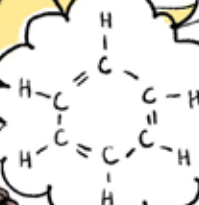
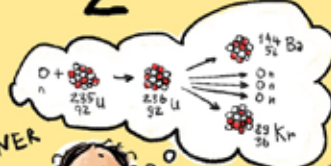


PIONEERS OF PROGRESS 2

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.

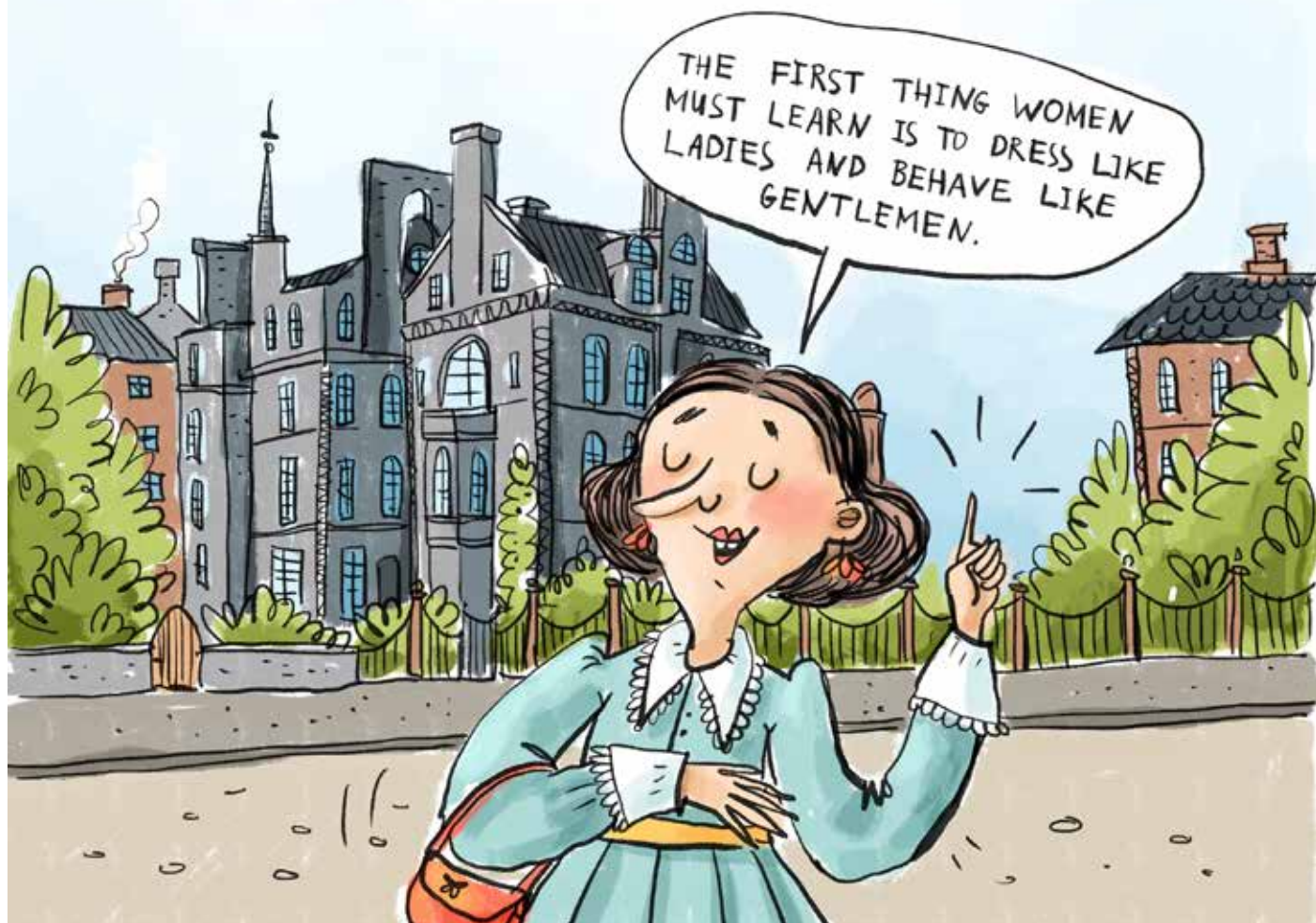
For more information contact:

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ELIZABETH GARRETT ANDERSON AND HER HOSPITAL



1849

DO I REALLY HAVE
TO GO TO THIS SCHOOL?
THEY DON'T EVEN TEACH
MATHS OR SCIENCE!

YOU HAVE TO
BECOME A LADY
TO FIND A
HUSBAND!

YOU KNOW THAT
WE COME FROM A
HUMBLE BACKGROUND.

BUT DON'T FORGET
TO TAKE A HOT BATH
ONCE A WEEK!



I DON'T WANT TO
PLAY CARDS AND
DRINK TEA ALL DAY.

I THINK WE WILL BECOME
GREAT FRIENDS. YOU
MUST MEET MY FRIEND
ELIZABETH BLACKWELL.
SHE IS A DOCTOR.



IT IS QUITE CLEAR WHAT HAS
TO BE DONE. I MUST DEVOTE
MYSELF TO SECURING HIGHER
EDUCATION WHILE YOU OPEN THE
MEDICAL PROFESSION TO
WOMEN, ELIZABETH.

YOU HAVE TO DO SOMETHING
TO ADVANCE WOMEN'S RIGHTS
HERE IN ENGLAND.

MILLIE, YOU MUST
GET US THE VOTE.

EMILY DAVIES

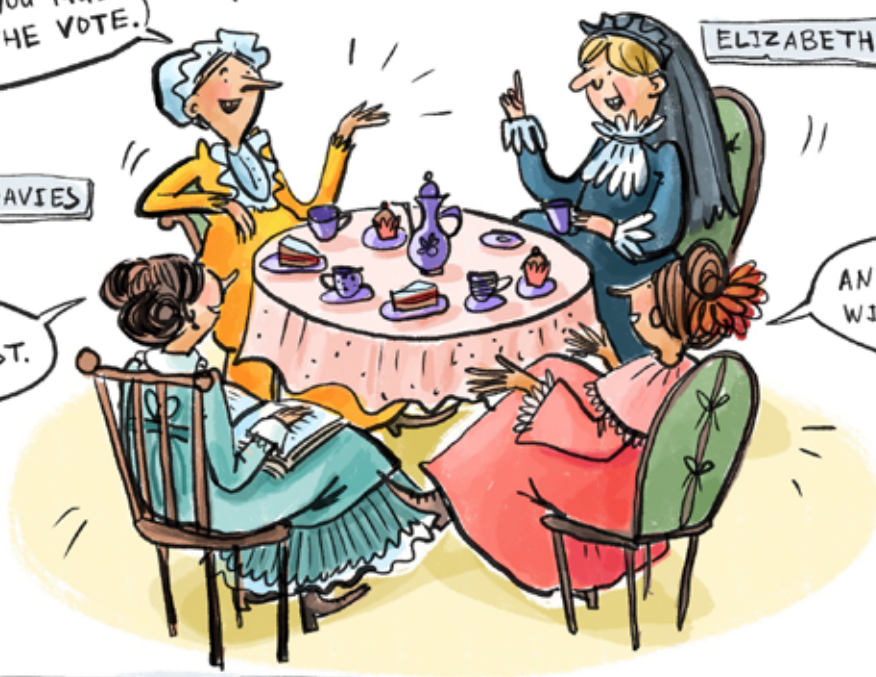
ELIZABETH BLACKWELL

I WILL
TRY MY BEST.

AND WHAT
WILL I DO?

ELIZABETH GARRETT ANDERSON

MILLICENT GARRETT



MEDICAL SCHOOL

I WOULD LIKE TO APPLY.

WE DON'T TAKE FEMALE APPLICANTS.



MEDICAL SCHOOL

I DON'T WANT TO STUDY WITH A FEMALE.

ME NEITHER



MEDICAL SCHOOL ADMISSIONS

I AM SORRY, I CAN'T DO ANYTHING FOR YOU.



WORSHIPFUL SOCIETY OF APOTHECARIES

YOU WON'T BE ALLOWED TO GO TO MEDICAL SCHOOL BUT THE SOCIETY OF APOTHECARIES HAS TO ADMIT YOU. IT IS IN THEIR CHARTER AND YOU CAN GET A LICENCE TO PRACTICE MEDICINE.

THANK YOU!



