
FOR MONTHS OR EVEN YEARS,

--> Display at 01:54:04:22
THE EMBRYO INSIDE PROTECTED
BY THE SEED COAT AND PROVIDED

--> Display at 01:54:08:13
WITH A SOURCE OF FOOD TO FUEL THE FIRST
STAGES OF GROWTH.

--> Display at 01:54:11:19
THEN, WHEN THE TIME IS RIGHT, THE SEED
GERMINATES,

--> Display at 01:54:15:26
AND THE FIRST SPROUT APPEARS.

--> Display at 01:54:19:11
THE YOUNG PLANT GROWS
UNTIL IT REACHES MATURITY.

--> Display at 01:54:22:16
THEN THE REPRODUCTIVE
PHASE BEGINS.

--> Display at 01:54:26:02
THE MALE AND FEMALE
REPRODUCTIVE STRUCTURES

--> Display at 01:54:29:25
CREATE INTERMEDIATE GENERATIONS CALLED
SPORES.

--> Display at 01:54:33:26
THE MALE REPRODUCTIVE STRUCTURE

--> Display at 01:54:36:18
CREATES THE MALE SPORE,
CALLED POLLEN.

--> Display at 01:54:39:21
THE FEMALE SPORE
PRODUCES THE EGG CELL.

--> Display at 01:54:45:22
IF A POLLEN GRAIN
BEATS THE ODDS AND LANDS

--> Display at 01:54:49:21
ON THE FEMALE REPRODUCTIVE STRUCTURE
OF ANOTHER PLANT,

--> Display at 01:54:52:25
POLLINATION OCCURS,

--> Display at 01:54:54:21
AND THE POLLEN
PRODUCES SPERM CELLS.

--> Display at 01:54:57:17
FERTILIZATION OCCURS
WHEN SPERM JOIN WITH THE EGG

--> Display at 01:55:01:28
TO PRODUCE THE OFFSPRING,
AN EMBRYO CONTAINED IN A SEED.

--> Display at 01:55:08:10
BECAUSE PLANTS ARE IMMOBILE, STRUCTURES
LIKE FLOWERS

--> Display at 01:55:12:29
AND FRUIT HAVE EVOLVED
TO ENSURE SURVIVAL.

--> Display at 01:55:17:25
THESE REMARKABLE ADAPTATIONS HAVE
ALLOWED PLANTS

--> Display at 01:55:21:02
TO SPREAD ACROSS THE PLANET, RESULTING IN
A DIVERSE

--> Display at 01:55:23:28
AND SURPRISINGLY
INTERDEPENDENT BIOSPHERE.

--> Display at 01:55:28:29
PLANTS ARE SO IMPORTANT
TO LIFE ON EARTH

--> Display at 01:55:31:23
THAT IF PLANTS WERE
TO SUDDENLY DISAPPEAR,

--> Display at 01:55:35:01
--> Erase at 01:55:37:28
ANIMALS COULD NOT SURVIVE.

--> Display at 01:55:45:05
TODAY WE LOOKED AT SEXUAL
REPRODUCTION IN PLANTS.

--> Display at 01:55:48:22
BUT MANY PLANTS CAN ALSO REPRODUCE
ASEXUALLY.

--> Display at 01:55:52:10
THEY CAN GROW NEW PLANTS
ALL BY THEMSELVES.

--> Display at 01:55:55:27
LEAVE AN ONION OR A POTATO
ALONE FOR A WHILE,

--> Display at 01:56:01:10
AND SEE WHAT HAPPENS.

--> Display at 01:56:03:05
FOR MORE INFORMATION

--> Display at 01:56:04:20
ON ASEXUAL REPRODUCTION
IN PLANTS,

--> Display at 01:56:06:06
PLEASE SEE OUR WEBSITE.

--> Display at 01:56:08:22
IN OUR NEXT SESSION,

--> Display at 01:56:10:06
WE'LL TAKE WHAT WE'VE
LEARNED ABOUT LIFE CYCLES

--> Display at 01:56:12:12
AND BEGIN TO LOOK
AT THE WAYS

--> Display at 01:56:13:24
LIFE FORMS
HAVE CHANGED OVER TIME,

--> Display at 01:56:16:04
THROUGH A PROCESS
SCIENTISTS CALL EVOLUTION.

--> Display at 01:56:18:20
AND WE'LL START

--> Display at 01:56:19:22
WITH VARIATION
AND ADAPTATION --

--> Display at 01:56:21:21
ASPECTS OF EVOLUTION
THAT ALLOW NEW LIFE FORMS

--> Display at 01:56:24:09
TO ARISE IN THE WORLD,
AND EXPLAIN HOW POPULATIONS

--> Display at 01:56:27:26
CHANGE IN RESPONSE
TO SHIFTING ENVIRONMENTS.

--> Display at 01:56:31:25
THANKS
FOR BEING WITH US.

--> Display at 01:56:33:16
--> Erase at 01:56:35:18
SEE YOU NEXT TIME.

--> Display at 01:57:59:27
FUNDING FOR THIS PROGRAM
IS PROVIDED BY ANNENBERG/CPB

--> Display at 01:58:04:03
--> Erase at 01:58:07:20
TO ADVANCE EXCELLENT TEACHING.

--> Display at 01:58:09:21
FOR INFORMATION ABOUT THIS

--> Display at 01:58:11:14
AND OTHER ANNENBERG/CPB PROGRAMS

--> Display at 01:58:14:09
CALL 1-800-LEARNER

--> Display at 01:58:16:10
--> Erase at 01:58:20:07
AND VISIT US
AT WWW.LEARNER.ORG.

--> Display at 01:58:24:10