This cartoon history is the outcome of my nine years at Harvard, where I studied mathematics—yes...

Nine years the math department scoffed at my theories! But what do they know about time travel? Snort! Most mathematicians can't tell a second hand from a second base! We parted ways in 1972...

After I dropped out, I built this: my time machine! Let's hear 'em scoff now!

You see? Simple! Just a pile of old history books! Gad, but that musty smell is bracing!!

If I read the right books and concentrate hard enough, the machine transports me—in my imagination—anywhere in the past that I want!

For you it's even easier—all you have to do is keep reading! But hang on tight! I've set the controls for the time before time began... Heh heh heh...

Hmm—another overdue library book?
THE CARTOON HISTORY OF THE UNIVERSE

VOLUME 1.

THE EVOLUTION OF EVERYTHING

by LARRY GONICK

BEFORE TIME BEGAN, THE ENTIRE UNIVERSE WAS Pressed TOGETHER IN ONE HOT LUMP. THEN CAME...

Sgt. mark e. Rainey
THE BIG
In the first 30 minutes, all the original hydrogen and helium were formed.
AFTER SEVERAL MILLION YEARS, THE EXPANDING GASES CALMED DOWN ENOUGH TO ACCUMULATE INTO CLOUDS, WHICH CONDENSED—HEATING UP AGAIN—INTO CLUSTERS OF STARS.

IN THE STELLAR FURNACES HYDROGEN AND HELIUM FUSED TOGETHER, CREATING THE MIDDLE-WEIGHT ELEMENTS, LIKE CARBON, OXYGEN, AND IRON...

AS THESE FIRST STARS GREW OLD, SOME EXPLODED INTO SUPERNOVAS. THE HEAVIEST ELEMENTS, LIKE GOLD AND URANIUM, WERE FORMED IN THE INTENSE HEAT AND BLOWN INTO SPACE.
EIGHT BILLION YEARS AFTER THE BIG BANG, THE UNIVERSE LOOKED MUCH THE SAME AS IT DOES TODAY: GREAT GALAXIES OF STARS, GAS, AND DUST MOVING APART THROUGH EMPTY SPACE. IT WAS THEN THAT OUR SUN MADE THE SCENE!!

THE BIG BANG IS ONLY THE LATEST AND MOST RESPECTABLE THEORY OF THE ORIGIN OF THE UNIVERSE. YEARS AGO, BEFORE ACCURATE METHODS OF OBSERVATION, ALL SORTS OF IDEAS PREVAILED.

THE SNOW MATED WITH THE DUCK, SEE, AND PRODUCED THE COSMIC EGG!!

AAM - TELL IT TO THE COMMONERS!!

MODERN THEORIES HAVE MORE TO EXPLAIN, SUCH AS WHY THE GALAXIES ARE RECEEDING. FOR instance, THERE'S THE LITTLE-KNOWN CONSPIRACY THEORY (VERY MODERN):

THE GALAXIES ARE FLEETING BECAUSE THEY HATE US!

BETTER GON OUT THAN COMIN' IN!

NOWAYS, NEARLY EVERYONE ACCEPTS THAT THE UNIVERSE STARTED WITH A BANG, BUT NO ONE CAN FIGURE OUT HOW IT'S GOING TO END!!

WOT'S THE COMPUTER SAY?

WANT AND SEE.
At the edge of a spiral galaxy called the Milky Way, a cloud of gas began to collapse. Pulled together by the force of its own gravity, the compressed mass heated up, spinning faster and faster...

The gas got so hot, its hydrogen atoms began to fuse, and the cloud became a giant hydrogen bomb—a star.

As the fireball whirled, it flattened out...

...and spun off a blazing halo into space.
Most of the cast-off mass escaped forever, but some remained in orbit around the star.

Over the next few million years, bits of this "space junk" stuck together, until it had accumulated into nine planets, plus assorted moons, asteroids, and comets.

The new star was the Sun, and its third planet was good old Earth.

The sun isn't the only star in the universe with planets. In the Milky Way alone, scientists estimate, at least a billion stars have planets capable of supporting life.

Some scientists even say that life out there must look like us! (Guess what they say on Alpha Centauri.)

They're just like us, I tell you! I hope so!

For some time now, earthlings have been beaming signals to outer space, but so far no reply.

See? Just like humans!

Yeah, they don't return their calls!
As the Earth cooled, its surface scum solidified into a thin crust—the continents. Beneath lay a thick mantle of denser rock, and at the center a core of iron.

As the crust hardened, it let off jets of boiling water—the all-important medium of Life. Luckily for us, the atmosphere, too, was mainly composed of Life’s raw materials: methane and ammonia.

