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National Geographic: The Body Changers

By Unknown

In the beginning,
there is the fertilized egg.
Its form couldn't be simpler.
But this will change.
It's a piece of work to craft
a creature from a single cell.
By the time it enters the world,
every living thing has experienced
an odyssey of alteration.
Change doesn't stop
with hatching or birth.
Growing up is also
a story of transformation.
A newborn kangaroo can grow
over 50,000 times in weight.
Some creatures do far more than
simply grow up.
They reinvent themselves.
A fish can start life as a female
but end up as a male.
A bird can grow or shrink a brain area
for song to suit the season.
Polliwogs become frogs.
Caterpillars turn into butterflies.
We learn few more curious facts
than these.
But it's easy to lose sight of just
how astonishing these changes are!
And even weirder transformers
live among us.
Turn and face the strange.
Meet the body changers.
"Hey, Emma, come here!"
Compared to the epic alteration
of a caterpillar,
our own changes may seem subtle.
But there's no denying that
kids change shape
as they turn into grown-ups.
The brain kicks off our own
sexual transformations.
Girls tend to get curvier
from estrogen and other hormones.
A child's body,

and that of many other young creatures,
changes shape when it reaches
the age for reproduction.
These alterations prepare us
to compete for mates,
to have babies,
and to care for them.
Boys change in their own way.
They add muscle.
Shoulders become broader.
The body gets hairier.
Vocal cords lengthen as does the jaw.
A child's journey to adulthood
is a long one.
A grown-up is not just
a scaled-up kid,
but one rebuilt from head to toe.
Look back at
the odyssey of growing up,
and we see that
even our faces change shape,
starting in infancy with small chins,
huge eyes, and plump cheeks.
We are all body changers
when it comes to growing up
and growing old.
It may be no accident that
many baby animals have different
face shapes from their parents.
Adults find baby features irresistible,
a hard-wired system
that promotes infant care.
Silvered leaf monkeys
have Day-Glo offspring.
No one knows why,
unless it's a reminder
to rough-and-tumble mothers
to handle the baby with care.
The young and old of many animals
have different colors,
sometimes to conceal newborns
that are less able to flee danger.
A young, sexually mature male orangutan
has a distinguished, mournful visage.

But in middle age,
his face changes shape.
His new jowly look
is a badge of power.
Changes in our own faces
tell many stories.
A face that forms symmetrically
in the womb
and stays that way through adulthood
can be a mark of good nutrition
and resistance to disease.
Is it any wonder we are highly attuned
to symmetry and find it beautiful?
Old age brings new changes
as our faces transform again,
keeping a faithful record
of wear and tear, loves and losses.
As we change ourselves in the
subtle ways that human beings do,
we're surrounded by creatures
that become entirely new.
Around us are animals
that live out the youthful fantasy of
sprouting wings and flying like a bird.
But we also share the world
with animals
whose stories of change
echo darker myths.
Hercules' enemy,
the many-headed Hydra,
sprouted two new heads
for every one lopped off.
Nature nearly matches legend.
The salamander has powers of
regeneration bordering on the magical.
It will need these talents,
for it lives not in a fairy tale,
but rather in a world of real dangers.
A red-eared slider enters the stream.
The salamander picks
an unlucky moment for a swim.
It's a vulnerable creature,
unarmored and undisguised.
The turtle has nipped off

the salamander's hind leg.
Over three months, the creature
miraculously transforms itself
back to an earlier stage of life.
The genes that grew the leg
in the first place are activated again.
The new leg will be indistinguishable
from the original.
Unique among animals with backbones,
the salamander can regrow
not just limbs
but the lens of the eye
and even part of the brain.
This beast can survive
a bite to the head!
The Hydra lives.
The power to change shape or color
offers a special edge in life.
Some creatures change
to stay hidden.
Others transform
to find new kinds of food.
Still other animals change
for upward mobility,
for the chance to fly or leap
to another pond.
This lake is home to two body changers
that can be lifelong rivals.
A dragonfly nymph spends the first
part of its life beneath the surface.
Everything about this creature
seems honed for water.
It is tapered for speed.
Its head has powerful jaws and huge
eyes-the better to catch prey with.
It breathes through an anal gill,
also handy for jet propulsion.
It's hard to believe
that this pond predator,
sleek as a torpedo, accurate and deadly,
will one day take to the air.
Wings are already forming.
An amazing makeover is beginning.
But the dragonfly will not be able to

