It starts with an idea.

Panel 2: Hosler (Narration): Next comes the outline and script.

As well as a thumbnail plan of the page.

I then draw the panels and position the text.

This is followed by the pencil art...

...which is drawn over with India ink.

After that, the underlying pencils are erased.

Finally, I fill in solid black areas with ink and apply shading.

Of course, despite all of that work there are still folks that think comics are an inherently juvenile medium.
Some still consider this union of art and literature as reading material only fit for slack-jawed mouth breathers.

He takes after your side of the family.

But this perspective is more the product of historical circumstances than the intrinsic nature of comics.

In 1945, everybody was reading comics!

Educators were starting to use comics in the classroom with surprising results.

What the...? You all read the assignment?!

It was a time of unprecedented diversity.

So, what happened?
In 1954, a big asteroid named Fredric Wertham tumbled toward the world of comics. His book, Seduction of the Innocent, argued that comic books were a major source of juvenile delinquency.

When the Wertham asteroid hit, it provoked Senate hearings. Parents were horrified by the comics Wetham put on display. Comic book burnings followed.

In the end, the comic industry accepted a self-imposed censorship program called the Comics Code Authority (CCA).

The CCA seal was only placed on comics judged to be "wholesome." Not a scratch. I was already dead. Under these conditions, the creative potential of comics was severely restricted.

Holy Pabulum, bat-... stop that!

Only comics deemed "suitable" for children survived.
But that was fifty years ago.

Since then, comic books have diversified and matured even if public opinion has not.

With their unique synthesis of words and art, comics express thoughts and ideas in ways other mediums cannot. In fact, I would argue that comics have been essential to our understanding of the natural world.

By some estimates, humans were using images 25,000 years before we developed written language.

We are, by our very nature, visual creatures and we rely on images as a quick means of acquiring information.

Uh...

Cog!

A wheel or bar with a series of projections on its edge that transfers motion by engaging with projections on another wheel or bar.

Pictures have helped advance several fields of scientific study and are an essential component of science education.

Positron

Photon

Electron

Positron diagrams are used for performing calculations in quantum field theory.

Darwin's evolutionary tree reshaped the way biologists thought about how species are related to each other.

So, where do comics come in?
In his book, *Understanding Comics*, Scott McCloud defines comics as "juxtaposed pictorial and other images in deliberate sequence, intended to convey information and/or an aesthetic response in the viewer."

If we accept this definition, then science has been using comics to explain concepts for centuries.

**The Cell Cycle**

Parent cell → Prophase → Metaphase → Anaphase → Telophase

Mitosis

So, what if we take things a step further and use a comic book story to illustrate concepts in science?

I posed this question when I spoke at a lunch meeting with some retired faculty.

A terrible idea

This is the end of education.

...gulp...

Now, to be fair, that was just one comment.

But it made me think.

(and sweat)

My primary goal as an educator is for my students to understand science.
If we can accept that there is nothing inherently juvenile about comics, then they become a potentially powerful tool for teaching science.

And we need all of the tools we can get.

Only 1 in 5 Americans appreciate the value or process of scientific inquiry. Science proficiency of U.S. students is at or below students in other developed countries and dropping.

In light of this, the National Science Board has highlighted the need to communicate the fascination and joy of science.

Research indicates that instructors who use comics found that they increased student interest as well as the motivation to read.

Comics also improved reading performance and retention compared to non-illustrated text.

Do you remember way back in issue #267 when Capt. K-9 trapped the Brick Lord of Ignatzio in the Seventh Dimension of Kokonino?

Comics tell stories and we've been using stories to instruct for ages. We can remember complex or strange things because that information is situated in a narrative.

Didn't he have to use the orb of grimalkin?
SO, IT ISN'T TOO HARD TO IMAGINE USING COMICS AS AN INTERMEDIARY FOR NEW, SOMETIMES CHALLENGING, IDEAS FROM THE NATURAL SCIENCES.

I'VE SEEN IT NUMEROUS TIMES AT COMIC BOOK CONVENTIONS. IF THE STORY IS ENTERTAINING, KIDS REMEMBER THE SCIENCE BECAUSE IT IS PRESENTED IN CONTEXT.

INSTEAD OF THE ORB OF GRIMALKIN, LET'S SAY AN ADVENTURE CENTERED ON A CONCEPT LIKE... UH... NATURAL SELECTION.

YOU SAID IN YOUR BOOK THAT INDIVIDUALS DON'T EVOLVE.

JUST TO PICK SOMETHING COMPLETELY OUT OF THE BLUE... RAVEN?

SO THAT MUST MEAN WHEN A POKEMON CHANGES IT ISN'T EVOLVING, IT IS GOING THROUGH A METAMORPHOSIS, RIGHT?

A CHARLES DARWIN COMIC BOOK?

RIGHT.

THE IDEA IS CATCHING ON. LAST YEAR, I CREATED TWO SCIENCE COMICS FOR A LINE OF EDUCATION COMICS FROM HARCOURT PUBLISHING.15

I ALSO RECEIVED A GRANT FROM THE NATIONAL SCIENCE FOUNDATION TO BEGIN DEVELOPING A BIOLOGY TEXTBOOK IN COMIC BOOK FORMAT.
COMICS CAN CREATE UNFORGETTABLE WORLDS FOR US TO EXPLORE.

ONE OF THE GOALS OF MY COMIC BOOKS IS TO MAKE THE NATURAL WORLD ONE OF THOSE MEMORABLE PLACES.

OF COURSE, WITH GREAT POWER COMES GREAT RESPONSIBILITY.

FROM AN EDUCATIONAL STANDPOINT, THE IMAGES AND SITUATED NARRATIVES OF COMICS AND CARTOONS ARE SO POWERFUL THAT THEY CAN ACTUALLY MAKE THINGS WORSE IF EMPLOYED CARElessly.

THAT REMINDS US, DAD. WE JUST WATCHED A BUG’S LIFE AND WE HAVE A QUESTION.

DO ANTS RILLY ONLY HAB FOUR LEGS?

ONLY IF YOU PULL TOO OFF, WISE GUY.

NOW, BOYS, WHAT HAVE I TOLD YOU ABOUT UNDERMINING YOU FATHER’S ARGUMENTS?

Sigh.