Since it’s in the nature of radioactive elements to decay into stable ones, the Earth must have been far more radioactive 4 billion years ago than it is today.

This means geologists can date rocks by comparing relative amounts of (for instance) uranium and lead. There are less effective ways of dating rocks, too...

Well, then how about a week from Saturday?

One surprising result of radio-dating is that the earliest evidence of Life (3.5 billion years old) is almost as old as the very oldest rocks (3.7 billion years). Apparently, radiation didn’t faze early life forms!!

You close yer eyes fer a hundred million years, and the next thing you know, yer covered with green slime!!
A recipe for life: Shoot lightning through a cloud of methane and ammonia. Let the resulting chemicals fall with the rain and accumulate in thick puddles of "organic soup." Simmer for at least a hundred million years. Eventually, you will have produced a molecule with the ability to reproduce. It will take care of the rest!!
Using the complex ingredients of the organic soup, this strange molecule, called a nucleic acid, began making copies of itself. All the copies copied, too, and soon the best stuff in the soup was eaten up!

Mine! Mine!

The nucleic acid responded by organizing little chemical factories, which could convert simpler foods into the materials needed for reproduction.

Some of these worked better than others, and so, after eons of trial and error, true life evolved: the first crude cells.

This is the life, eh, Fred? Choff choff?

Tsk! How crude!

One day more than 3 billion years ago, some lucky cell discovered chlorophyll. When exposed to the sun, this green chemical helped build tissue out of the simplest possible foods: carbon dioxide and water. Having an almost unlimited larder, the cell and its chlorophyll-bearing descendants did well.

They were the blue-green algae—the first plants.

Fred... cough... I don't think I can hold out much longer against these #&@ green guys... Fred?

Fred!
As the algae ate, they gave off the first pure oxygen. Oxygen rusted metals, turned ammonia and methane to nitrogen and carbon dioxide, and formed an ozone layer in the upper atmosphere which screened out cosmic rays.

The plants paid for this pollution: new cells evolved which breathed oxygen and ate plants — the first animals!!

Pretty soon these animals will be eating each other!

The first free oxygen came from plants, and today we still rely on plants to maintain the oxygen content of the air we breathe.

A rose does more for your nose than you might suppose!

And vice versa!

Despite 3 billion years of progress, most plants still live in the ocean. Even now, more than 3/4 of the world’s fresh oxygen comes from one-celled marine plants called plankton. This is a good reason for saving the seas!
For self-protection, both plant and animal cells clustered together in colonies...

For efficiency, some cells began specializing in eating, digestion, seeing, coordination, or reproduction.

Before long, the world had worms! With brains!!

Brains! What's a worm to think?
A Digression on Evolution

Since the time of the algae, organisms have competed for resources, but don't get the idea that evolution is a simple war of all against all, in which the weak perish and only the strong survive! No!!

From the very beginning of life, one of the most successful survival strategies has been cooperation!!

First of all, different strands of nucleic acid had to team up into chromosomes to store all the information needed to run a living cell.

It is believed that modern cells, which are highly complex, evolved from cooperative arrangements among earlier, simpler cells...

Howzit goin' at your end of the protoplasm? I've been worried about losing my individuality. Hey, it's too late now, Jack!

Our own cells carry mysterious little globs called mitochondria which have their own genetic material.

I never know if I'm taking my mitochondria for a walk, or vice versa...

Then, single cells collaborated to make the higher life forms, and as for the higher life forms—well, haven't you heard of the bees and the flowers?!

On with the story!!
The Origin of Sex

For billions of years, all life reproduced asexually, by simply dividing in half.

All offspring were exactly like their parent (except for mutants).

Now suppose the environment changed; say a new predator came along. Our asexuals, being all alike, were all equally liable to be killed. If a few of them had been tougher or faster, they might have escaped to propagate the species.

Clearly, individual differences are a good thing—and that's where sex comes in...
SEX IS A GENETIC WAY OF CREATING AND TRANSMITTING INDIVIDUAL DIFFERENCES WITHIN A POPULATION...

SEX HAS BEEN AROUND A LOT LONGER THAN SEXUAL REPRODUCTION—EVER SINCE THE FIRST TWO STRANDS OF NUCLEIC ACID GOT CLOSE ENOUGH TO FORM A CHROMOSOME AND SOMETHING DIFFERENT.

EVER TAKE ACID BEFORE?

NEVER, MY DARLING!

IN FACT, SEX ORIGINALLY WAS JUST THE OPPOSITE OF REPRODUCTION. REPRODUCTION MEANT ONE CELL SPLITTING IN TWO, BUT SEX MEANT TWO CELLS JOINING FOR A WHILE TO PLAY WITH EACH OTHERS' GENES. SEX DELAYED REPRODUCTION!?