complete its body change
without regular meals.
Sharing the pond are
gray treefrog tadpoles.
You can't get any fishier than this
without actually being a fish.
A tadpole breathes through
internal gills.
Its long flat tail propels it
like a fish's tail.
Inside, powerful front legs have formed
and are nearly ready to burst out.
But not every ungainly swimmer will
live to be reborn as an elegant leaper.
With a secret weapon
locked and loaded,
the dragonfly nymph
waits for an opportunity.
Folded up under the nymph's head
is a hinged lip with a grasping tip.
This tadpole's dreams of frogdom
are dashed.
But in these death throes,
a chemical is released
which fellow tadpoles
take to heart or to tail.
In two weeks, tadpoles in the area
transform remarkably.
Their tails turn a shade of red.
The colored tail may protect tadpoles
from attack
like a neon sign flashing "Don't Eat."
Why this works, no one is sure,
but there's no need to turn tail
with a tail turned red.
The pond is abuzz with
changing bodies.
Not only are tadpoles about to
turn into frogs,
they've already changed colors.
At the age of five weeks, tadpoles,
both red- and clear-tailed,
shed their underwater ways.
Rear legs emerge slowly.

Front legs pop out of gill slits.
The tail is absorbed.
This frog may not have turned into
a prince,
but the tadpole's transformation
is no less astonishing.
An air-breathing, bug-eating,
lily-hopping, sweet-singing adult
has emerged from a silent
scum-sucking swimmer with gills.
Now is the dragonfly nymph's time
to change.
It's been lurking in the shallows
by the shore,
waiting for just the right moment
to abandon the water forever.
Tonight is perfectly calm,
since rain or wind could dislodge
the dragonfly at a vulnerable moment.
The nymph has crawled out of the water
and fastened itself to a stem.
It is now committed to the air.
A brand new creature
emerges from the old.
The husk of the nymph splits open.
In a single magical hour,
an adult struggles out.
At first, its goggle eyes look like
deflated beach balls.
But soon they are pumped up
to full size,
some of the keenest eyes
in the insect realm.
In the remaining hours before dawn,
the dragonfly pumps blood
into its soft, wet wings,
doubling their length.
The dragonfly has changed from
a jet-powered aquatic hunter
armed with a hydraulic spear
to a peerless aerialist
that will stalk on the wing.
About two hours after emerging,
the dragonfly takes flight.

Once master of the pond bottom,
the dragonfly now controls
the air space above.
No other insect devotes as big
a share of its body weight
to flight muscles as the dragonfly.
Scuba certification has been traded
in for a pilot's license.
As larvae,
dragonflies once hunted tadpoles.
Adult frogs sometimes have the chance
to even the score.
A dragonfly is a curve ball
on the wing.
There's nothing wrong with
the occasional whiff
if now and then you connect with
a solid double.
Just as body changes can take place
in individual creatures,
so they can occur across generations.
That's evolution.
Natural selection is the long process
of picking winners and losers
among organisms that differ slightly
from their parents.
Without body-changing over generations,
evolution would come to a standstill.
As it is, change adds to change
to create the entire parade of life.
Life may have begun with a blob
that by chance transformed.
When alterations were successful,
the transformer thrived
and transformed again.
One of natural selection's
winning picks
is the trick of morphing
during a single lifetime.
Plankton is a potpourri of larvae,
body changers of many species
at an early stage of life.
Creatures like this have an edge:
each stage can be honed

for a different job.
Now they are shaped for spreading
around-drifting on the currents.
Soon these beasts will be changed
beyond recognition
into new forms tailored
for feeding and reproduction.
One member of the plankton,
a crab larva,
starts life with scant
resemblance to its parents.
It shares the ocean with
another tiny drifter, the seaslug.
This relative of the snail
hatches wearing a transparent shell,
a suit of crystalline armor.
Seaslug and crab, similar as larvae,
may confront each other as adults,
as different as two animals can be.
Having shed its shell,
the seaslug eventually becomes
an adult four inches long.
It now has a new organ,
a feeding hood.
The billowy hood caresses eel grass
to catch food like skeleton shrimp.
Like a submarine Venus fly trap,
the seaslug closes up,
trapping prey like skeleton shrimp
with a zipper like seal.
Growing on the seaslug's back
are other new organs,
fleshy paddles
that will soon save its life.
As the seaslug feeds,
it is being watched
by its former plankton mate.
The crab has changed into
a formidable scavenger
with molar-like grinders on its claws.
Blind except perhaps to light and dark,
the seaslug approaches danger.
The crab pinches at the seaslug,
as hard to grab as a water balloon.

