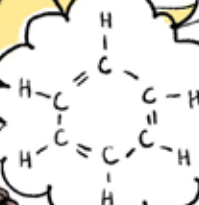
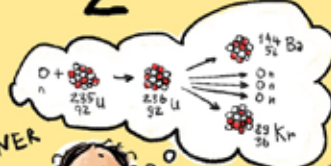


PIONEERS OF PROGRESS 2

ELIZABETH
GARRETT
ANDERSON

LISE
MEITNER

ROSA
BEDDINGTON



KATHERINE
JOHNSON

KATHLEEN
LONSDALE

EVA
CRANE

ELSIE
WIDDOWSON

BARBARA
MCLINTOCK





1908

WHAT DO
THEY WANT NEXT?
HALF OF THE
WORLD?



Pioneers of Progress II

Pioneers of Progress II continues to tell the tales of women whose contributions to scientific discovery made a huge impact on the world. Their work and scientific legacies have often gone unrecognised.

These eight women were pioneers in the truest sense of the word, and not only because of their scientific breakthroughs. Many were advocates for the education of women. All championed the proper recognition of the role of women in society, by acting as role models for those who have followed them.

These stories appear in chronological order. We begin with **Elizabeth Garrett Anderson**, who became the first woman to qualify as a physician in Britain, co-founded the first hospital staffed by women, and opened the medical profession to women. Physicist **Lise Meitner** contributed to the discovery of the element protactinium and of nuclear fission. She declined an offer to work on the Manhattan Project, and was described by her nephew as “a physicist who never lost her humanity”. American geneticist **Barbara McClintock** was awarded the 1983 Nobel Prize in Physiology and Medicine. Her research focused on developing ways to visualise and characterise maize chromosomes. She discovered transposons and understood their role in evolution and genome change well before others. The crystallographer and prison reformer **Kathleen Lonsdale** was one of the first two women elected to the Royal Society (along with Marjory Stephenson). Lonsdaleite, an allotrope of carbon and a rare form of diamond formed when meteorites strike the Earth, was named after her. The nutritionist **Elsie Widdowson**, older sister to Eva Crane, studied chemistry at Imperial College. She oversaw the addition of vitamins to food during rationing in Britain in World War II. **Eva Crane**, born Ethel Eva Widdowson and younger sister of Elsie, became one of the greatest writers on bees and beekeeping of the 20th century, though her original subjects were mathematics and quantum mechanics. **Katherine Johnson** was an American mathematician whose calculations of the mechanics of orbits as a NASA scientist were key to the success of crewed spaceflights. She earned a reputation for complex manual calculations and helped to pioneer the use of computers. She was one of the first African-American woman to work as a NASA scientist, and her life is the subject of the 2016 film *Hidden Figures*. The career of British biologist **Rosa Beddington** had a major impact on developmental biology and the understanding of the fate of cells in the early embryo.

Pioneers of Progress Book II is the second in a series that follows **Heroes of Health**, a comic book that describes how the Medical Research Council began, more than 100 years ago. It tells the stories of some of the ground-breaking discoveries that have transformed the way we all live. We hope you enjoy this book.

For more information contact:

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BARBARA MCCLINTOCK

AND THE JUMPING GENES

I START WITH THE SEEDLING.
AND I DON'T WANT TO LEAVE IT.
I DON'T FEEL I REALLY KNOW THE STORY
IF I DON'T WATCH THE PLANT ALL
THE WAY ALONG.



SHE DOESN'T LIKE
TO CUDDLE.
SHE DOESN'T CRY.
SHE JUST WANTS
TO BE ON HER OWN.

LEAVE HER BE.
SHE WILL BE
FINE.

ELEANOR?

SHE DOESN'T
EVEN LOOK LIKE
AN ELEANOR.
SHE IS NOT
DELICATE ENOUGH

WHY DON'T WE
CALL HER
BARBARA THEN?





19 19

I FORBID IT!
YOU WILL NEVER FIND A
HUSBAND AND BE AN
ODDBALL... OR EVEN WORSE,
A FEMALE COLLEGE PROFESSOR!

I WANT
TO GO TO
UNIVERSITY!

I DON'T CARE.
I WANT TO DO
RESEARCH.

LET HER GO, SARA.
THAT IS WHAT
SHE WANTS.

CORNELL UNIVERSITY, ITHACA, NEW YORK

I DON'T MIND WAITING
EACH KERNEL IS INDIVIDUALLY
FERTILISED AND THERE ARE
HUNDREDS ON A COB. PERFECT
FOR GENETIC ANALYSIS!