I'M ONLY DOING THIS, ANITA, BECAUSE I WANT YOUR DESCENDANTS TO BE AN IMPROVEMENT ON YOU.

EGOTIST?

BACTERIA, TINIER THAN THE SMALLEST CELL, ARE THEMSELVES LIKE A FOOTNOTE TO LIFE. YET SCIENTISTS HAVE RECENTLY DISCOVERED THAT BACTERIA, TOO, CAN HAVE SEX.

THE EXPERIMENT: TWO STRAINS OF THE GONORRHEA-CAUSING BACTERIUM GONOCOCUS, ONE RESISTANT TO PENICILLIN AND THE OTHER NOT, WERE COMBINED IN A DISH.

ALL RIGHT!


MY GOD! IT'S AN ORGY!!

BUT NOT TONIGHT, OK? I HAVE A VIRUS!
Sexual reproduction, the regular use of sex in the reproductive process, began as a perversion of ordinary reproduction. Who knows why?

Some cell, instead of dividing into two regular cells, split into four half-cells called gametes.

Since these gametes had only half a set of genes, they experienced —

The urge to merge!!

Goosh!

And that was it.

That was it?

Yes, by splitting into gametes and recombining, the cell had found a way to reproduce and shuffle its genes at the same time.

With two parents, it worked even better, as the offspring combined features of both.
So sex was good for individual differences, and individual differences were good for survival. Therefore, sexual beings survived, and the ones who liked sex the most—which is why sex feels good then, feels good now, and can only feel better tomorrow!!!

So you see—er, um—eggs and sperm—hee hee hoho—are just gametes, and—oh, why don't I just show you?

Yes, my inarticulate Brachiopod!!

What was the effect of sex on evolution, Professor?

One: Sex is designed to create individual differences, this makes sexual species more adaptable and allowed us to take over the planet from the algae.

Two: Sex allowed the development of the higher organisms. Asexual creatures ensure survival by breeding like crazy. Sexual beings have more leisure to develop.

Three: Sex speeded up evolution. Asexual creatures can pass good genes along only one line. Sex allows useful variations to be spread rapidly throughout a population.

Since that long-necked family showed up, no one will look at me!

Four: Sex created the need for natural death. When an asexual amoeba divides, its individual life becomes two new ones—unlike sexual beings, which have to be cleared away for the new generation.

Oh, well...
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Pre-Cambrian time lasted 4 billion years

Thanks partly to sex, life really began to flourish about 600 million years ago.

Since then, the fossil record has been complete enough to permit this classification of the Earth's "recent" history.
THE CAMBRIAN BEGAN AFTER AN ICE AGE. MOUNTAIN-BUILDING HAD RAISED THE LAND, AND GLACIERS HAD SOAKED UP THE SEAS.

...CAUSING COMPETITION FOR FOOD AND SPACE TO INCREASE!

AS A RESULT, ANIMALS FINALLY DEVELOPED SOME ARMOR.

CRUNK

WHEN THE ICE MELTED, AND SHALLOW SEAS AGAIN FLOODED THE LOWLANDS, PRACTICALLY THE WHOLE AQUARIUM HAD LIMY PLATES OR SHELLS.

OOF!

OW!

BASH

THUS, "HAPPY AS A CLAM" IS ONE OF THE MOST ANCIENT Cliches.

THE CROWN OF CAMBRIAN CREATION WAS THE TRILOBITE, WHOSE PLENTIFUL FOSSILS YOU CAN BUY TOPAY IN MUSEUM GIFT SHOPS. THESE 3-LOBED BOTTOM-DWELLERS, WITH THEIR GREAT VARIETY, FLEXIBLE ARMOR, GOOD EYES, AND WILLINGNESS TO EAT ANY SORT OF MUCK, SEEMED ADAPTABLE ENOUGH TO LAST FOREVER! AND YET ——-
The Ordovician

Already produced a change which was to put trilobites out of the swim—and it wasn't this giant shell-squid (who was only passing thru).

What's your problem? Gas

A small, soft, wormy animal began to develop an internal stiffening rod, called a notocord, running along its central nerve.

The notocord evolved into a flexible sequence of cartilage units, which protected the central nervous system without any cumbersome armor.

The animal had no bones, no jaws, and no teeth, yet it was the first vertebrate, almost a fish!

Bump

Outa my way, trilobite!

Silurian

In the brief but wild, the jawless fish shared the seas with eurypteris, a 7-foot sea scorpion, so they had to grow armor after all—or else very fast fins!!

