

# HOPE BEYOND HYPE

NEWS SCIENTISTS DISCOVER

*The Gazette*  
*The Sun*  
STEM CELLS  
MAY CURE  
CANCER

MINISTER

LAW

A STORY OF STEM CELLS FROM DISCOVERY TO THERAPY

**'HOPE BEYOND HYPE: A STORY OF STEM CELLS FROM DISCOVERY TO THERAPY'** IS © OPTISTEM, JAMIE HALL, KEN MACLEOD, EDWARD ROSS AND CATHY SOUTHWORTH, 2012.

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**OPTISTEM IS AN EC-FUNDED RESEARCH PROJECT THAT BRINGS TOGETHER STEM CELL BIOLOGISTS AND CLINICAL EXPERTS FROM ACROSS EUROPE WHO ARE INVESTIGATING STEM CELLS IN SKELETAL MUSCLE AND EPITHELIA. THE PROJECT BEGAN ON 1ST MARCH 2009 AND WILL RUN FOR FIVE YEARS.**

THIS COMIC AND ITS TRANSLATION WAS SUPPORTED BY FUNDING FROM TWO EUROPEAN COMMISSION'S SEVENTH FRAMEWORK PROGRAMME (FP7) PROJECTS: OPTISTEM AND EUROSTEMCELL. FOR INFORMATION ABOUT THESE PROJECTS VISIT:

**[WWW.OPTISTEM.ORG](http://WWW.OPTISTEM.ORG)**

**[WWW.EUROSTEMCELL.ORG](http://WWW.EUROSTEMCELL.ORG)**







WRITTEN BY KEN MACLEOD, WITH JAMIE HALL, EDWARD ROSS AND CATHY SOUTHWORTH.

ILLUSTRATED BY EDWARD ROSS.





THE **STRANGEST** DISCOVERIES CAN END UP **SAVING LIVES.**

HEY, COME  
AND HAVE A  
LOOK AT THIS!

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1974.

LIKE THE DISCOVERY THAT **SKIN** COULD BE GROWN IN A **DISH.**

IT'S FROM ONE OF MY  
**MICE**. IT'S **GROWN** FROM  
JUST A **FEW CELLS**.

YOU CAN LIFT IT UP  
WITH **TWEEZERS**...

YOU KNOW, THIS LOOKS  
LIKE **ACTUAL SKIN**!

IF WE COULD DO THIS WITH **HUMAN  
SKIN**, WE COULD MAKE **CUSTOM  
SKIN GRAFTS** FOR PATIENTS...  
THINK OF THE **POSSIBILITIES**!

THEY GOT TO WORK. FOR TWO  
YOUNG BOYS, THE **DISCOVERIES**  
THAT FOLLOWED WOULD PROVE  
TO BE A **LIFE-SAVER**.

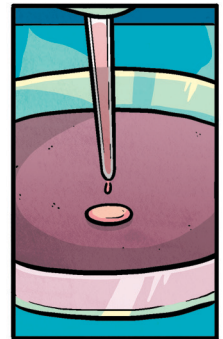
**BOSTON, 1983.** A TERRIBLE **FIRE**  
HAD SWEEPED THROUGH THEIR HOME.

THEY'VE GOT **BURNS** OVER MOST  
OF THEIR BODIES. THEY'LL **DIE**  
IN A **MATTER OF WEEKS**...

BURNS UNIT

I HEARD YOU'RE  
**PIONEERING** A NEW  
TECHNIQUE...

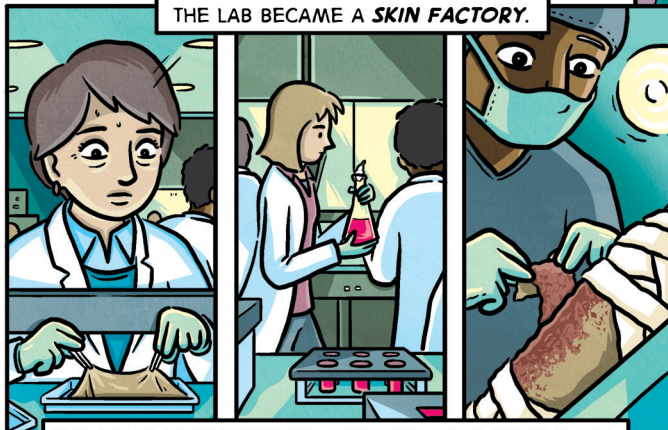
A **SMALL PATCH** OF UNDAMAGED  
**SKIN** FROM EACH BOY WAS TAKEN,  
**PREPARED** AND **PUT IN CULTURE**.



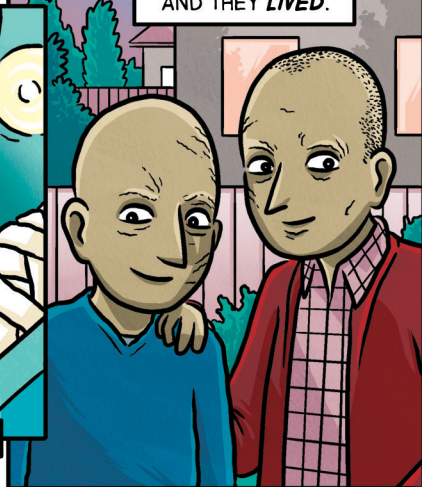
THEN THE SKIN BEGAN TO **GROW**...



