

A BOOK EXPLAINING  
COMPLEX IDEAS USING  
ONLY THE 1,000 MOST  
COMMON WORDS



RANDALL MUNROE  
XKCD.COM

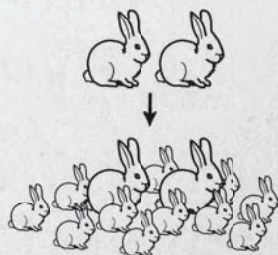
# BOOKS INSIDE US

Why people's children are sort of like them but not exactly the same

You know that genetic material from two parents results in offspring with traits that follow a pattern of inheritance. Mendel found that these patterns can be predicted by using mathematical probabilities. Here's an overview.

## THE STORY OF HIDDEN WRITING AND FAMILY TREES

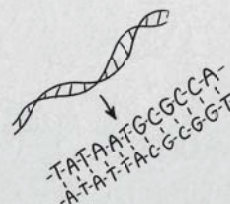
LIVING THINGS MAKE MORE OF THEMSELVES.



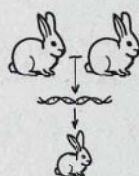
THE THINGS THEY MAKE ARE A LOT LIKE THEM, BUT AREN'T EXACTLY THE SAME.



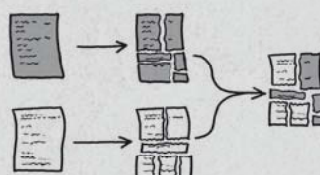
THERE ARE LOTS OF REASONS FOR THIS, BUT ONE OF THEM IS A KIND OF WRITING INSIDE LIVING THINGS.



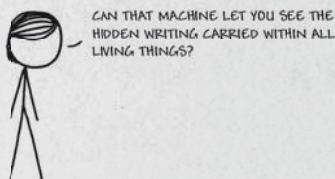
THIS WRITING, WHICH IS STORED IN OUR BODIES AND IS TOO SMALL TO SEE, IS PASSED DOWN TO EVERY LIVING THING FROM THE LIVING THINGS IT CAME FROM.



WHEN THIS WRITING IS PASSED DOWN, LIKE WHEN TREES MAKE NEW TREES OR PEOPLE MAKE BABIES, THE WRITING GETS CHANGED AROUND AND PUT TOGETHER IN NEW WAYS.



THERE ARE LOTS OF THINGS ABOUT THE WRITING THAT WE DON'T UNDERSTAND. BUT SOME THINGS, LIKE WHAT KIND OF BLOOD YOU HAVE OR WHICH THINGS MAKE YOU SICK, SEEM TO RUN IN FAMILIES IN THE SAME WAY. LOOKING AT HOW THE WRITING GETS CHANGED AROUND AND PUT TOGETHER IN EACH NEW LIVING THING CAN HELP US UNDERSTAND WHY.