I WOULDN'T HAVE
THE PATIENCE TO DO
MAIZE RESEARCH.
THEY TAKE TOO LONG
TO GROW.



1931

AMAZING! WITH THESE
NEW STAINING TECHNIQUES
WE CAN SEE THE
CHROMOSOMES MUCH BETTER.

NOT ONLY WE
CAN SEE THEM BETTER.
WE CAN DEMONSTRATE THAT
THE CHROMOSOMES CAN
EXCHANGE GENETIC
INFORMATION DURING
MEIOSIS!

CHROMOSOMAL
CROSSOVER

PATERNAL
CHROMOSOME



MATERNAL
CHROMOSOME

HARRIET CREIGHTON



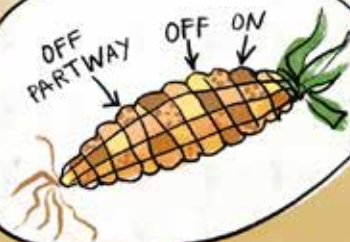
COLD SPRING HARBOUR LABORATORY

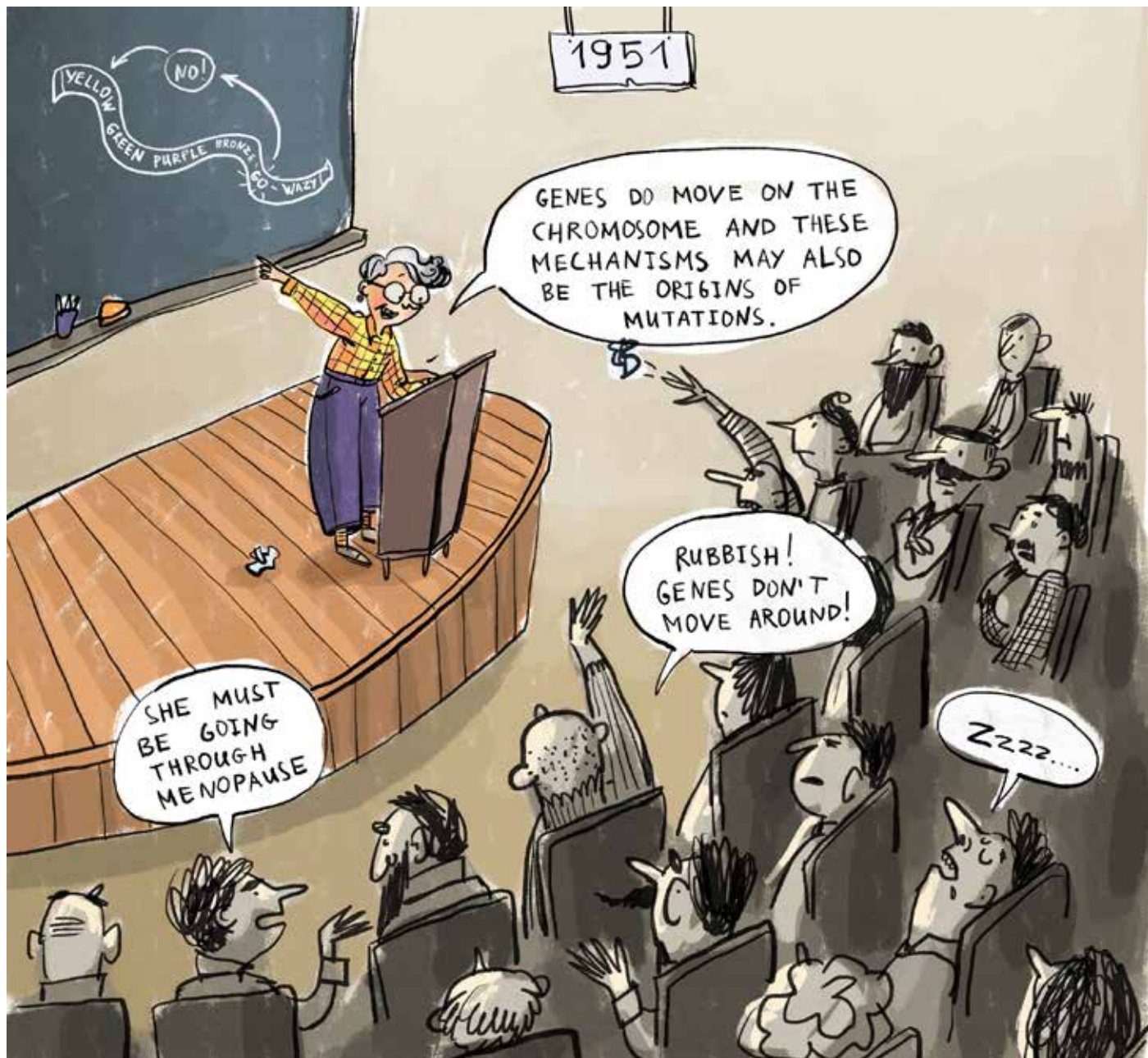


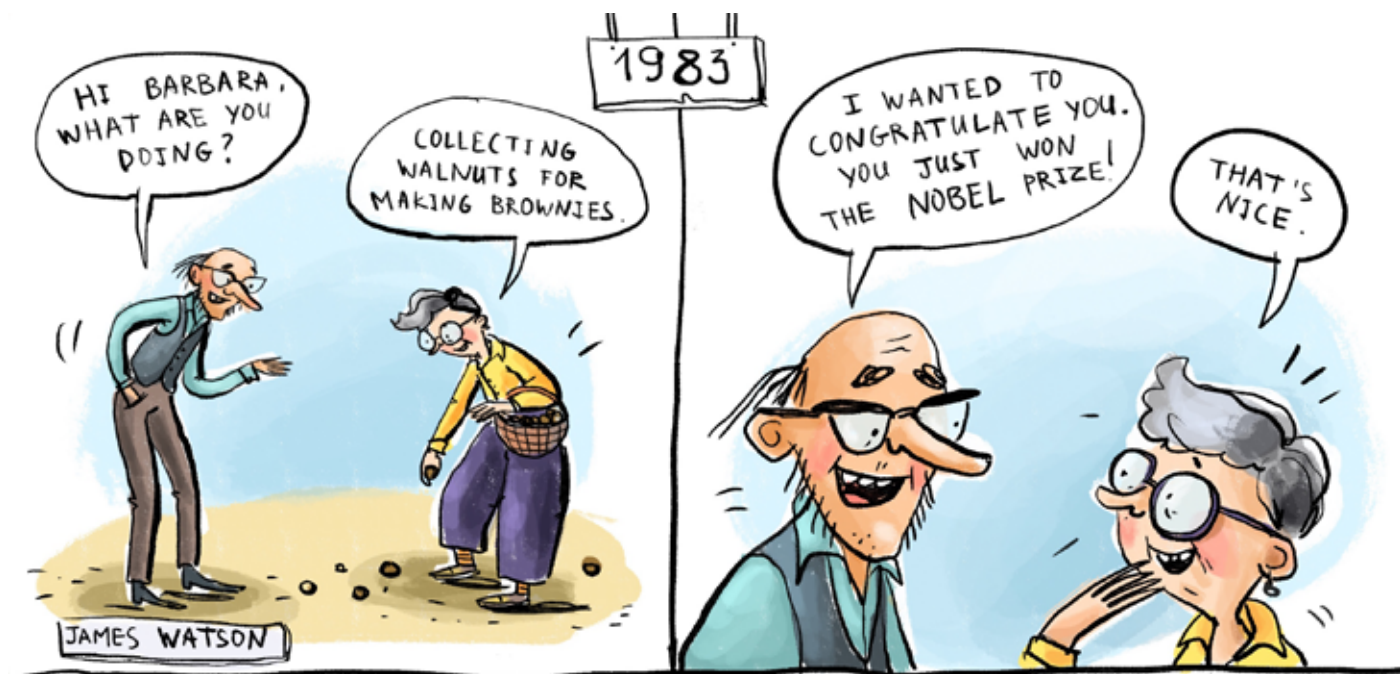
IT LOOKS LIKE SOME CHROMOSOMES HAVE BEEN SNIPPED OFF AND SOME PARTS HAVE BEEN MOVED TO NEW LOCATIONS.

THIS HAPPENS WHEN DISSOCIATION ELEMENTS (DS) JUMP FROM ONE PLACE ON A CHROMOSOME TO ANOTHER. ONCE AT A NEW LOCATION, DS SWITCH OFF NEIGHBOURING GENES, EXPRESSING SAY COLOUR. THEY THEN MOVE AGAIN, AND THE PIGMENT GENE IS TURNED BACK ON! I'LL CALL THESE JUMPING GENES 'TRANSPOSONS!'

OFF PARTWAY OFF ON







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2020

WHAT ARE
THEY ON ABOUT?
THEY ALREADY
HAVE THE VOTE!