Get 'em, Eurypty!
By evolving superior brains, backbones, ribs, skulls, scales, speed, and—of course—JAWS, the fish survived and thrived. The Devonian is called the Age of Fishes.

The first fish lacked jaws, and today two species of jawless fish survive: the parasitic Hagfish and Lampreys.

In mammals the jaw has become one bone, but two tiny chips remain separate, in a new role.

Exactly how jaws evolved is not known. Early fish jaws are made up of several bony pieces, each apparently secreted along a nerve line.

They're the "hammer and anvil" of our inner ear, key to efficient mammalian hearing?

Gak—our days are numbered!
By the Devonian, plants had covered the land and the animals followed. First came the **bugs**, and then the **fish**...

**I will be the first on land!**

**Hmm... appears the bugs are already there!**

**Don't worry— they won't get the credit!**

**Why not?**

**Because my descendants will write the book!**
Some Daring Fish Began Wriggling Out of the Water in Search of Food or Glory—

We Are the Brave Pioneers...

Look Out!

Squish

The Ones That Survived Were the Ones Best Able to Wriggle Back!

Phew! Hard Enough to Breathe Out Here Without All Those Dead Fish!

So Nature Selected in Favor of a Strong Set of Fins... Which Gradually Evolved into Legs. For Breathing Purposes the Land-Fish Adapted Its Air Bladder, Originally Used in the Water for Buoyancy, into Lungs...

The Result of This Bit of Evolution was Icthyostega—The First Amphibian.

Ah!

My Fellow Bugs, We Must Prepare for a Long War.

While We Usually Think of a Lungfish as the First Animal Out of Water, the True Pioneers Were the Bugs (Insects, Millipedes, Scorpions, Etc.).

What Accounts for the Bugs' Spectacular Success (Over 900,000 Living Species) Is, Among Other Things, a Willingness to Eat Anything, Including Other Bugs...

Gack! Flies? Don't You Know What They Eat?

Some Have Developed Regimented Social Systems...

It's Good That We Do All the Work and the Queen Gets All the Sex—Yes, Good for the Hive

While Others Are Just Plain Indestructible!

@#%$ Cockroach!

It's Laughing!

Stomp, Crush!
THE CARBONIFEROUS

is named for coal, the eventual by-product of the forests where Ichthyostega’s children lived their semi-fishy lives. Especially fishy were their sex lives. Consider:

When a male amphibian spotted a likely female, he went into a song and dance.

Croak

Twang

Splash

*ME ME ME*-trans.

She signalled acceptance by laying a huge number of soft, shell-less eggs in the water.

Oo! Oo!

...and left the rest to him. They never even touched!!

Later, fish-face!

The male fertilized the eggs in private.

They hatched, and another generation of amphibians began its miserable existence...

Polls
Their sexual habits were keeping the amphibians in the water, but how to lay eggs on dry land? A protective shell would be needed, but then how could the eggs be fertilized??

Some amphibians laid semi-soft eggs, which had to be fertilized before the shell congealed.

Now! Now!

Yeah—uh—wait—er—

One thing led to another...

Maybe if I climb up here...

OO, HERBERT...

Hopeless! I'm going back to being a fish!

...and soon, they learned to fertilize the eggs before they were laid—a method which hasn't been improved in 300 million years!

In the evolution of sex, no animals have acquired more bizarre habits than the insects. Almost all bees, for example, are female, and at season's end they drive the males from the hive.

In many species, the male courts the female with a gift of something tasty, like a dead fly or a ball of dung...

For our bridal chamber!

Praying mantises may have carried this ritual a mite too far, as the female eats the male himself after the act.

Oh, Herbert, this has been a once-in-a-lifetime experience? (choff choff)

And speaking of mites, termites form stable marriages that can last for years...

But everyone knows a termite's life is boring, right, Herbert?
Another problem faced by reptiles was regulating body heat. This is harder on land, where temperatures fluctuate more than in the water.

During the Permian, many reptiles became expert sun-bathers, catching the rays with specially designed solar collectors, then retreating to shade when they'd had enough.

This worked fine as long as the sun was out and the weather was warm...

But when it rains—blah!

...or the wind wasn't blowing too hard?

Yike!

Splash

A few more windy days, and finbacks are finished?

Or flying?

Meanwhile, in cool Permian South Africa, other reptiles, the therapsids, were learning to generate heat internally, by burning their food faster...

This meant therapsids had to eat more than ordinary reptiles.

Junior! Don't wolf your lizard! You'll make yourself feverish!

That's the idea, ma!