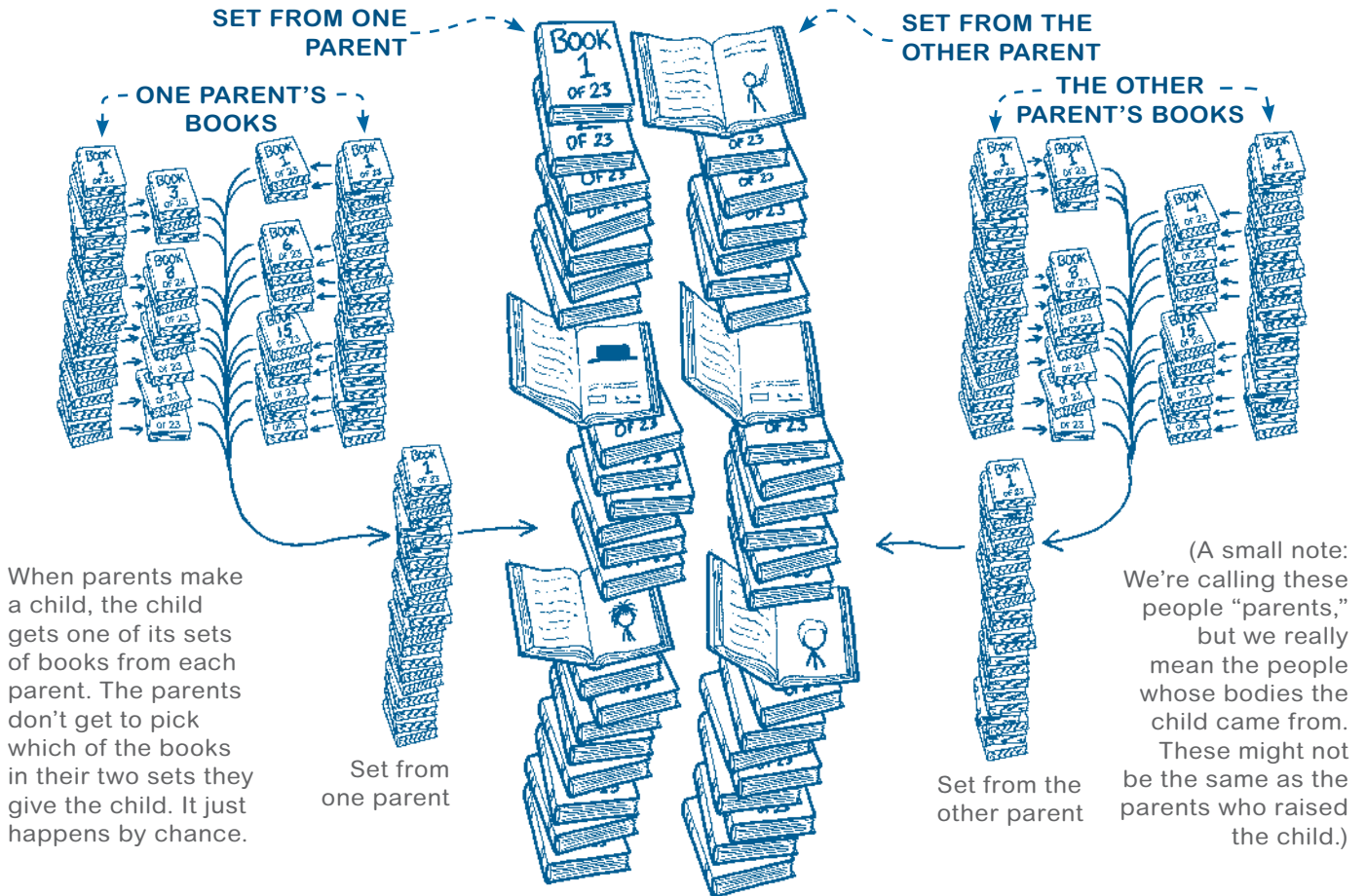


## WRITING INSIDE YOUR BODY

Living things are full of a kind of writing telling them how to grow. It's not written using letters and words; it uses four different tiny pieces, like letters, stuck together in long lines. We can think of them like words in a set of books, but remember, they're not really "words" like we're used to. People, like a lot of animals, have two different full sets of books in their bodies.

One set is from each parent. The two sets match; each book in a set has a matching book in the other set that is about the same size, as if they have the same number of pages, even if each page doesn't have the same words. We won't worry about how to read what the writing says. After all, in real life, we don't really know what most of the writing is for!

### THE TWO SETS OF WRITING IN YOUR BODY THAT TELL IT HOW TO GROW

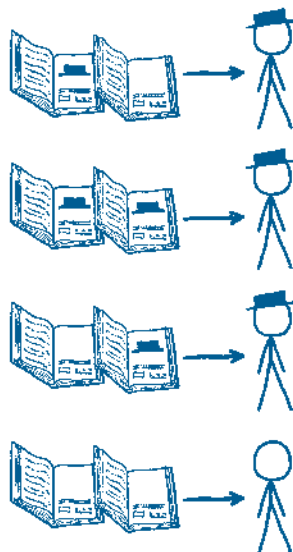


### LEFT AND RIGHT

To learn a little more about how the left and right books come together, let's imagine that there's a piece of writing in a person's book that decides whether they will have a hat or not. (We'll pretend hats are part of our bodies.)

In the part of the book about hats, let's say some books have a piece of writing that means "HAT" and other books don't.

Here's the Hat Law: If either of your books says "HAT," then you will have a hat.



This person has a hat because there's a hat in one of their books.

This person has a hat because there's a hat in both of their books.

This person has a hat because there's a hat in one of their books.

This person doesn't have a hat because there's no hat in either one of their books.

# WHY CHILDREN ARE DIFFERENT

## TWO PARENTS WHO ARE THE SAME

Let's suppose two parents with hats have a baby. These parents both have the same thing in their books, as far as hats go—a hat in their left book and no hat in their right.