THE SCIENTISTS WORKED **NON-STOP**.  
THE LAB BECAME A **SKIN FACTORY**.



AND THEY **LIVED**.



THE BOYS' **OWN SKIN** WAS **GRAFTED** BACK ONTO THEM.

THE RESULTS WERE **AMAZING**.



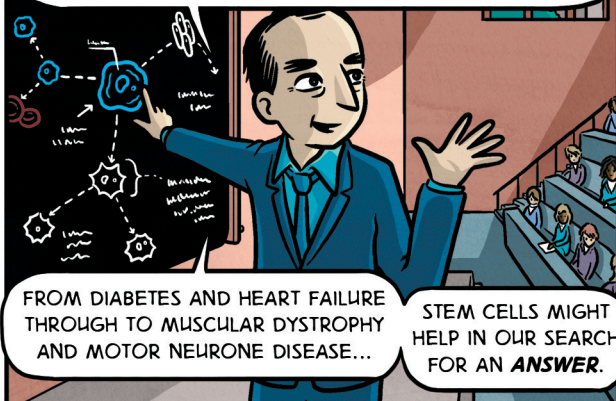
SCIENTISTS FROM **AROUND THE WORLD** WERE SLOWLY DISCOVERING  
THAT SKIN, BLOOD, AND OTHER PARTS OF THE BODY, NATURALLY  
**GROW** AND **REGENERATE** THANKS TO STEM CELLS.



BUT IT WOULD TAKE FURTHER  
SCIENTIFIC RESEARCH TO  
**PROPERLY UNDERSTAND**  
WHAT HAD HAPPENED.

A **WHOLE NEW AVENUE** OF SCIENCE WAS OPENING UP.  
STEM CELL RESEARCH **EXPLODED**.

BY HARNESSING THIS **POWER** IN THE CLINIC, WE COULD  
USE **STEM CELLS** TO TACKLE ALL MANNER OF DISEASES.



FROM DIABETES AND HEART FAILURE  
THROUGH TO MUSCULAR DYSTROPHY  
AND MOTOR NEURONE DISEASE...

STEM CELLS MIGHT  
HELP IN OUR SEARCH  
FOR AN **ANSWER**.

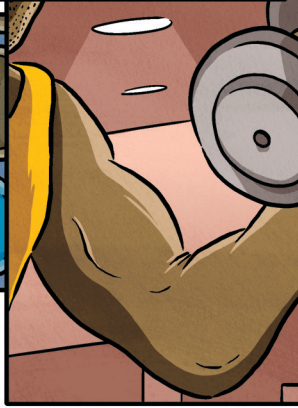
AND AS RESEARCH **CONTINUES**,  
MORE IS BEING DISCOVERED  
ABOUT STEM CELLS ALL THE TIME.



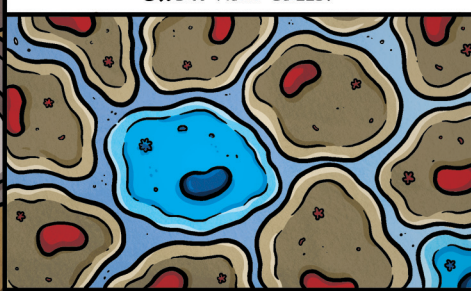
HEY! TAKE A  
LOOK AT **THIS**...



THERE ARE **TRILLIONS** OF CELLS IN THE HUMAN BODY. **EVERY DAY** NEW CELLS ARE NEEDED AS OLD ONES **WEAR OUT**, WOUNDS **HEAL** AND MUSCLES **DEVELOP**.

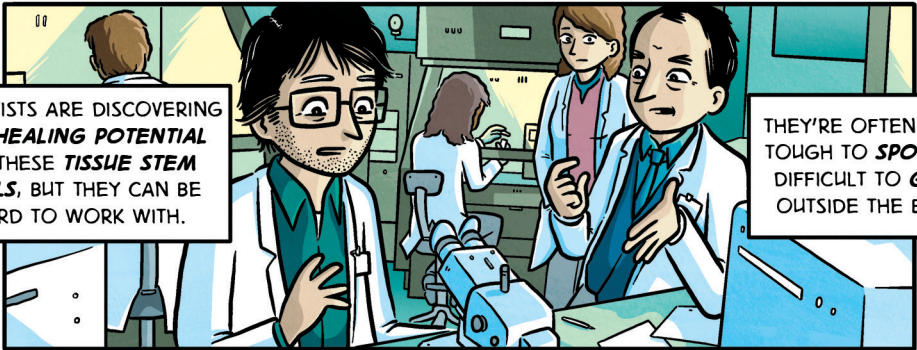


SINCE MOST CELLS **CAN'T REPLICATE**, IT IS THE JOB OF **STEM CELLS** TO **GROW** NEW CELLS.