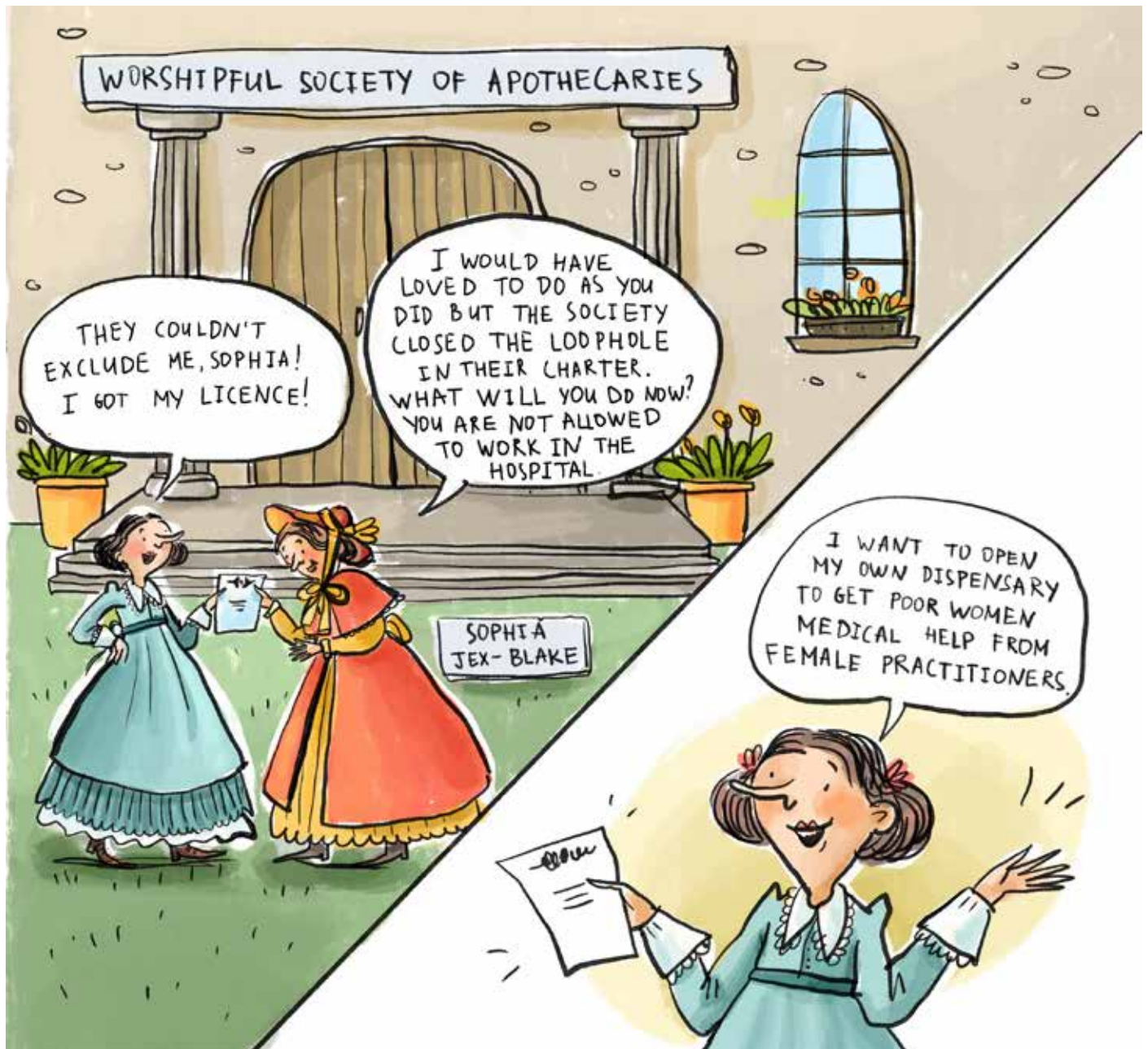
WORSHIPFUL SOCIETY OF APOTHECARIES

THEY COULDN'T
EXCLUDE ME, SOPHIA!
I GOT MY LICENCE!

I WOULD HAVE
LOVED TO DO AS YOU
DID BUT THE SOCIETY
CLOSED THE LOOPHOLE
IN THEIR CHARTER.
WHAT WILL YOU DO NOW?
YOU ARE NOT ALLOWED
TO WORK IN THE
HOSPITAL

SOPHIA
JEX-BLAKE

I WANT TO OPEN
MY OWN DISPENSARY
TO GET POOR WOMEN
MEDICAL HELP FROM
FEMALE PRACTITIONERS.





1870, PARIS, SORBONNE





WE NEED
A NEW
BUILDING!

A speech bubble containing the text "WE NEED A NEW BUILDING!".



1916

WHAT HAVE WE ACHIEVED
SO FAR? ELIZABETH BECAME
THE FIRST WOMAN PHYSICIAN
IN BRITAIN AND OPENED THE
MEDICAL PROFESSION TO
WOMEN. I FOUNDED GIRTON
COLLEGE AND MILLICENT
IS FIGHTING FOR THE VOTE!
NOT BAD, BUT...

... THERE'S
STILL A LOT
TO DO!

COURAGE CALLS
TO COURAGE
EVERYWHERE AND
ITS VOICE CANNOT
BE DENIED.



EMILY DAVIES



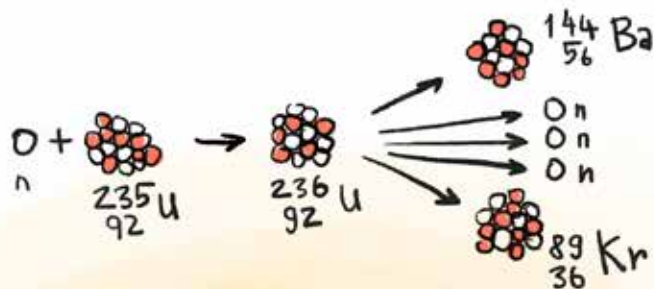
ELIZABETH GARRETT
ANDERSON



MILlicENT GARRETT
FAWCETT

LISE MEITNER

AND 48 NOBEL PRIZE SUGGESTIONS



LIFE NEED NOT
BE EASY, PROVIDED
ONLY IT IS NOT
EMPTY



1890, VIENNA

WHAT SHALL I DO
WITH YOU, WUTZERL?
YOU'VE GREAT MARKS
IN SCIENCE BUT YOUR
HAND WRITING IS
REALLY AWFUL!

IT DOESN'T MATTER.
I WANT TO STUDY
MATHEMATICS AND
PHYSICS.

WHILE I AGREE
THAT ALL MY DAUGHTERS
SHOULD HAVE AN
EDUCATION, I HAVE TO
SAY THAT I THINK
TEACHING FRENCH
WOULD BE MUCH MORE
SUITABLE FOR YOU.



1906, UNIVERSITY OF VIENNA

WHAT WILL YOU DO
WITH YOUR DOCTORATE,
BECOME A TEACHER?

NO, I WANT TO GO
TO BERLIN AND
STUDY WITH
MAX PLANCK.



1926. BERLIN



SINCE CHADWICK PROVED
THE EXISTENCE OF THE
NEUTRON WE SHOULD DO
SOME TRANSURANIUM
RESEARCH TO CREATE
HEAVIER ELEMENTS
THAN URANIUM.

I GUESS
WE HAVE
TO HURRY UP.

BUT RUTHERFORD,
JOLIOT-CURIE AND
FERMI ARE ALSO
ON TO IT.