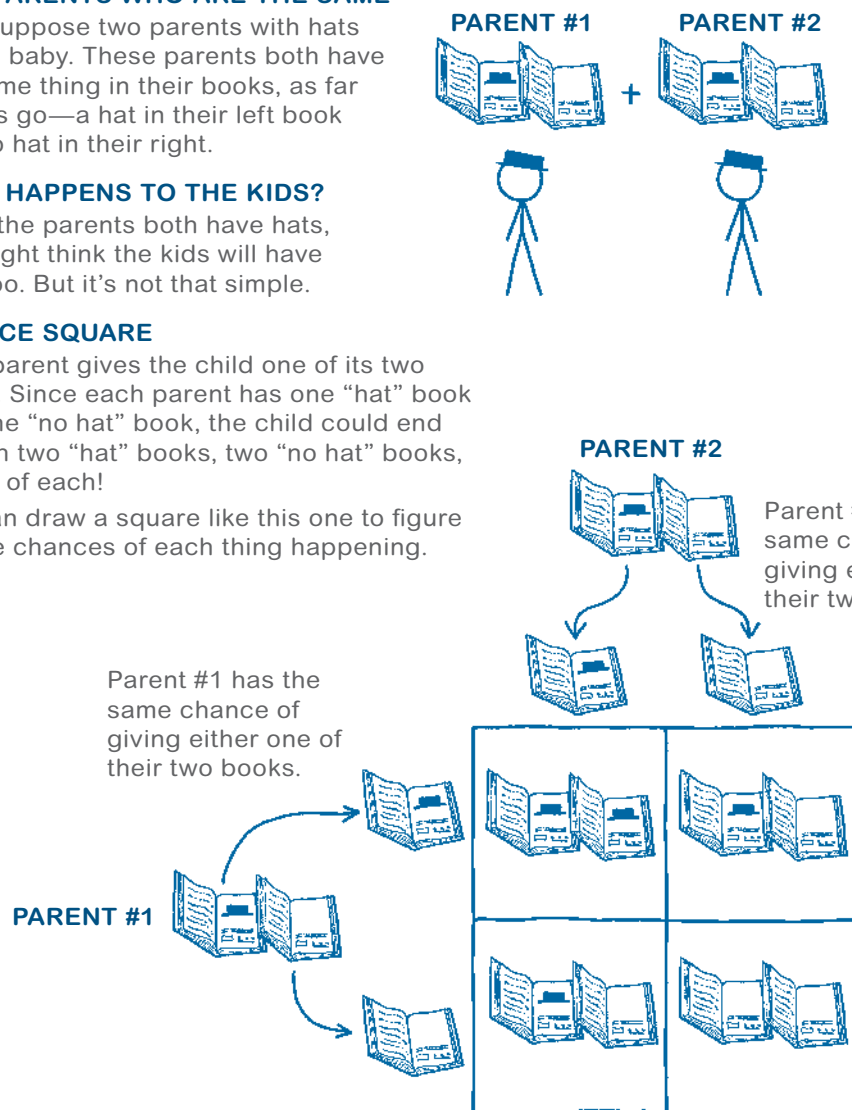
## WHAT HAPPENS TO THE KIDS?

Since the parents both have hats, you might think the kids will have hats too. But it's not that simple.

## CHANCE SQUARE

Each parent gives the child one of its two books. Since each parent has one “hat” book and one “no hat” book, the child could end up with two “hat” books, two “no hat” books, or one of each!

You can draw a square like this one to figure out the chances of each thing happening.



## A NOTE ON HATS

In real life, hats aren't passed down in families like this, but lots of real things are.

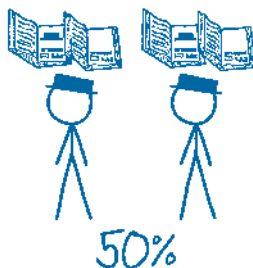
Humans have yellow stuff in their ears, which is either wet or dry. “Having wet yellow ear stuff” is passed down in families like these hats are.

In cats, short hair is passed down in the same way. Having long hair is like having a hat and follows the same rules as hats do in these pictures.

The child has a one-in-four chance of getting the “no hat” book from both parents. If that happens, the child will not have a hat, even though both parents do.



The child has a two-in-four chance of getting the “no hat” book from one parent and the “hat” book from the other. That means the child will have one “hat” and one “no hat” book, just like both parents do. Like their parents, these children will have hats.



The child has a one-in-four chance of getting the “hat” book from both parents. This child will have a hat, and they are different from their parents because they don't have a “no hat” book.







## A HAT FAMILY TREE

Let's follow a pretend family tree to see how different branches end up with different sets of hat and no hat books.