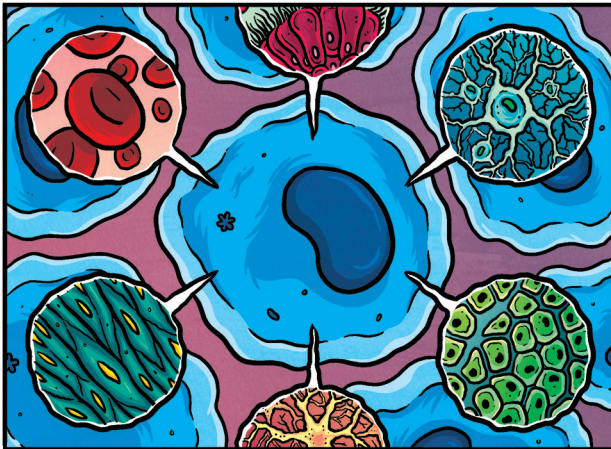
STEM CELLS ARE FOUND **THROUGHOUT** THE BODY, WITH **DIFFERENT KINDS** OF STEM CELLS PROVIDING FOR **DIFFERENT TISSUES**.

SCIENTISTS ARE DISCOVERING THE **HEALING POTENTIAL** OF THESE **TISSUE STEM CELLS**, BUT THEY CAN BE **HARD TO WORK WITH**.



THEY'RE OFTEN **RARE**, TOUGH TO **SPOT**, AND **DIFFICULT TO GROW** OUTSIDE THE BODY.

MEANWHILE, THE CELLS FOUND IN **EMBRYOS** ONLY A FEW DAYS OLD OFFER FURTHER CLUES. THESE AMAZING CELLS HAVE THE ABILITY TO GROW INTO **ANY CELL** IN THE HUMAN BODY.



IN THE LAB, **EMBRYONIC STEM CELLS** ARE USED TO **UNDERSTAND** HOW THE BODY **DEVELOPS** AND **HEALS**, AND HOW **STEM CELLS** WORK.

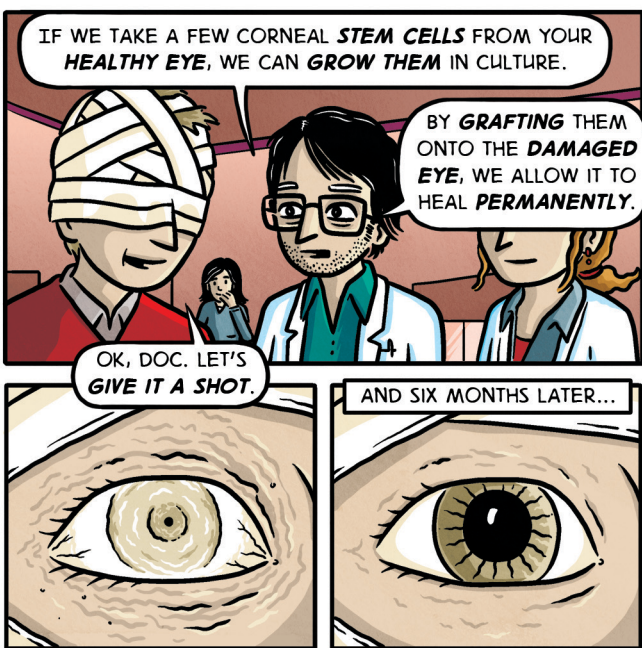
BY INVESTIGATING BOTH **TISSUE STEM CELLS** AND **EMBRYONIC STEM CELLS**, SCIENTISTS ARE PIECING TOGETHER A **PICTURE** OF HOW THE BODY **GROWS** AND **REGENERATES**.



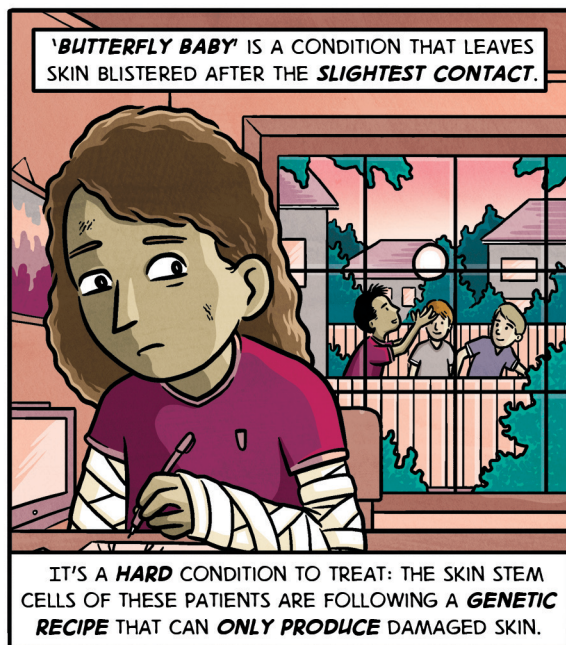
MAYBE THEN WE COULD **HARNESS** THE BODY'S MOST POWERFUL ABILITY: **TO REPAIR ITSELF**.