OTTO HAHN

PARIS



IRENE JOLIOT-CURIE

CAMBRIDGE



ERNEST RUTHERFORD

ROME



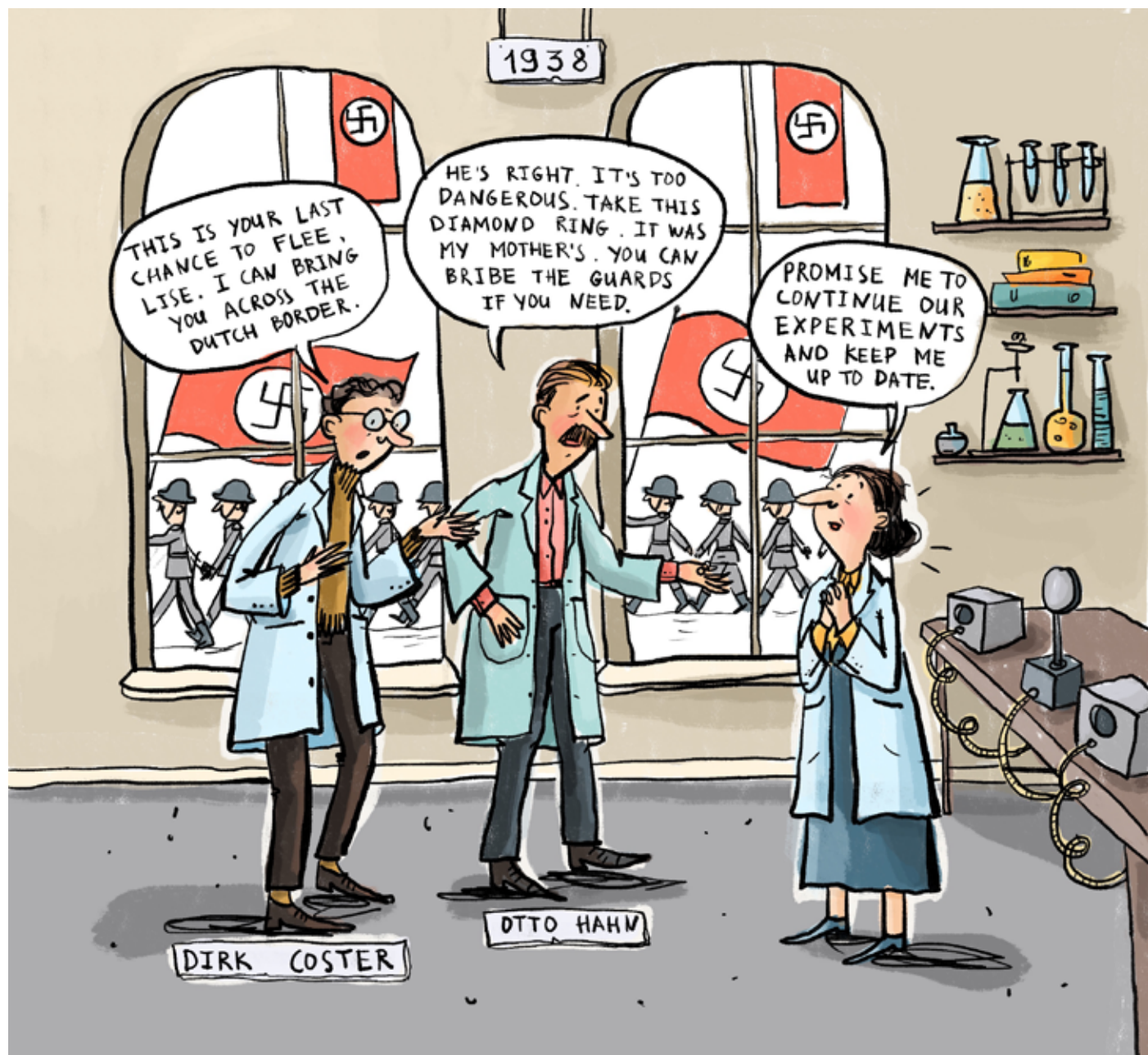
ENRICO FERMI

1933

ISN'T IT BECOMING
TOO DANGEROUS HERE
FOR YOU? THEY ALREADY
TOOK AWAY YOUR TEACHING
AUTHORITY. MANY JEWISH
COLLEAGUES LEFT GERMANY
ALREADY.

NONSENSE! I AM PROTECTED
BY MY AUSTRIAN CITIZENSHIP.
WE HAVE IMPORTANT WORK
TO DO AND BESIDES: WHO
ELSE COULD EXPLAIN THE
RESULTS OF OUR EXPERIMENTS?
YOU ARE A BRILLIANT
CHEMIST HAHNCHEN. BUT YOU
DON'T UNDERSTAND PHYSICS.





1938

THIS IS YOUR LAST CHANCE TO FLEE, LISE. I CAN BRING YOU ACROSS THE DUTCH BORDER.

HE'S RIGHT. IT'S TOO DANGEROUS. TAKE THIS DIAMOND RING. IT WAS MY MOTHER'S. YOU CAN BRIBE THE GUARDS IF YOU NEED.

PROMISE ME TO CONTINUE OUR EXPERIMENTS AND KEEP ME UP TO DATE.

DIRK COSTER

OTTO HAHN

DECEMBER 1938 . IN A SWEEDISH FOREST

HAHN IS BAFFLED BY THE UNUSUAL RESULTS OF THE EXPERIMENTS. WHEN THEY BOMBARDED THE URANIUM WITH NEUTRONS THEY DIDN'T GET HEAVIER ELEMENTS, BUT LIGHTER ONES: BARIUM AND KRYPTON. ALSO SEVERAL NEUTRONS AND LARGE AMOUNTS OF ENERGY WERE RELEASED.

ASTONISHING!

OTTO ROBERT FRISCH

IF WE USE $E=mc^2$ THE RELEASED ENERGY CAN BE EXPLAINED BY THE CONVERSION OF REST MASS INTO KINETIC ENERGY.

LET'S CALL IT NUCLEAR FISSION!

1942, LOS ALAMOS

WOULD YOU LIKE
TO COME AND WORK
ON OUR PROJECT TO
FIND OUT HOW AN ATOMIC
EXPLOSION CAN BE
GENERATED?

SWEDEN

NO THANKS.
I WANT NOTHING
TO DO WITH A
BOMB!



1945, NOBEL PRIZE AWARD CEREMONY



SURELY HAHN FULLY DESERVED
THE NOBEL PRIZE FOR CHEMISTRY..
BUT I BELIEVE THAT OTTO
ROBERT FRISCH AND I CONTRIBUTED
NOT INSIGNIFICANTLY TO CLARIFYING
THE PROCESS OF URANIUM FISSION.