Finally the crab gets purchase.
But it gets only
a small serving of seaslug,
whose paddles pop off by design.
The seaslug swims away
with wild undulations.
Only a stump remains
where once there was a paddle.
The missing organ
may eventually grow back.
Once a tiny drifter, this body changer
is now rebuilt for escape.
Up the water column without a paddle,
the seaslug leaves the crab,
its fellow transformer,
with a meager souvenir.
Transformation is not
just the privilege of living things.
The morphing of clouds may offer
nothing more than delight.
The morphing of bodies serves
a more important goal: survival.
In the Arizona desert,
the weather shifts late in June.
After eight crispy months,
skies darken.
The monsoon has arrived.
The pounding of the rain has stirred
strange creatures beneath the soil.
In this small, evaporating pond,
animals race against the clock
to transform.
Tadpoles of the spadefoot toad
must absorb their tails,
grow lungs, sprout legs.
They must transform from
fish-like swimmers
with gills to hopping air-breathers.
If changing from tadpole to toad
isn't miracle enough,
tadpoles of this species have two ways
to do it,
the nice way and the not so nice.
In this hot summer,

the pond is shrinking quickly.
It could become a death-trap,
a cauldron of bouillabaisse.
As the water level drops,
time is running out
for the tadpoles to become toads.
Meanwhile, another creature
joins the fray.
Fairy shrimp may have lain dormant
underground as eggs for years,
waiting for just the right conditions
to rush through their lives.
As the pool dries up,
it gets more crowded.
Tadpoles bump into more and more of
these crustaceans.

Advantage:

If they end up snacking on
lots of Sonoran scampi,
the tadpoles sense that their pond
is shrinking fast.
There's something about fairy shrimp
that throws a chemical switch
inside some of the tadpoles.
And these gentle browsers now
begin to transform into brutes
that will stop at nothing
to become a toad.
Some of the tadpoles are
turning into cannibals!
This is body-changing with attitude.
The cannibals are lighter
in color and larger.
A huge muscle forms in the jaw,
the better to grab their neighbors with.
We're no longer on golden pond.
The cannibals grow at breakneck speed
on their unneighborly diet.
On the fast track, they will need only
two and a half weeks to become toads.
The slower, mild-mannered tadpoles
need six weeks to grow up.
The extra time helps them become

healthier adults than the cannibals.
But often in the desert,
time is a luxury.
And the race goes to
the swift and brutal.
It was a remarkable turning point
in evolution
when a fish transformed
to emerge from the sea,
gulp air and drag itself around.
But what took eons in evolution is an
everyday occurrence in tadpoles.
To reach adulthood, spadefoot toads
must live fast and hard,
then dig down into cool damp soil
before the next drought arrives.
For others in the desert,
the season of change has also arrived.
On an acacia blossom, an egg barely
visible to the human eye hatches.
A bristled beast emerges.
This caterpillar has a problem.
If it's ever going to become
a butterfly,
it must first survive its life
as a larva.
The desert is alive with predators
like ants and wasps.
This caterpillar has
an ingenious defense.
It will soon enlist one of its enemies,
but only after it transforms to develop
special organs for manipulating ants.
At the base of the acacia tree,
ants have dug a nest.
Most ants like nothing better than
dismantling caterpillars.
But these ants love them, intact.
They will protect the caterpillar.
That's because the ants march to
the beat of a different drummer.
The caterpillar has become
the drummer.
This is the sound

the caterpillar makes
with body vibrations
so tiny we can't see them.
But ants feel the beat through twigs
and stems and come running.
A strange rendezvous of
two very different creatures
is about to take place.
The caterpillar has, in effect,
shouted to the ants,
"Come and get it!"
It's not a ploy.
The caterpillar doles out sugary
droplets which the ants lap up.
For the price of a few servings
of food,
the caterpillar is surrounded by
friendly ants.
Not a bad thing to have
the neighborhood
toughs at your beck and call
when you have a soft body
and a nasty array of predators.
This remarkable relationship will last
for most of the caterpillar's life.
The caterpillar now transforms
into a new stage.
Tentacles have appeared,
strange chemical transmitters,
that seem to rile up the ants.
The caterpillar needs the ants

to be ferocious:

Another kind of ant lives nearby,
a predatory species.
An enemy ant has grabbed
the caterpillar.
The friendly ants rally
in a desperate tug-of-war.
Not all battles can be won.
But without the aid of bodyguard ants,
not as many caterpillars would live
to become butterflies.
About ten days after hatching,

the caterpillar descends the tree.
It's hard to believe this creature
will soon shed its wormy form,
sprout wings and head for the heavens.
But that is the miracle
of a caterpillar.
Down in the enclave of the ant nest,
the caterpillar is reborn as a pupa.
Hunkered inside what looks like
a sarcophagus,
the pupa is a creature in the midst
of a total makeover.
Nerves are being rewired.
Old organs are dissolving;
new ones are being built.
The ants tend this defenseless animal
even though it will no longer
feed them.
After ten days,
one of the most radical redesigns
in all of nature is complete.
The pupa has become an adult,
a butterfly.
This creature's long relationship
with ants is now over.
The butterfly struggles to emerge.
It must move quickly.
In fact, if the butterfly isn't
out of the nest in minutes,
it will be devoured by the same ants
that protected it for almost
its entire life.
As larvae, these creatures were
basically enormous digestive tracts
hauled around on caterpillar treads.
As adults, they are flying machines
dedicated to sex.
If we couldn't witness a caterpillar
turn into a butterfly,
we'd never believe
they were the same animal.
It's as astounding as a Cuisinart
transforming into a 747.
Some animals undergo one

major transformation in their lives.
Others change fashions
every year with the seasons.
Dogs may wear heavy coats in winter.
But lengthening days will cause
the fine underhairs to drop out.
Soon, this dog will be cooler
in his new spring wardrobe.
Some animals change
not only their coat but their color.
The arctic fox wears white
for stealthy winter hunting.
By summer, the coat is less than
half as thick.
Arctic birds like the ptarmigan
also change color.
In summer, they're as mottled as
the terrain.
By winter, the ptarmigan is a bird
of a different color.
Other prey species
like the arctic hare
must track the seasons
with their wardrobe.
Understatement is de rigueur.
If some animals change
for the seasons on the outside,
others are transforming
on the inside.
All over North America,
redwing blackbirds prepare for spring
with remarkable changes.
Males arrive from winter havens
to squabble for territories.
No one gets a home
without singing for it.
But this male is out of practice.
He hasn't sung much at all
for half a year.
But he's been quietly transforming.
It's now opening day
of a new season of song.
The transformation was
all in his head, literally.

The blackbird is a brain changer.
Over the past months, one tiny area
in his brain devoted to song
has more than doubled in volume.
With his new swelled head,
this male now woos females with song.
When a female becomes all a-flutter,
the serenade has succeeded.
The happy new couple flies off
to the shrubbery.
It's time for a little
two-in-the-bush.
The burgeoning brain of the male may
have kept the sexes in tune this season.
Transformation promoted communication
which helped launch the next generation.
Late in the summer, blackbirds glean
the fields for the last easy morsels.
Males will transform once again.
The brain's song area dwindles,
along with sweet serenades for sex.
Birds are in good company when
it comes to changing for reproduction.
For most of its life,
a flowering plant makes stems and
leaves, a single pattern repeated.
But when the right conditions arrive,
of temperature, daylight, or rainfall,
a plant will suddenly transform,
producing a brilliant package of
sex and advertising.
As one poet put it,
"The flower is a leaf mad with love."
Deer browse among blossoms,
eating tender leaves and grasses.
A once flowering feast is
transformed into a pile of dung.
In the leftovers of a deer's meal,
two organisms will each
struggle to survive.
A fungus begins to grow threads
invisible to the human eye.
The fungus is transforming
for reproduction.

It shoots up stalks as tall as
an eyelash is long.
Each stem lifts ripening spores
above the deer's ground zero.
Meanwhile, tiny larvae are growing.
The deer was infected
with a roundworm.
To survive, these wriggling parasites
must leave their dump
of a neighborhood to reach a new deer.
So the worm climbs a fungus stalk.
Just below a black beret
packed with spores,
water pressure builds.
When the cap bursts, spores can be
shot up to eight feet away.
And worms will fly.
One of the parasites
lands several feet away.
A passing deer eats it,
an inadvertent diet of worms.
The roundworm has found a host,
and millions of scattered spores
await their fate.
Wintertime.
And the living's hard
in the far north.
At least for a relative of
the deer... caribou.
The landscape is littered
with body parts.
Antlers.
Up to 20 pounds of bone,
grown every year and discarded.
Males start to grow antlers
every spring,
a transformation
from bald to bedecked.
Antlers are living tissue crisscrossed
with blood vessels and nerve endings.
The sensitive fuzzy skin
is called velvet.
Each caribou has a signature pattern
which can grow back year after year.