THERE HAVE BEEN SOME **EXCITING SUCCESSES** SO FAR. IN **SOME CASES**, IT HAS BEEN AS STRAIGHTFORWARD AS MOVING **HEALTHY STEM CELLS** TO THE **DAMAGED** BODY-PART...



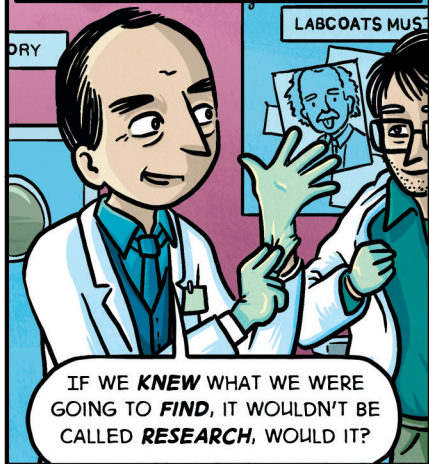
IN **SOME CONDITIONS** THE STEM CELLS THEMSELVES ARE **FAULTY**.



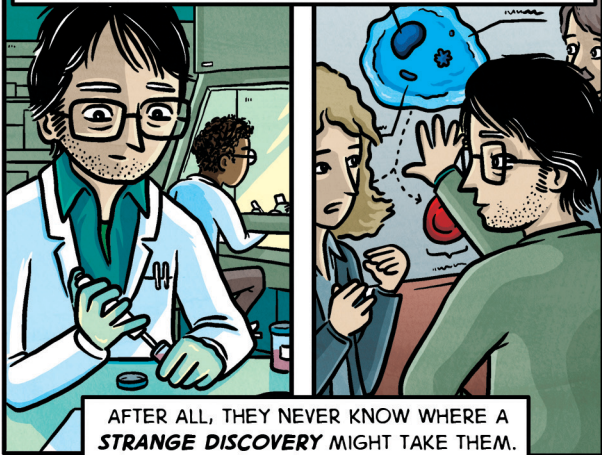
THIS HOLDS OUT **EXCITING POSSIBILITIES** FOR CURING OTHER **GENETIC CONDITIONS** LIKE MUSCULAR DYSTROPHY AND WISKOTT-ALDRICH SYNDROME.



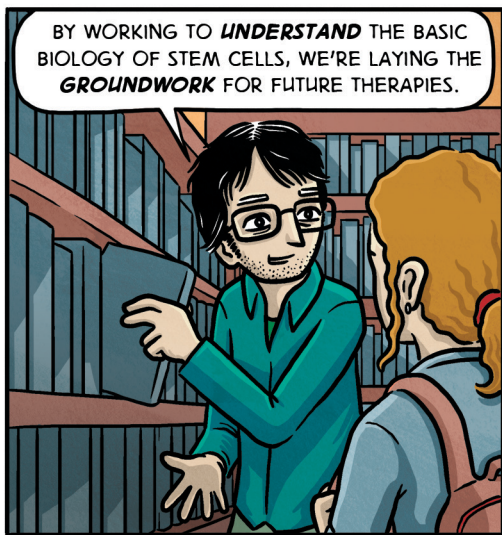
THE **PROBLEM** WITH SETTING OUT TO **CREATE** THERAPIES IS THAT STEM CELL SCIENTISTS CAN'T KNOW IN ADVANCE **WHERE** THEIR RESEARCH **MIGHT** LEAD.



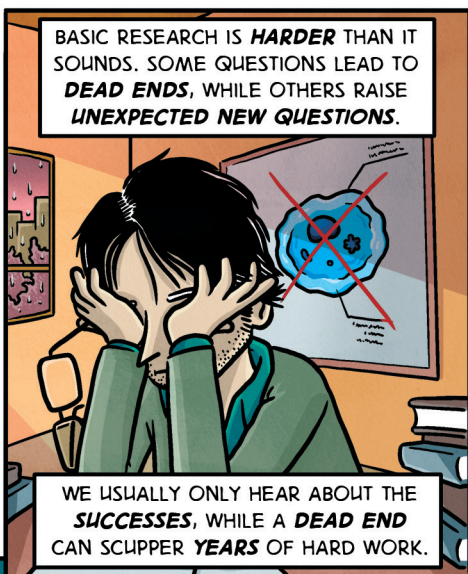
WHEN SCIENTISTS DO **BASIC RESEARCH**, THEY'RE LOOKING TO **ANSWER ANY QUESTIONS** THEY HAVE ABOUT STEM CELLS, WITHOUT WORRYING WHETHER THE FINDINGS HAVE AN IMMEDIATE PRACTICAL **APPLICATION**.