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



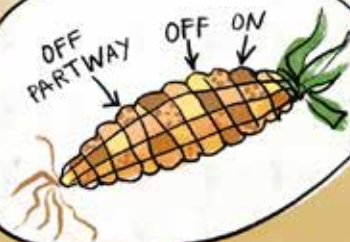
COLD SPRING HARBOUR LABORATORY

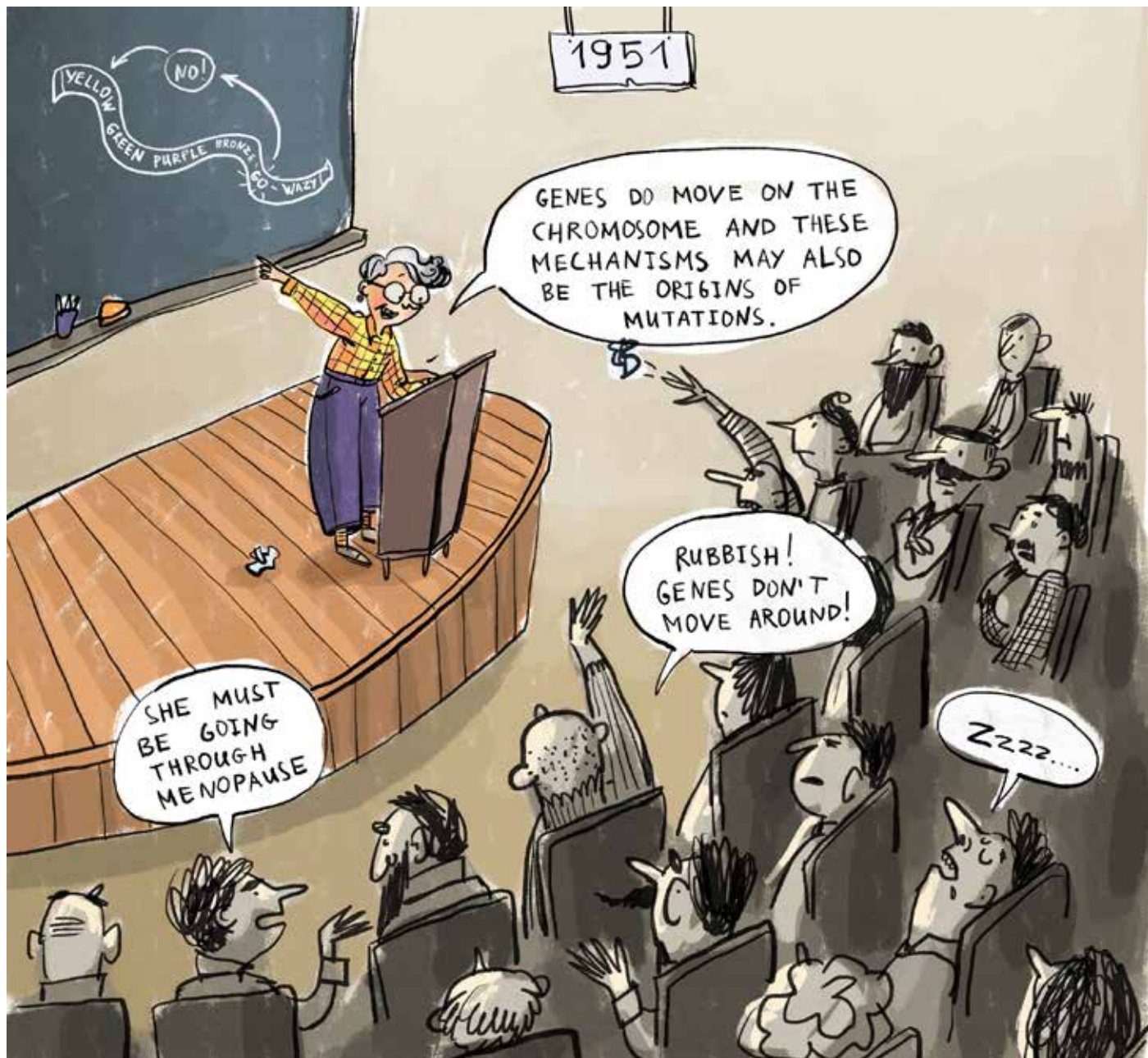


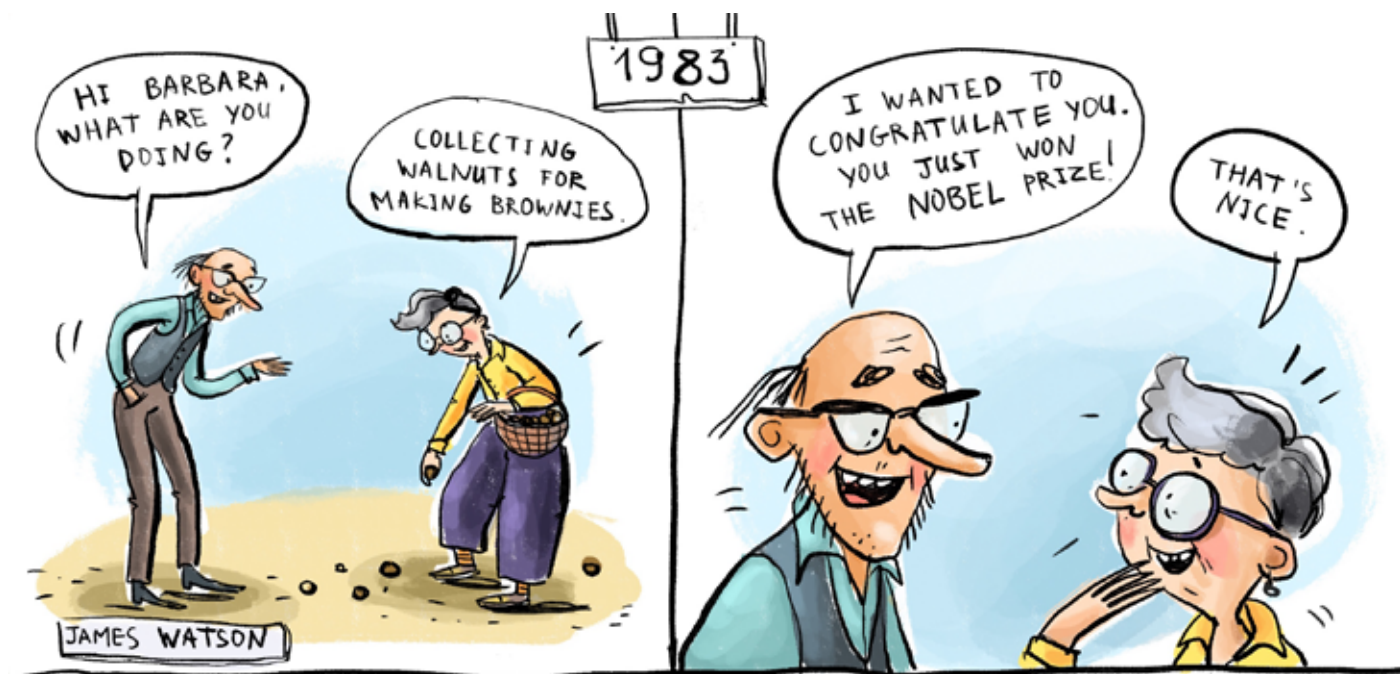
IT LOOKS LIKE SOME CHROMOSOMES HAVE BEEN SNIPPED OFF AND SOME PARTS HAVE BEEN MOVED TO NEW LOCATIONS.

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

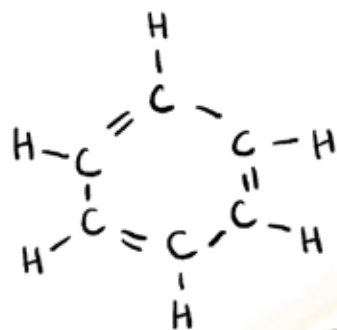






KATHLEEN LONSDALE

AND THE STRUCTURE OF CRYSTALS



A CRYSTAL IS LIKE A
CLASS OF CHILDREN
ARRANGED FOR DRILL,
BUT STANDING AT EASE
SO THAT WHILE CLASS AS
A WHOLE HAS REGULARITY
BOTH IN TIME AND SPACE,
EACH INDIVIDUAL CHILD
IS A BIT FIDGETY!



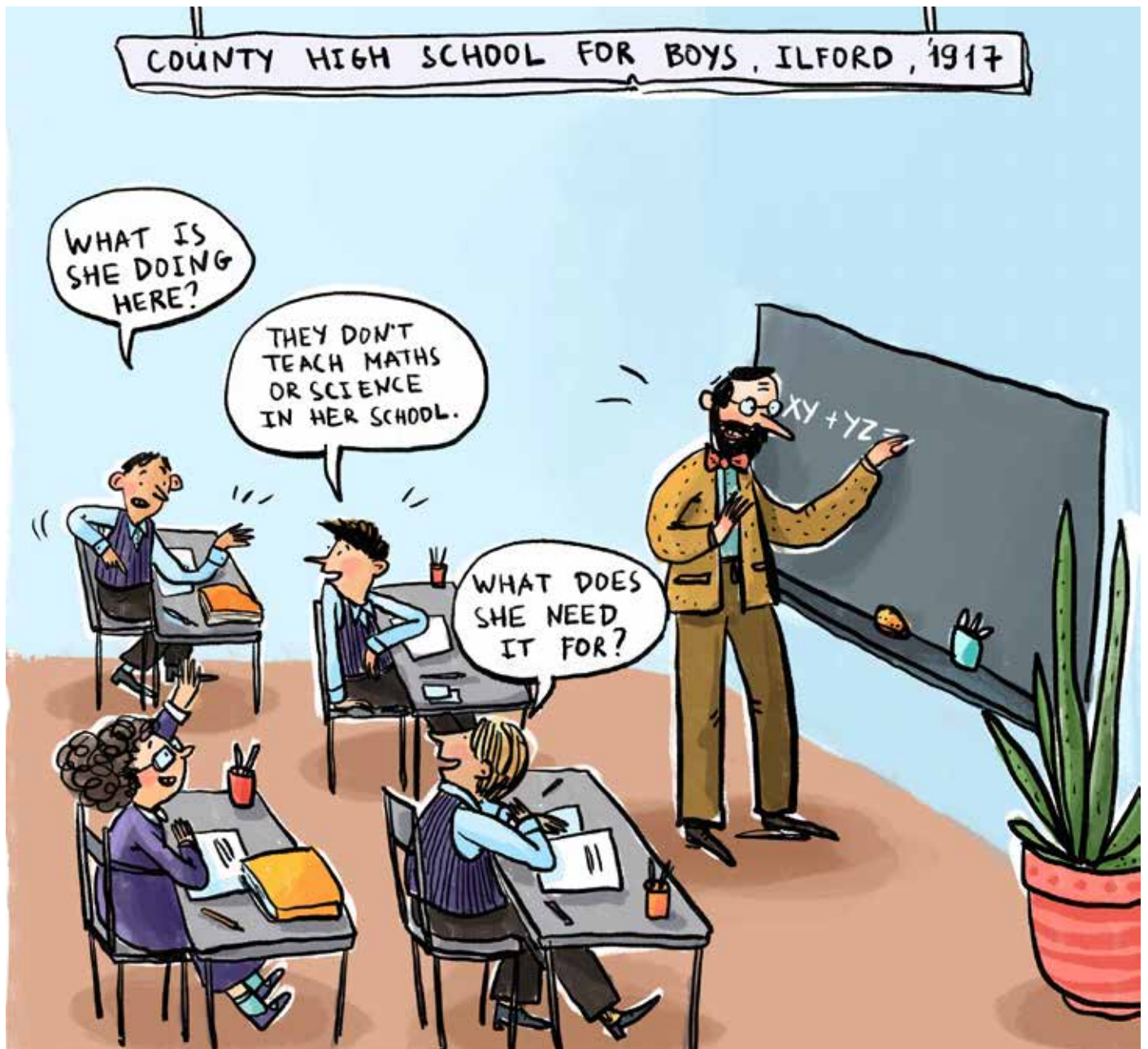
COUNTY HIGH SCHOOL FOR BOYS, ILFORD, 1917

WHAT IS SHE DOING HERE?

THEY DON'T TEACH MATHS OR SCIENCE IN HER SCHOOL.

WHAT DOES SHE NEED IT FOR?

$$xy + yz =$$



1922

CONGRATULATIONS!
YOU PASSED YOUR EXAM
BRILLIANTLY. WOULD
YOU LIKE TO COME TO MY
LAB AND WORK IN
X-RAY CRYSTALLOGRAPHY?

THANK YOU.
I WOULD LOVE TO.

WILLIAM HENRY BRAGG





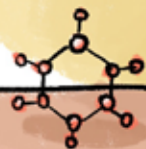
UNIVERSITY OF LEEDS, 1928

OK, I HAVE TO FIGURE OUT
THE STRUCTURE OF THESE
CRYSTALS. WHAT IF I USE
FOURIER ANALYSES?

HEXAMETHYLBENZENE

HEXACHLOROBENZENE

THAT'S IT!
THE BENZENE
RING IS FLAT
WITH ALL CARBON
ANGLES AND BOND
LENGTHS IDENTICAL.