Woy's "wolf?"
To gather their food more actively, therapsids gave up the slithering gait of the lizards in favor of a more upright stance.

For more efficient processing, their teeth diversified into cutters and grinders...

Hair probably started as therapsid side-whiskers, used to extend the sense of touch, and then spread over the body later, as a way to keep warm.

Because of their structure, teeth, and probable hair, the therapsids are also known as mammal-like reptiles.

Too ugly to survive?

The rise of the mammal-like reptiles marked a great episode of extinction, the first of three in Earth history.

Lurch? A lethal fun!

The second episode of mass death came 160 million years later, with the extinction of the dinosaurs (about which more later).

And the third is now, as we humans wipe out the wildlife.

Sure hope we can preserve ourselves!
IN THE EARLY TRIASSIC, THERAPSIDS FACED THEIR FIRST REAL COMPETITION, SPEEDY LITTLE BIPEDS CALLED THECODONTIDS.

"PANT PUFF? COME BACK WITH MY DINNER!"

DESCENDED FROM AQUATIC REPTILES WHOSE LONG HIND LEGS WERE ADAPTED FOR SWIMMING, THECODONTIDS FOUND LONG LEGS TO BE HANDY ON LAND, TOO!

"OUR FAMILY WILL MAKE GIANT STRIDES!"

ONLY TWICE IN EARTH HISTORY HAS A QUADRUPED STOOD UP ON TWO LEGS, AND BOTH TIMES THE EXPERIMENT WAS A FANTASTIC SUCCESS (FOR THE ANIMAL THAT TRIED IT, ANYWAY)...

THECODONT CHILDREN BEGAN TO GROW LARGER...

OUT OF THE DINING AREA, HAIRY ONE!

BAF

SPAT

COELOPHYSIS

... AND LARGER.

THERAPSID? WHAT THERAPSID?

OOG... GRAND-DAUGHTER!

UNABLE TO COMPETE WITH SUCH MONSTERS, THE LARGER THERAPSIDS DIED OUT. ONLY A FEW VERY SMALL TYPES SURVIVED TO EVOLVE INTO THE FIRST MAMMALS.
FOR 130 MILLION YEARS THE TINY MAMMALS WERE KEPT DOWN BY THE THECODONTs GIANT DESCENDANTS—OTHERWISE KNOWN AS THE DINOSAURs!!

EVERYONE STILL TINY DOWN THERE?
GOOD!

WHEN GIANT REPTILE BONES WERE FIRST UNEARTHED IN THE LATE 1700s, THEY PRESENTED A CHALLENGE TO RELIGION. THE BIBLE SAYS NOTHING ABOUT EXTINCT SPECIES!

GOD IS PERFECT, THEREFORE HE WOULDN'T CREATE ANYTHING HE DIDN'T INTEND TO USE, THEREFORE THIS DOESN'T EXIST!

IN AN EFFORT TO BE ACCOMODATING, SCIENTISTS PROPOSED THE THEORY OF MANY CREATIONS: EXTINCT SPECIES HAD BEEN WIPED OUT IN A SERIES OF CATASTROPHES, EACH FollowED BY A FRESH CREATION.

...AND IT REQUIRES ONLY A MINOR RE-WRITE OF A FEW PAGES IN GENESIS?

IT COULD BE ARRANGED, I GUESS...

THUS, WHEN THE THEORY OF EVOLUTION WAS Finally ANNOUNCED IN 1859, DINOSAURs WERE USED AS AN ARGUMENT AGAINST IT!!

IT'S SIMPLE, REALLY! WHEN NOAH SAILED, THE DINOSAURs MISSED THE BOAT!
In the Jurassic, small dinosaurs evolved into birds, while the large meat-eaters got even meatier.

Dinosaur cousins invaded the air and the sea.

The big plant-eaters got so fat they had to return to all fours.
Because brontosaurus often walked in mud, they left behind fossil footprints, which have given us glimpses of actual episodes of brontosaurian life. Here are three:

Brontosaurus fleeing allosaurus: (At a weight upward of 30 tons, Bronty's top speed was only 12 M.P.H.)

A migrating herd of 23 brontosaurus:

Ow! My tail!

Ow!

Ouch!

The third set of tracks shows only a brontosaurus's forefeet, with an occasional hind foot impression. Was the beast idly swimming, as most authorities say, or was it doing something else?
AND AFTERWARDS, THE BRONTOSAURS INVENTED NECKING!

DID YOU FEEL THE EARTH MOVE?

SHEESH!
HONEY-TONS, THAT WAS THE CONTINENTAL DRIFT!

In the early dinosaur era, all the continents were lumped together on one side of the Earth.