It would be no less wondrous
if we were to sprout a fresh arm,
the same arm, every year.
When antlers stop growing
late in the summer,
another transformation takes place.
The tender velvet dies and is scraped
away until it hangs in tatters.
Each male is now crowned with
spikes of unfeeling bone.
Fighting is one reason for
the male caribou's transformation.
And this helps solve the mystery of
why antlers shed their velvet:
You can't fight a battle if your sword
can bleed
and is sensitive to the touch.
Some creatures grow head weaponry
every year.
Others, only a single time.
Altogether, male caribou
have plenty of company
when it comes to transformations
for battle.
If some animals transform
what's on their head,
others change what's in it.
This male's appearance
and his personality
will transform with his fortunes.
Meet a member of the cichlid family.
He's something of
a piscine Austin Powers.
"Oh behave, baby!"
He's the proud owner of
a prime bachelor pad,
about one square foot of lake bottom.
He's dressed for success,
or, rather, because of it.
His dark stripes and sharp colors are
the marks of a territory holder.
Nearby lurks a male with
the dull colors of a wannabe.
In fact, he looks just like a female.

If fish experience envy,
this one covets his neighbor's life.
The flashy bachelor invites
a female over to suck gravel.
This counts as fine dining
in these shallows.
After dinner, the couple retires
to the grotto for a little spawning.
There's only so much a guy can take.
The wannabe has switched
on his colors,
a kind of warpaint,
to prepare for battle.
The wannabe wins.
And he is transformed by victory.
He retains his bright colors.
His grievances are redressed
as much as he himself has been
redressed in the wardrobe of a winner.
A more profound transformation will
soon take place inside his body.
In a week his gonads will plump up
thirty-fold in weight
and a brain area dedicated to sex
will increase eight times in volume.
At last the new bachelor is ready to
take his enlarged gonads for a spin.
Guided by his bigger brain area
for sex,
he courts a female with macho motions
and furling fins.
But no male holds a long-term lease
in these gravel beds.
The new owner soon discovers the
high cost of upkeep for his pad.
Neighboring bachelors are
always testing the lot lines.
A neighbor attacks.
The new territory holder is defeated.
He switches off his fancy colors.
His gonads and brain region for sex
will soon shrink.
He rejoins the ranks of the wannabes.
Some body changers

save their most dramatic
transformations for the end of life.
Sockeye salmon are beckoned
from the ocean
back to the Alaskan streams
where many hatched five years ago.
Some must travel hundreds of miles
in an odyssey that can take weeks.
Along the way,
salmon will undergo one of the most
remarkable changes in all of nature.
Head shape starts to change.
Every salmon will die
by the journey's end.
The only question is
whether they will get the chance
to complete their transformation.
Many will be stopped here by
a terrible gauntlet of brown bears.
On this journey of the condemned,
the salmon throw themselves
upriver with abandon.
The salmon that escape,
especially the males,
will now carry on
with their transformation.
The head turns green and body red
as the fish prepare to die,
on their own terms.
Few have made it this far.
Fewer yet will
finish the transformation.
Approaching the spawning grounds,
the males achieve their final shape.
A sleek silvery male,
over a few weeks,
transforms into a gaudy hunchback
with a toothy grimace.
The skin turns smooth and unfishlike
as the body absorbs its scales.
In tatters after their journey,
salmon arrive in the shallows
where they hatched.
They've lost up

to a third of their weight.
Not to mention their looks.
Only one in a thousand has completed
this harrowing roundtrip.
With her own changed body,
a female sweeps out a gravel nest
and releases her eggs.
A male offers his swirl of milt.
This grotesque body change
is still a mystery.
Does the male's hooked face help in
jousting matches with rivals?
Does the female choose a male
for his new colors,
a sexy but reckless display
that draws the fire of predators?
All that's certain is that this change
is the creature's last.
And perhaps in death,
the final transformation,
the parents offer their decaying
bodies to feed the pools
where the next generation will grow.
The life of every creature
is a journey of change.
So too is the path of all life
since the very dawn of living things.
Though we may resist change,
or wish to turn back the clock,
no one can tether time.
We are all transformers,
for the story of life
is the story of change.