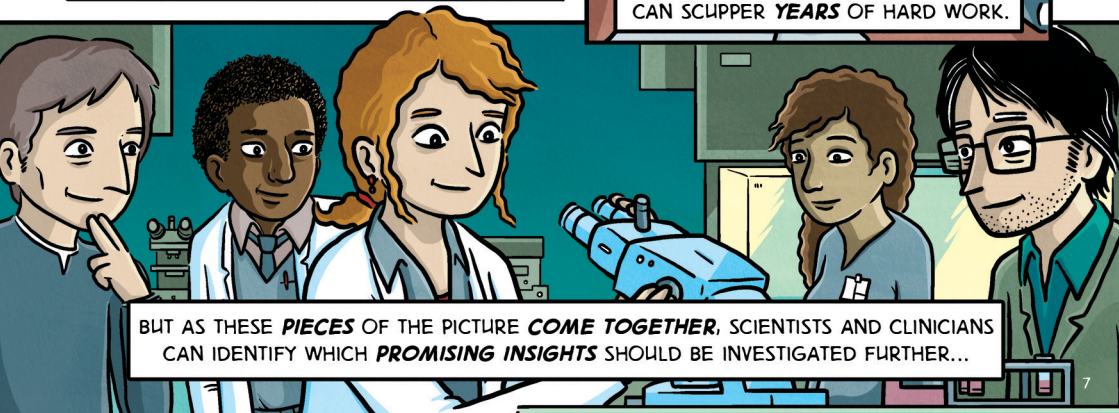
BY WORKING TO **UNDERSTAND** THE BASIC BIOLOGY OF STEM CELLS, WE'RE LAYING THE **GROUNDWORK** FOR FUTURE THERAPIES.



BASIC RESEARCH IS **HARDER** THAN IT SOUNDS. SOME QUESTIONS LEAD TO **DEAD ENDS**, WHILE OTHERS RAISE **UNEXPECTED NEW QUESTIONS**.



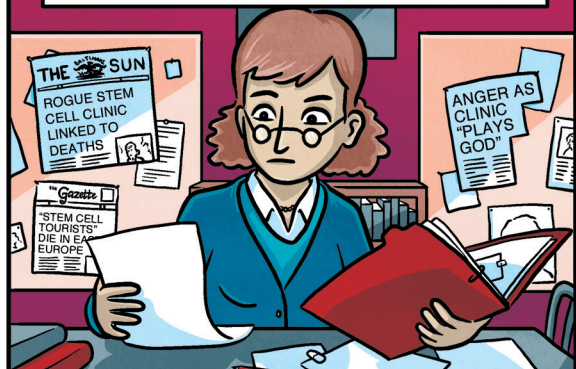
BUT AS THESE **PIECES** OF THE PICTURE **COME TOGETHER**, SCIENTISTS AND CLINICIANS CAN IDENTIFY WHICH **PROMISING INSIGHTS** SHOULD BE INVESTIGATED FURTHER...





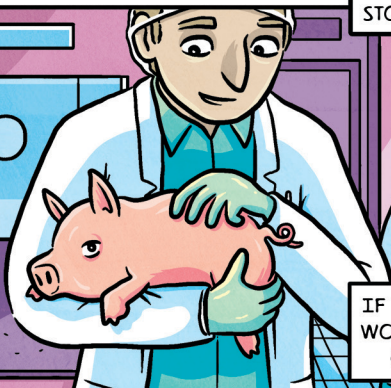
**EVEN WHEN EARLY RESULTS ARE ENCOURAGING, WHAT WORKS IN A TEST TUBE MIGHT NOT WORK IN A PATIENT'S BODY.**

WITHOUT FIRST **TESTING** IF THEY ARE SAFE, POTENTIAL **CURES** CAN BECOME **DEATH-TRAPS**.



**REGULATIONS** HELP TO **PREVENT** THIS, ENSURING THAT **SAFE PROCEDURE** IS FOLLOWED EVERY STEP OF THE WAY.

SCIENTISTS NEED TO **ENSURE** THEIR ANIMALS **DO NOT SUFFER UNNECESSARILY**. ANIMAL RESEARCH IS **TIGHTLY CONTROLLED**, REQUIRING A **LICENCE** AND SPECIAL **TRAINING**.



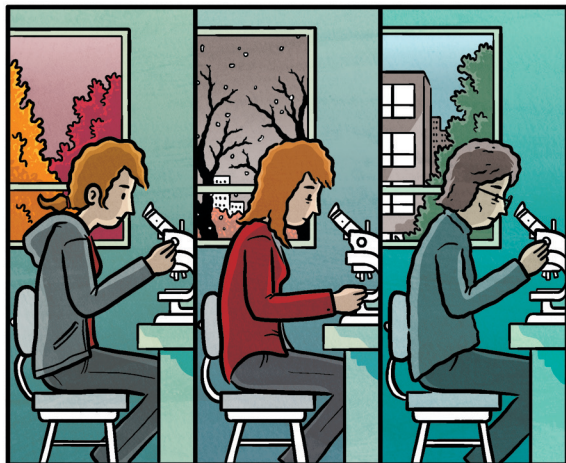
FIRST, RESEARCHERS MUST SEE IF THEIR **TREATMENT** GIVES THE **SAME RESULTS** IN ANIMALS, WHICH CAN REVEAL **COMPLICATIONS** TEST TUBES CAN'T.