Today, the continental drift continues as heat, rising from inside the Earth, makes the solid rock flow.

Around 200 million years ago, South America split off from Africa and began to drift away...

Crack

North America is riding a westward flow. In California it runs into a contrary flow. The result: earthquakes!

Good thing we know how to go with the flow out here?

©1978 Larry Crummer
THE CROWDED CRETACEOUS WAS THE HEIGHT OF THE DINOSAUR ERA. IN THIS SCENE, THE GIANT TYRANNOSAURUS REX EYES SOME DUCKBILLS WHILE HIS COUSIN GORGOSAURUS FLEES FROM A RAMPAGING HERD OF TRICERATOPS. SPECTATORS INCLUDE TWO ARMORED ANKYLOSAURS, AN AIRBORNE PTERANODON, AND SOME DISTANT TITANOSAURS. STRUTHIOMIMUS ("OSTRICH-MIMIC") IGNORES THE WHOLE SITUATION!
The vegetation begins to look modern, as broadleaf trees and grass appear for the first time. Some plants are developing flowers, to lure the newly-evolved bees, who will be used to carry pollen to other flowers for purposes of plant sex. A few large birds have also appeared.
Suddenly, around 70 million years ago, for reasons that are still unclear, the world cooled rapidly.

In the ocean, entire populations of one-celled plankton perished, setting off an ecological catastrophe.

Hey! what are we supposed to eat?

With the basis of the food chain gone, many families of sea life were wiped out, including various fish, shellfish, and all the great sea reptiles...

On land the devastation was equally widespread. As plants died out, all animals began to suffer, especially the giants.

The undernourished dinosaurs, like poisoned birds, laid eggs with thinner and thinner shells. The embryos, unable to draw enough calcium from their eggshells to develop bones, were too weak to hatch...
After 130 million years of dominance, the dinosaurs had finally left the world to their old competitors, the tiny mammals.

The disappearance of the dinosaurs has given rise to many theories, some of which do not take all the facts into account.

Clearly, they were allergic to newly-evolved plants, and sneezed themselves to death! Clearly, my dear colleague, tiny mammals ate their eggs! Maybe they rotted their tiny brains with dinosaur comics!

The latest explanation suggests they were done in by a supernova in outer space. The intense radiation, harmful in itself, would also disrupt the world's climate, causing the sudden cooling evident in the fossil record.

But as the debate goes on, dinosaur fans, remember: only the big ones died out. The small dinosaurs, which sprouted wings, are still with us — as birds!!

They built rockets and blasted off! Oof! They went out for cigarettes and never came back. Duck — a dinosaur!
THE AGE OF MAMMALS

THE TINY MAMMALS SCURRIED OUT OF THE SHADOWS, RACING TO TAKE THE PLACES VACATED BY THE DINOSAURS.

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CRETACEOUS PERIOD

SOME WENT FOR THE PLAINS, PODGING THE 8 FOOT "TERROR CRANE" DINORNIS.

OTHERS CHASED INSECTS INTO THE AIR.

STILL OTHERS DEVELOPED A TASTE FOR FISH AND TRIED TO SWIM.

...WHILE OUR ANCESTORS, THE PRIMATES, JUST STAYED IN THE TREES, WHERE THEY HAD ALWAYS BEEN!

-WHAT’S THE RUSH?

WOULD YOU PLEASE DROWN AND STOP SCARING THE FISH?
By the Eocene epoch, mammals were no longer tiny. Here we see *Uintatherium*, 7 feet tall at the shoulder, *Zeuglodon*, an ancestral whale, some early *bats*, *Coryphodon*, a primitive hoofed mammal, and little *Equus*, the "dawn horse."

---

Exactly how wings evolved is something of a mystery. The problem is that partly-evolved wings are useless for flying.

Since trying to fly would be fatal, it's hard to see how a half-winged animal could live to reproduce. And yet...

This is batty!

The answer seems to be that half a wing has some other function, like snagging bugs, and only later is used for flight.

Wow! Look how Bernadette is using her bug-snaggers!
SO MANY DELICIOUS SPECIES WERE NOW EVOLVING, THAT MAMMALS BEGAN EATING EACH OTHER. THE EARLIEST MAMMAL MEAT-EATERS, THE CRUDE CREODONTES, WERE PUSHED ASIDE BY MORE INTELLIGENT TYPES, WHO QUICKLY BECAME THE ROYALTY OF NATURE.

WE'RE THE REIGNING CATS AND DOGS!!

YOWL!

I KILL FOR PUN'S LIKE THAT!

THE PREY THAT GOT AWAY WERE THE FAST ONES—EARLY HORSES, PIGS, ANTELOPES, AND LITTLE RUNNING RHINOS.