I HAD TO FINISH
MY PAPER AT
HOME. BUT NOW
IT'S DONE!

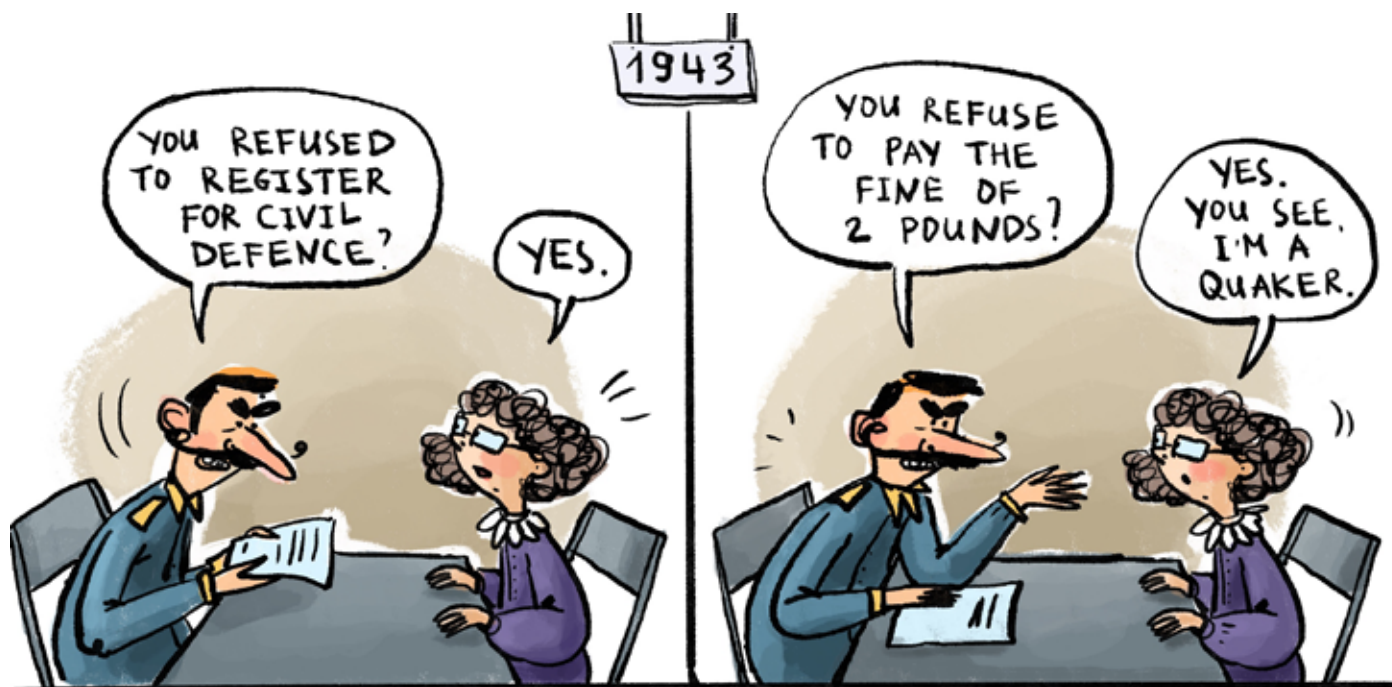


ONE PAPER LIKE THIS
BRINGS MORE CLARITY
INTO ORGANIC CHEMISTRY THAN
GENERATIONS OF ACTIVITIES
BY US PROFESSIONALS.



PROFESSIONALS
MY WORD!





ONE MONTH LATER

YOU'RE FREE NOW.
YOU CAN GO HOME

THANK YOU VERY MUCH.
I GOT A GOOD AMOUNT
OF WORK DONE.
MAY I MAKE SOME
SUGGESTIONS ON HOW TO
IMPROVE THE CONDITIONS
FOR THE PRISONERS?

HOLLOWAY PRISON



1945

CONGRATULATIONS LADIES.
YOU ARE THE FIRST TWO
FEMALE FELLOWS OF THE
ROYAL SOCIETY.

AFTER SPENDING
TIME IN PRISON
NOTHING SCARES
ME ANY MORE.

SOMEONE
HAS TO MAKE
A START.



MARTORY STEPHENSON



1966

THEY WANT
TO NAME A
HEXAGONAL
DIAMOND
AFTER ME.
LONSDALEITE...

WELL YOU ACHIEVED
ALOT: DISCOVERED
THE STRUCTURE OF
AROMATIC COMPOUNDS,
WROTE THE 'BIBLE'
FOR CRYSTALLOGRAPHERS,
PUBLISHED MORE THAN
200 PAPERS, HEAD
OF CRYSTALLOGRAPHY
AT UCL, DAME OF...

...YES DARLING.
I'D RATHER HAVE
ANOTHER SLICE
OF YOUR WONDERFUL
CAKE...

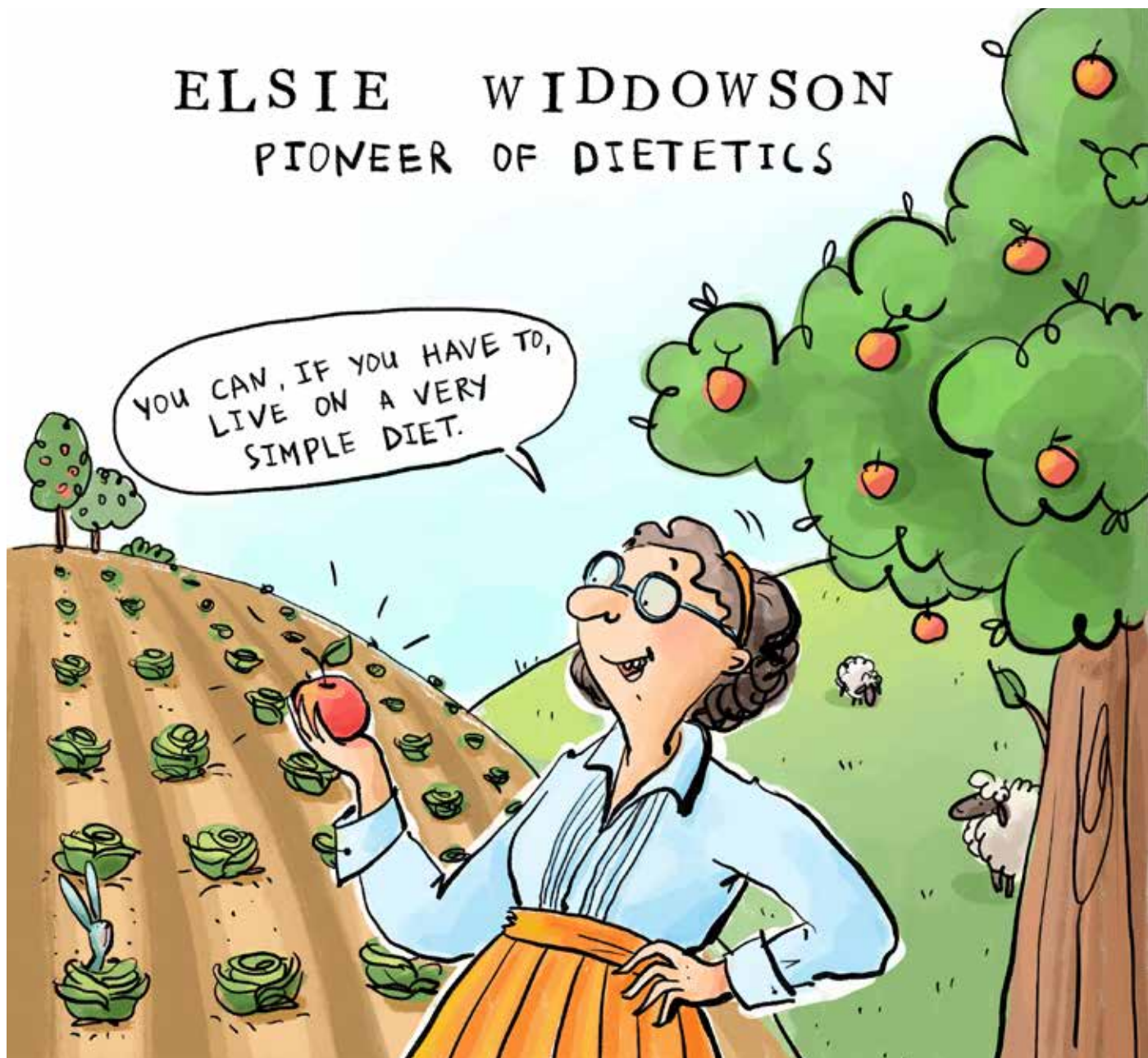
PROBABLY I
WILL REPLY THAT
THE NAME SEEMS
APPROPRIATE
SINCE THE
MINERAL ONLY
OCCURS IN SMALL
QUANTITIES AND
IS GENERALLY
RATHER MIXED
UP!