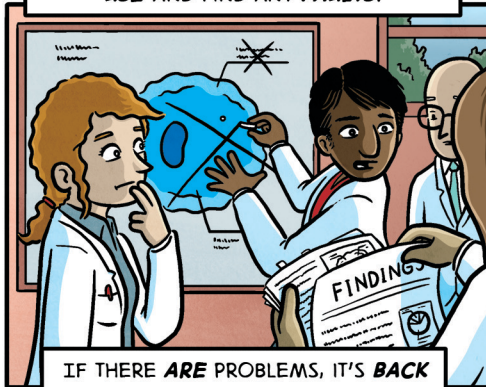
THEY ALSO NEED TO WORK OUT HOW TO **ADMINISTER** THE TREATMENT AND STOP THE BODY **REJECTING THE CELLS**.

IF RESEARCHERS GET **GOOD RESULTS** WORKING WITH **SMALL ANIMALS**, THEY CAN WORK WITH **LARGER ONES**.

BUT THIS CAN LEAD TO **EVEN MORE QUESTIONS**, WHICH TAKE EVEN MORE **TIME** AND **MONEY** TO ANSWER.



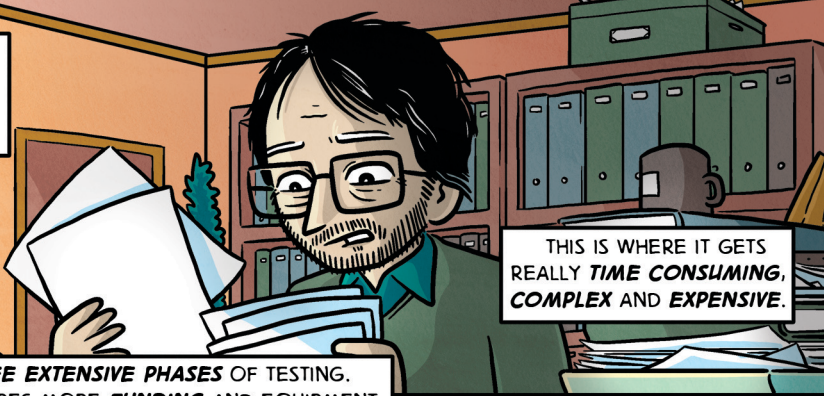
**EVENTUALLY** RESEARCHERS CAN **PUBLISH** THEIR RESULTS FOR OTHER SCIENTISTS TO **USE** AND FIND ANY **FAULTS**.



IF THERE **ARE** PROBLEMS, IT'S **BACK TO THE LAB...** OR EVEN THE **LIBRARY...**



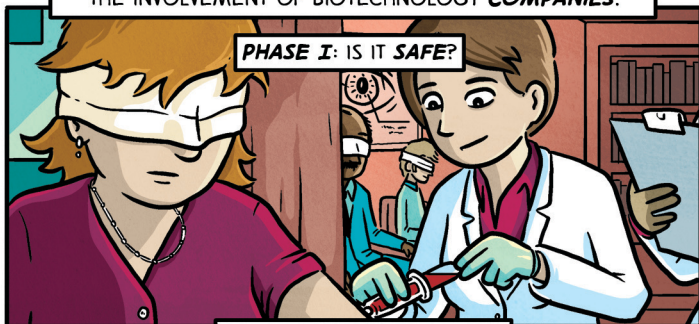
AFTER ALL THAT, THEY'RE **READY** TO START TRYING OUT THE TREATMENT ON **HUMANS**.



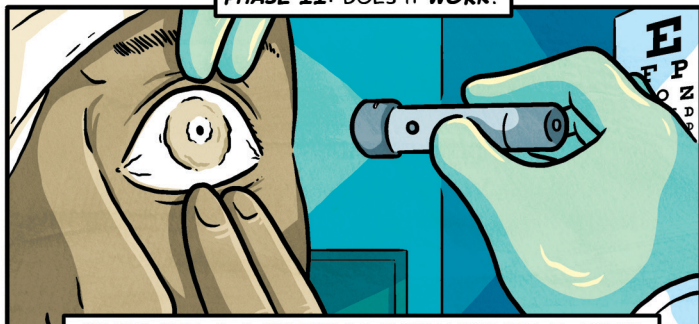
THIS IS WHERE IT GETS REALLY **TIME CONSUMING**, **COMPLEX** AND **EXPENSIVE**.

THERE ARE **THREE EXTENSIVE PHASES** OF TESTING. **EACH** PHASE REQUIRES MORE **FUNDING** AND EQUIPMENT, FURTHER TRAINED **SPECIALISTS** AND VOLUNTEERS, AND THE INVOLVEMENT OF BIOTECHNOLOGY **COMPANIES**.