THE ONES THAT DIDN'T NEED TO GET AWAY WERE THE MEAN ONES—BIG RHINOS AND THEIR COUSINS. THE OLIGOCENE IS CALLED THE AGE OF HORN'S!
Still, the largest land mammal of all time was a hornless Oligocene rhino: Baluchitherium, 18 feet tall at the shoulder!

Mee! Yowl!

Most animals with horns maintain their equipment through sexual competition. Here’s how it works: (The animal is the extinct horned gopher, Epigaulius.)

During mating season, the males bash their heads together, while the females stand by.

Winner takes all.

Mee! Me!

Sniff? It’s the survival of the horniest.
Many modern whales and dolphins appeared in the seas of the Miocene epoch. Bigger than Balluchitherium, bigger than any dinosaur, whales are the biggest animals in Earth history—and the brainiest.
ON LAND THE MIocene PRODUCED THE MASTODONS. THIS "SHOVEL-TUSKER" IS CALLED AMBELODON, AND BEHIND IT IS MAMMUT.

OUTSIDE THE MAMMALIAN MAINSTREAM, IN ISOLATED SPOTS LIKE AUSTRALIA, THE PRIMITIVE TYPES KNOWN AS MARSUPIALS AND MONOTREMES EVOLVED. THE MAIN MONOTREME IS THE DUCK-BILLED PLATYPUS, WHICH LAYS EGGS.

I THINK OF MYSELF AS A MAMMAL... BOOED DUCK?

MY MAIN MONOTREME!

MARSUPIALS—KANGAROOS, WOMBATS, ETC.—GIVE BIRTH TO A HALF-FORMED EMBRYO WHICH THEY CARRY AROUND IN A SPECIAL POUCH UNTIL IT'S READY TO GO.

GOSH! ARE YOU READY YET?

GOSH, MOMMY, I DON'T KNOW...

SHH!

WHILE MOST MARSUPIALS ARE NOW ENDANGERED SPECIES, ONE, THE OPOSSUM, STILL THRIVES, UNCHANGED AFTER 40 MILLION YEARS! ITS SURVIVAL SECRET IS COWARDICE.

IT'S ONLY PLAYING POSSUM— WE COULD BAT IT...

YEAH...

BUT WHO CAN STOMACH SUCH A WIMP?
Meanwhile, back in the trees, the primates still lived as they had since the days of the dinosaurs.

Primates resemble squirrels, but for some reason squirrels didn’t evolve into humans.

Except in a few cases...

One reason may be that primates have toenails, instead of claws, so they are forced to grasp the branch.

Another is that primates eat bugs—so, like many hunters, they developed stereo vision, with both eyes facing front.
THE EARLIEST APES HAD FAIRLY SHORT ARMS AND LONG LEGS, LIKE OTHER ANIMALS.

BUT APES DISCOVERED A NEW WAY TO GET AROUND THE TREETOPS: "BRACHIATION"—OR SWINGING.

AEGYPTOPITHECUS—WITH MANY MONKEY-LIKE CHARACTERISTICS

OOP!

THIS NATURALLY LED TO LONGER ARMS, SHORTER THUMBS, AND SHORTER LEGS.

YOU ARE SUCH A SWINGER, YOU BIG APE?

AND MY KIDS WILL APE ME!

BY THE MIocene, SEVERAL APES HAD EVOLVED: PROPLIOPITHECUS, THE MOST EXPERT SWINGER, ANCESTOR OF THE GIBBON...

DRYOPITHECUS, A MORE VERSATILE TYPE...

AND THE OBSCURE RAMAPITHECUS, WHICH APPARENTLY SPENT SOME TIME ON THE GROUND.

I CAN SEE HER GREAT-GREAT-GREAT-GREAT-GREAT GRAND-DAUGHTER ON TELEVISION???

GREAT!
AND SO WE COME TO THE PLACID PLEISTOCENE, CLIMAX OF THE AGE OF MAMMALS. DURING THE PLEISTOCENE, THE MIOCENE JUNGLES RECEDED, GIVING WAY TO VAST PLAINS COVERED WITH HERDS OF ANTELOPES, 3-TOED HORSES, CAMELS, GIRAFFES, RHINOCEROS, AND MASTODONS. PLEISTOCENE CARNIVORES INCLUDED SABER-TOOOTHED CATS, DOGS, "DOG-BEARS," AND HYENAS.
As the savannah encroached on their forest home, some of the primates were finally forced out of the trees. A group of Pliocene monkeys took to the plains and evolved into baboons. Of the apes, only Ramapithecus stepped onto the steppe, at first making short forays for food, but gradually staying longer and longer. By the end of the epoch, this primate walked upright on two legs, and was adapted (more or less) to life on the ground.
THE AGE OF HUMAN BEINGS HAD BEGUN.