ELSIE WIDDOWSON

PIONEER OF DIETETICS

YOU CAN, IF YOU HAVE TO,
LIVE ON A VERY
SIMPLE DIET.





IMPERIAL COLLEGE, DEPARTMENT OF
PLANT PHYSIOLOGY

WOULD YOU LIKE
TO WORK ON THE
PHYSIOLOGY OF
APPLES?

HELEN ARCHBOLD



AN ORCHARD IN KENT

IF I FIND A METHOD
FOR MEASURING THE
STARCH, HEMICELLULOSE,
SUCROSE, FRUCTOSE AND
GLUCOSE IN THE APPLE
SEPARATELY...



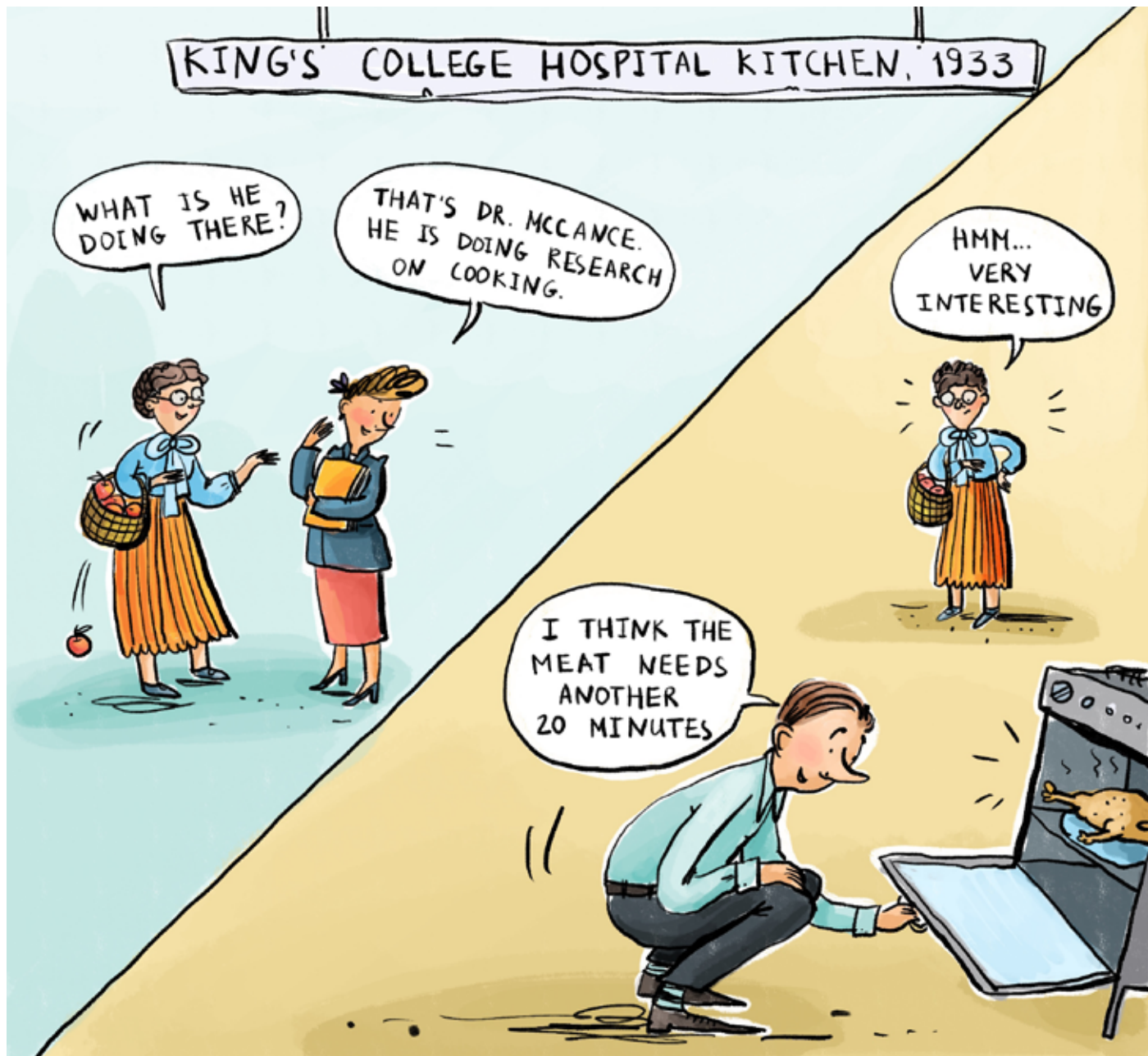
KING'S COLLEGE HOSPITAL KITCHEN, 1933

WHAT IS HE
DOING THERE?

THAT'S DR. MCCANCE.
HE IS DOING RESEARCH
ON COOKING.

HMM...
VERY
INTERESTING

I THINK THE
MEAT NEEDS
ANOTHER
20 MINUTES

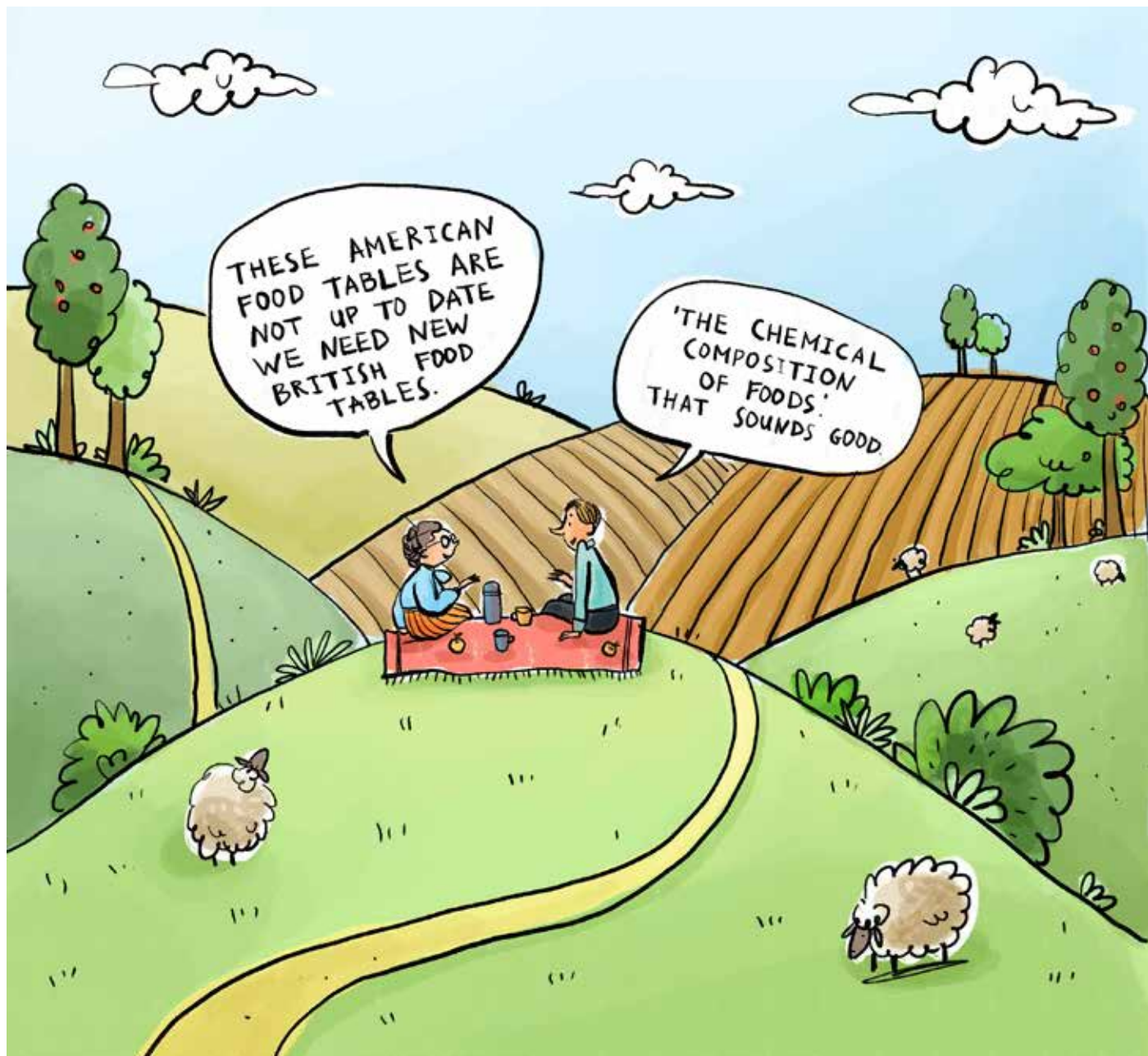


ROBERT MCCANCE'S LABORATORY

SOME OF YOUR
RESULTS ARE WRONG
BECAUSE YOU BOILED
THE FRUIT WITH ACID
AND DESTROYED SOME
OF THE FRUCTOSE.