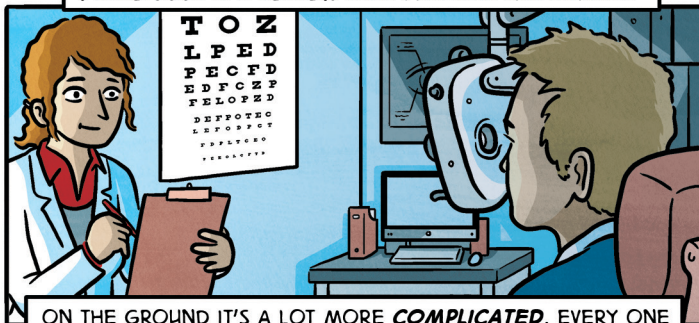
**PHASE I: IS IT SAFE?**



**PHASE II: DOES IT WORK?**



**PHASE III: IS IT BETTER** THAN PREVIOUS TREATMENTS?



ON THE GROUND IT'S A LOT MORE **COMPLICATED**. EVERY ONE OF THESE PHASES IS A HUGE UNDERTAKING THAT TAKES **YEARS**. BUT EACH COMPLETED PHASE ALSO BRINGS THE TREATMENT **ONE STEP CLOSER** TO BECOMING A **WORKING THERAPY**.

IF THERE ARE **PROBLEMS** AT **ANY** OF THESE STEPS, IT CAN MEAN HAVING TO START **ALL OVER AGAIN**.



**MEANWHILE**, THERE'S OTHER RESEARCH GOING ON, WHICH BRINGS UP **NEW QUESTIONS**, AND MAY EVEN SUGGEST AN APPROACH **MORE PROMISING** THAN A **WHOLE LIFE'S WORK**.

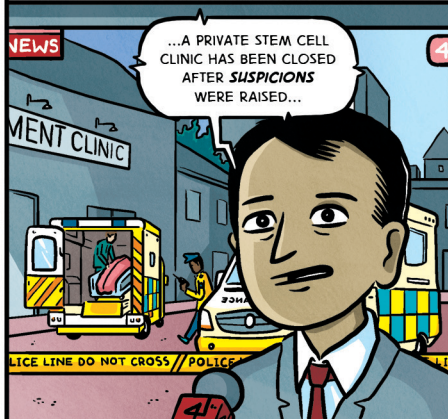




**REGULATIONS** and **SAFETY CONCERNS** TAKE HUGE AMOUNTS OF **TIME** AND **EFFORT**, SLOWING THE RESEARCH PROCESS DOWN.

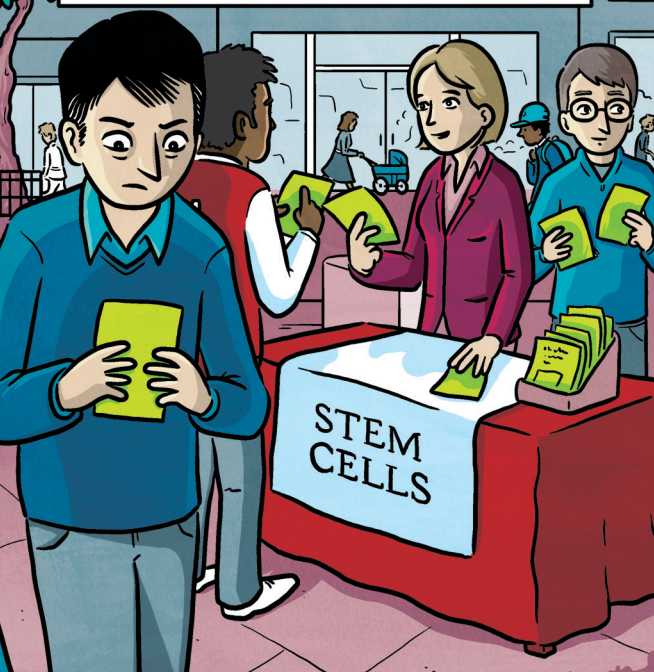


BUT IT'S **IMPORTANT** THAT SCIENCE IS **GUIDED** BY **ETHICS** -- QUESTIONS OF RIGHT AND WRONG.



**PATIENTS** NEED TO BE **PROTECTED** FROM **ROGUE SCIENCE**, WHILE SCIENTISTS WANT TO **ALLEVIATE** SUFFERING, **NOT CAUSE** IT.

**STEM CELL SCIENCE** IS A RELATIVELY **NEW FIELD**. WITH IT COME SOME NEW AND CHALLENGING **QUESTIONS** THAT **DIVIDE** **PUBLIC OPINION**.

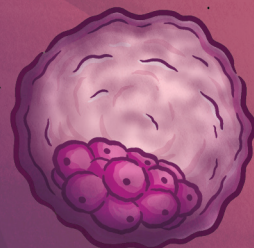


**REGULATIONS** and **LAWS** ARE BASED ON THESE COMPROMISES, **GUIDING** **RESEARCH** AND ENSURING IT IS **SAFE**, **ETHICAL** AND **DEMOCRATIC**.