NEXT: THE DESCENT AND ASCENT OF GENUS HOMO!!
WHEN'S 13 BILLION YEARS OF TIME TRAVEL IN 48 PAGES... I'M BUSHED!

IF YOU STILL HAVE THE ENERGY TO READ MORE ON THE SUBJECT, I RECOMMEND THE FOLLOWING BOOKS:

ASTRONOMY AND COSMOLOGY, A MODERN COURSE
BY FRED HOYLE. FRED HAS FINALLY COME AROUND ON THE BIG BANG. ALSO HAS INFO ON DNA & GENETIC CODE.

NEW FRONTIERS IN ASTRONOMY
A SCIENTIFIC AMERICAN COLLECTION. NOT ALL HEAVY GOING, AND SOME GREAT PICTURES.

IN QUEST OF QUASARS BY B. BOVA

THE FIRST THREE MINUTES
BY STEPHEN WEINBERG. TITLE TELLS IT ALL.

ESSENTIALS OF EARTH HISTORY
BY W. LEE STOKES. READABLE & COMPREHENSIVE. GOOD ON ORIGIN OF LIFE, TOO.

PHYSICS OF THE EARTH
BY T.F. GASKELL. REPRESENTS THE VIEWPOINT OF THE OIL CARTEL.

HISTORICAL GEOLOGY
BY CARL DUNBAR. MORE THAN YOU EVER WANTED TO KNOW ABOUT IGNEOUS SCHIST.

FOSSILS
BY RHODES ZIM & SCHAEFFER.
POCKET-SIZED AND COLORFUL.

THE FOSSIL BOOK
BY C.L. AND M.A. FENTON. MILLIONS OF MEDIOCRE DRAWINGS.

THE ORIGIN OF SPECIES
BY CHARLES DARWIN. THE AUTHOR SHOWS PROMISE.

EVOLUTIONARY BIOLOGY
BY STANLEY SALTHE. I READ IT, BUT I CAN'T REMEMBER IT.

THE LIVES OF A CELL
BY LEWIS THOMAS. METAPHYSICAL MUSING ON MITOCHONDRIA.

PALEOZOIC FISHES
BY J.A. MOY-THOMAS, REVISED BY R.S. MILES. NOT MANNY LAUGH, BUT SOME LOVELY LINE DRAWINGS.

THE ECONOMY OF NATURE
AND THE EVOLUTION OF SEX
BY MATTHIEU, AN AMAZING BOOK RIGHT-WING, CRANKY, AND DENSE, BUT ALSO WITTY, PROVOCATIVE, AND INFORMATIVE.

THE REPRODUCTION OF LIFE
BY R.L. LEHRMANN. IS A MORE EASY-GOING AND ELEMENTARY TREATMENT.

ANCIENT PLANTS AND THE WORLD THEY LIVED IN
BY HENRY N. ANDREWS, JR. A BEAUTIFULLY WRITTEN AND ILLUSTRATED BOOK BY A FOSSIL FERN ENTHUSIAST. ONE OF MY FAVORITES.

DINOSAURS
BY EDWIN COLBERT. THE STANDARD WORK.

DINOSAUR RENAISSANCE
ARTICLE IN APR, 1978 SCIENTIFIC AMERICAN. BY UPSTART THEORIST ROBERT BAKKER, WHO MAKES A STRONG CASE FOR

THE HOT-BLOODED DINOSAURS
BY ADRIAN DESMOND. COVERS ALL THE LATEST IN MESOZOIC MONSTERS.

THE AGE OF MAMMALS
BY BOSNIA KORRAHL, HETH NO-Colbert, but not bad.

MAMMALS
BY THE TIME-LIFE PUBLISHING EMPIRE. GOOD PIX.

HISTORY OF THE PRIMATES
BY W.E. LEGROS CLARK. IF YOU'VE EVER WANTED TO KNOW YOUR TEETH DIFFER FROM A GORILLA'S, THIS BOOK WILL TELL YOU.

NOW, IF YOU'LL EXCUSE ME, I'M GOING TO REST UP FOR VOLUME 2!
The Cartoon History of the Universe: "Sticks and Stones"

The Mastery of Tools

Domestication of the Dog

The Invention of Agriculture

Plus: Neanderthal Burials, Cro-Magnon Cartooning, the Use of Fire, Cannibalism, Religion, the First Cities, Pottery, Weaving, War, and Much, Much More!!

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