I'M GOING TO TRY
AND GET A GRANT
FOR YOU FROM THE
MEDICAL RESEARCH
COUNCIL. COME AND
PUT THIS RIGHT.





THESE AMERICAN
FOOD TABLES ARE
NOT UP TO DATE
WE NEED NEW
BRITISH FOOD
TABLES.

'THE CHEMICAL
COMPOSITION
OF FOODS:
THAT SOUNDS GOOD.

1939

WE SHOULD LOOK INTO THE DIETARY IMPACT OF WAR RATIONING. CAN FOOD PRODUCED SOLELY IN BRITAIN MEET THE NEEDS OF THE POPULATION?

WE PUT OURSELVES ON A MINIMAL DIET OF BREAD, CABBAGE AND POTATOES WITH CALCIUM SUPPLEMENTS AND THEN WE TEST OUR ENDURANCE AND FITNESS.



6 MONTHS LATER AFTER A 36 MILE WALK

HOW DO YOU FEEL?

I'M FINE. I THINK OUR RATIONS PROVIDE ENOUGH ENERGY.





1993, BUCKINGHAM PALACE

YOU ARE NOW A
MEMBER OF THE ORDER
OF THE COMPANIONS
OF HONOUR.

THANKS!

HOW
WONDERFUL
ELSIE!



EVA CRANE

MAY I ASK:
HOW DO YOU KEEP
SO FIT? WHAT IS
YOUR SECRET?



IT RUNS IN THE
FAMILY I SUPPOSE...
AND I FOLLOW A
SIMPLE DIET: 'A LITTLE
BIT OF WHAT THEY
LIKE' AND MILK
WITH EVERYTHING.



EVA CRANE

QUEEN OF BEES

THIS CURIOUS PASSION
FOR A SMALL INSECT CAN
TRANSCEND BARRIERS OF
POLITICS, RACE AND LANGUAGE
AND BRING STRANGERS
TOGETHER AS FRIENDS.



SYDENHAM COUNTY SCHOOL

WELL DONE
EVA WIDDOWSON,
YOU SEEM TO HAVE
THE SAME APTITUDE
FOR SCIENCE AS
YOUR SISTER ELSIE.

$$\frac{x+2}{3x} =$$

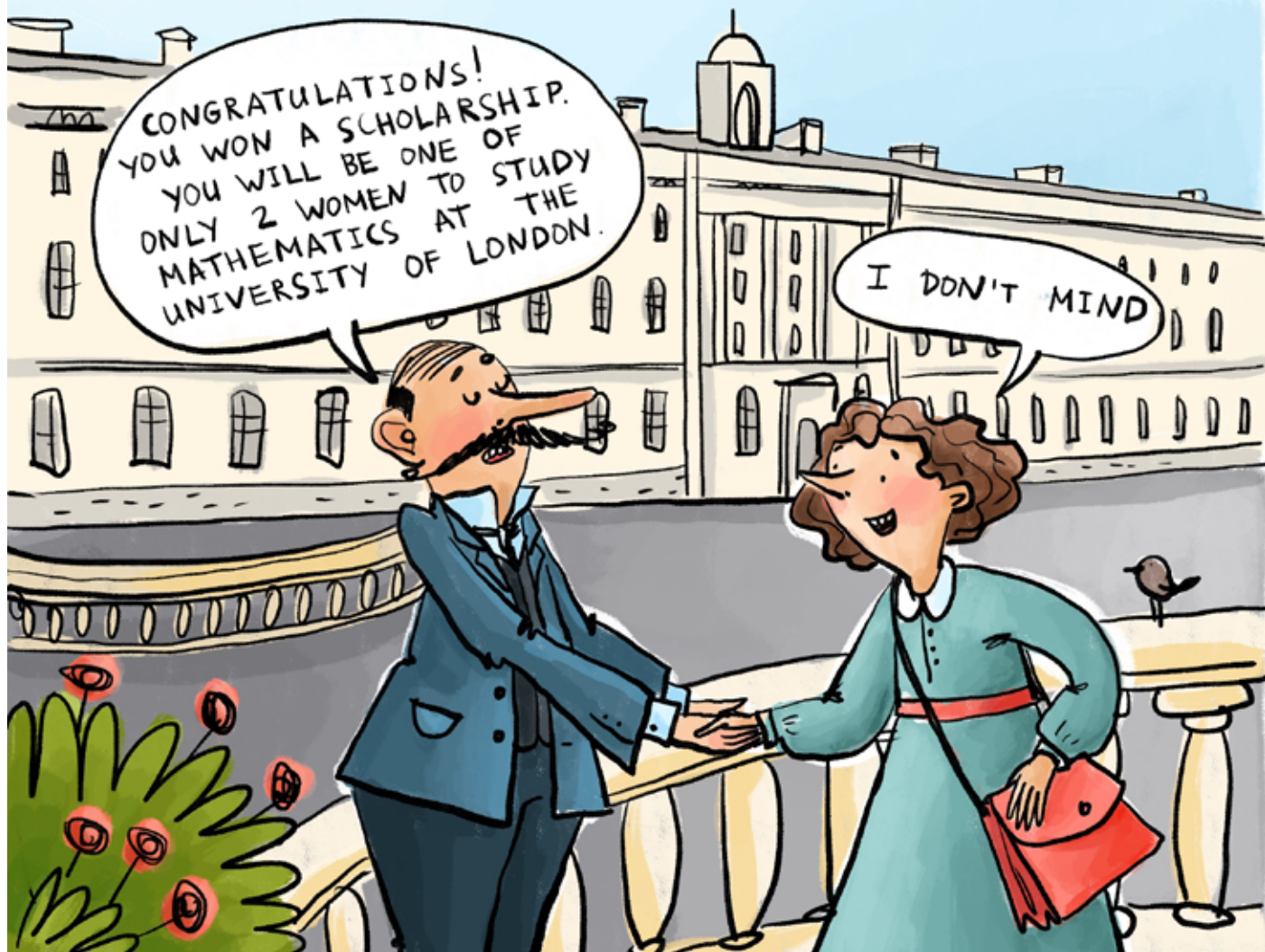
KNOW
IT ALL...



1933. KING'S COLLEGE, LONDON

CONGRATULATIONS!
YOU WON A SCHOLARSHIP.
YOU WILL BE ONE OF
ONLY 2 WOMEN TO STUDY
MATHEMATICS AT THE
UNIVERSITY OF LONDON.

I DON'T MIND



1941, SHEFFIELD UNIVERSITY.

YOUR RESUMÉ IS PRETTY
IMPRESSIONING. YOU HAVE A
BSc IN MATHS AND MSc IN
QUANTUM MECHANICS AND
A PhD IN NUCLEAR PHYSICS.
WE EXPECT GREAT THINGS
FROM YOU.





WHAT ARE YOU
LOOKING AT,
HONEY?

YOU KNOW THE BEES DON'T
ATTRACT ME AT ALL. I AM A
SCIENTIST AND I JUST WANT TO
KNOW HOW THEY WORK, I SHOULD
TAKE OUT A SUBSCRIPTION TO
BEE'S WORLD.

SURE





1950 - 1990

INTERESTING
PREHISTORIC HONEY
COLLECTION!

RESEARCHING BEE
KEEPING ON REMOTE
ISLANDS. WHAT DID
I THINK?

HMM... THE ANCIENT
BABYLONIANS USED
HONEY TO PRESERVE
THEIR CORPSES...

... AND THE VIETKONG
USED BEES AS A
MILITARY WEAPON.

'2001'

DR. CRANE, I'M FROM
THE UNITED STATES
DEPARTMENT OF AGRICULTURE
IN LOUISIANA.
UNFORTUNATELY ALL OUR
BEES ARE DYING BECAUSE
THEY HAVE MITES. DO YOU
KNOW OF ANY
MITE-RESISTANT VARIETY

THANK YOU VERY MUCH!
WE WILL DO THAT.



I THINK YOU
COULD IMPORT
RUSSIAN QUEENS,
WHICH ARE MITE
RESISTANT.





KATHERINE JOHNSON

SENDS MEN TO THE MOON







KATHERINE DARLING,
YOU SKIPPED A FEW GRADES
BUT IT WILL NOT BE EASY FOR
YOU TO HAVE A CAREER AS
AN AFRICAN AMERICAN IN
WEST VIRGINIA.

TELL
THEM I'M
COMING!

$$A \left\{ \frac{-2C_0}{C_L} \log + \frac{2C_0}{C_L} \sqrt{C} \dots \right.$$



1952

I AM LOOKING
FOR WORK

KATHERINE, DON'T
YOU HAVE ENOUGH ON
YOUR PLATE WITH YOUR
THREE GIRLS AND A
TEACHING JOB?



I WANT TO BE
A RESEARCH
MATHEMATICIAN.



I MIGHT HAVE SOMETHING
FOR YOU. THEY ARE HIRING
AFRICAN AMERICAN
WOMEN AT NACA.



NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS (NACA, LATER NASA)

COLORED COMPUTERS

YOUR MAIN JOB WILL BE
TO READ DATA FROM BLACK BOXES
AND DO CALCULATION. WE ARE
BASICALLY COMPUTERS
WEARING SKIRTS.

COLORED RESTROOMS
1/2 MILE

DOROTHY VAUGHAN







TRAJECTORY FOR ALAN SHEPARD'S
SPACE FLIGHT, MAY 1961



THREE DAYS TO LAUNCH
1962

GET THE GIRL TO CHECK
THE NUMBERS. IF SHE
SAYS THEY ARE GOOD
I'M GOOD.

JOHN GLENN

KATHERINE?



PRESIDENTIAL MEDAL OF FREEDOM
2015





2018

REALLY? FIRST THE FILM
AND NOW A KATHERINE
JOHNSON LEGO FIGURE
AND BARBIE?



ROSA BEDDINGTON

AND THE FATE OF CELLS





I DON'T KNOW WHAT TO DO WITH HER. SHE IS BRILLIANT AT SCIENCE, SPORTS, ART. BUT THIS IS THE THIRD TIME I CATCH HER SNEAKING OUT OF SCHOOL TO THE PUB. THAT CAN'T BE TOLERATED!

CUT HER SOME SLACK. SHE HAD A DIFFICULT CHILDHOOD.

1974. BRASENOSE COLLEGE, OXFORD

I REALLY WOULD LOVE
TO UNDERSTAND THE
DEVELOPMENT OF THE
MAMMALIAN EMBRYO.

I LOVE
YOU.

AND A GREAT
SCIENTIST TOO

SHE IS
SOO COOL!





WHEN THE EMBRYONIC CELLS
ARE MOVED TO A DIFFERENT
POSITION ALONG THE AXIS OF
THE EMBRYO, WILL THEY BECOME
LIKE THE CELLS IN THEIR NEW
LOCATION OR ARE THEY
ALREADY SPECIFIED?

I NEED TO LEARN
HOW TO TRANSPLANT
CELLS IN THE EARLY
EMBRYO SO THAT THEY
CAN BE TRANSFERRED
BACK.



COLD SPRING HARBOR, MOUSE COURSE

HOW NICE!
ROSA MADE ME
A MOUSE
BIRTHDAY CARD.

HOW IS
WORK ?
GOING.

OH, WE HAD
SOME TROUBLE
TRANSPLANTING
EARLY EMBRYOS...

YOU NEED A
ROSA BEDDINGTON
TO DO THAT.

ROSA BEDDINGTON



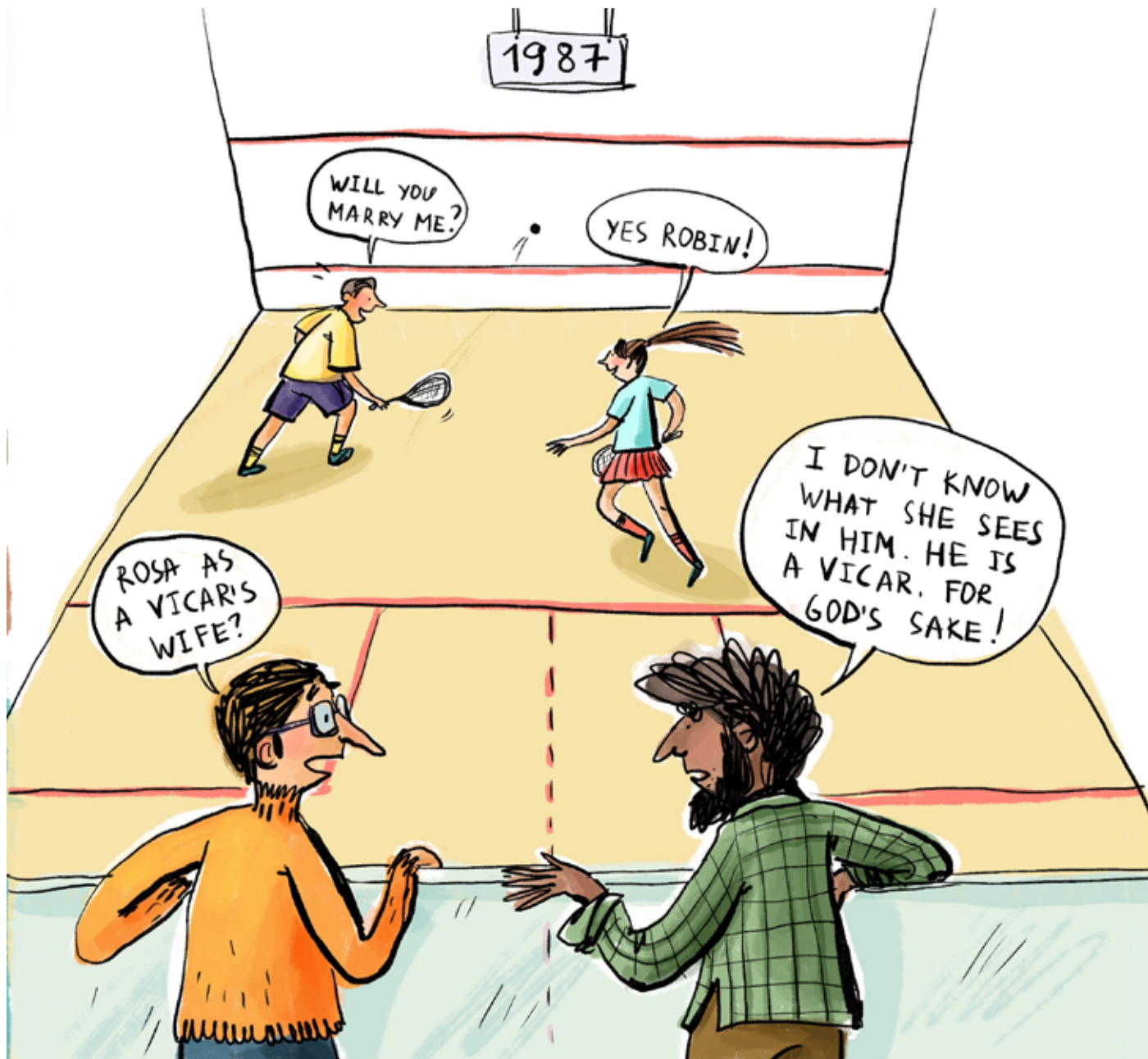
1987

WILL YOU
MARRY ME?

YES ROBIN!

ROSA AS
A VICAR'S
WIFE?

I DON'T KNOW
WHAT SHE SEES
IN HIM. HE IS
A VICAR. FOR
GOD'S SAKE!



1993, HEAD OF MAMMALIAN DIVISION, NIMR, MILL HILL

THE 'NODE' OF THE
MOUSE EMBRYO CAN
INDUCE A SECOND
NEURAL AXIS WHEN
TRANSPLANTED IN A
HOST EMBRYO.

YES, BUT...

SO IT DOES
THE SAME AS
THE ORGANISER
IN FROG
EMBRYOS?



DEARLY
BELOVED...

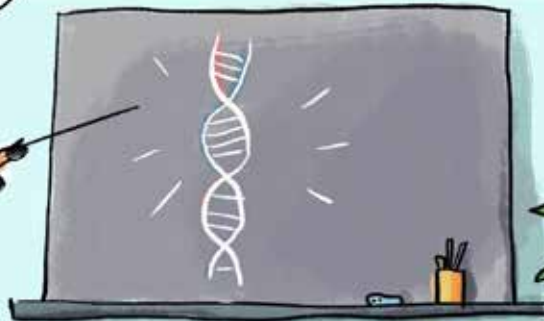
CAN I HAVE
SOME TEA?

PSSS! WE SHOULDN'T
DISTURB THE VICAR.
HE'S CONCENTRATING
ON HIS SERMON.

FROGS...
MICE...



GENETIC
MODIFICATIONS...



?

... I THINK THE HEAD OF
THE EMBRYO IS INDUCED
BY ONE OF THE TISSUES
SURROUNDING IT.

I WONDER
IF MY CHICKS
HAVE HATCHED?



1997

IT'S LATE ROSA.
DON'T YOU WANT
TO GO TO BED?

THEY ASKED ME TO DESIGN
THE WADDINGTON MEDAL FOR
DEVELOPMENTAL BIOLOGY.
WADDINGTON SAW THE SNAKE
EATING ITS TAIL AS AN EMBLEM
FOR HIS WORK "THE ONE, THE ALL".
I PUT IN REPRESENTATIONS OF
ALL THE DEVELOPMENTAL SYSTEMS
HE WORKED ON: CHICK EGGS
DROSOPHILA WINGS
AND CHROMOSOMES.





I BROUGHT YOU
THE MANUSCRIPT
OF 'MANIPULATING
THE MOUSE EMBRYO.'

THANKS... YOU KNOW...
I'VE HAD REASON TO
CONTEMPLATE MY LIFE
RECENTLY, AND I HAD
A BLOODY GOOD ONE!

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2020

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