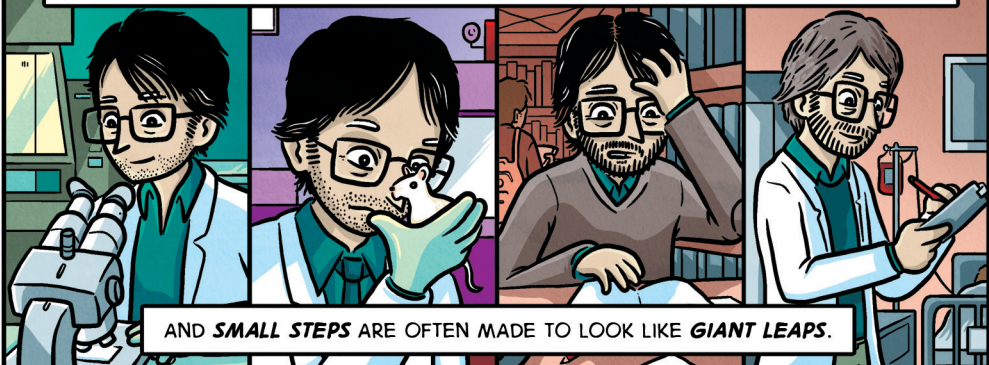
AS **INDIVIDUALS** WE HAVE TO DECIDE WHERE WE STAND, AND FIND A **COMPROMISE** AS A **SOCIETY**.

AND AS WITH **ANY COMPROMISE**, NOT EVERYONE IS HAPPY WITH THE **DECISIONS** THAT ARE MADE.





IT'S A **LONG JOURNEY** FROM THAT LAB-BENCH DISCOVERY TO A **WORKING THERAPY**...



AND **SMALL STEPS** ARE OFTEN MADE TO LOOK LIKE **GIANT LEAPS**.

**SCIENTISTS** APPLYING FOR GRANTS NEED TO MENTION MEDICAL POTENTIAL **LONG BEFORE** IT'S REALISTICALLY POSSIBLE.

THE **UNIVERSITIES** AND **COMPANIES** THAT SCIENTISTS WORK FOR MAKE SCIENTISTS' RESEARCH SOUND **EXCITING** TO SPARK INTEREST AND **GAIN EXPOSURE**.

AND THE **MEDIA** NEED TO SELL THESE COMPLEX IDEAS TO THEIR AUDIENCE TO KEEP THEM **INFORMED** AND **ENTERTAINED!**

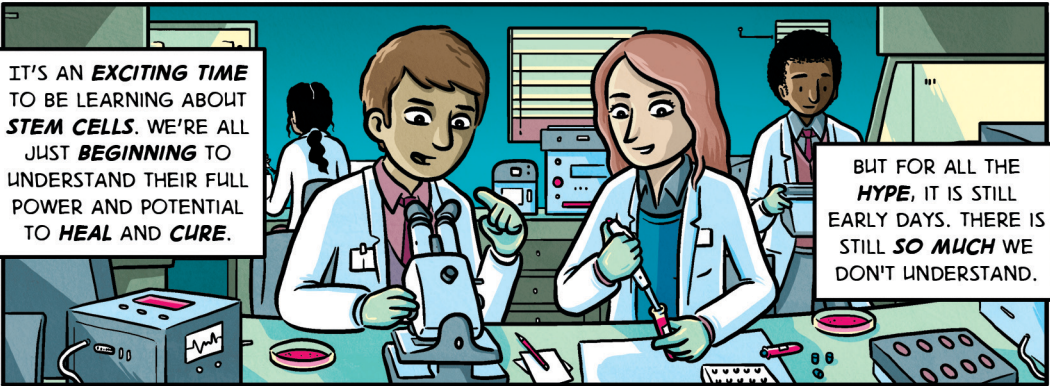


THEN, ONCE IT'S OUT ON THE INTERNET, **ANYTHING GOES**.

THIS LEAVES A **HUGE GAP** BETWEEN WHAT PEOPLE **EXPECT** FROM RESEARCH AND WHAT IT CAN **DELIVER** NOW.





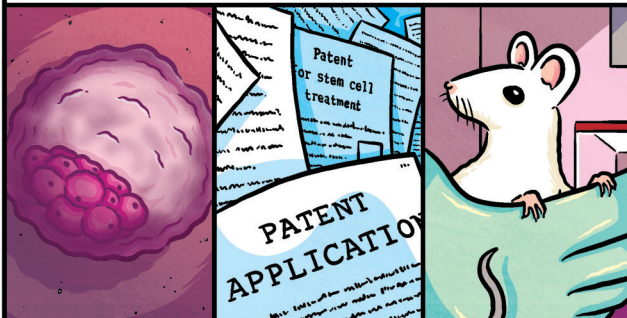
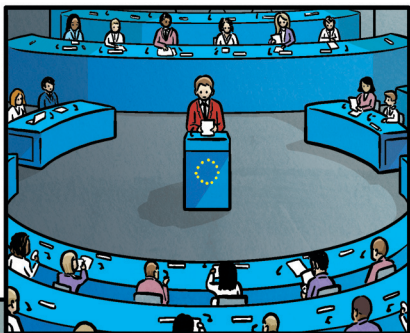


IT'S AN **EXCITING TIME** TO BE LEARNING ABOUT **STEM CELLS**. WE'RE ALL JUST **BEGINNING** TO UNDERSTAND THEIR FULL POWER AND POTENTIAL TO **HEAL AND CURE**.

BUT FOR ALL THE **HYPE**, IT IS STILL EARLY DAYS. THERE IS STILL **SO MUCH** WE DON'T UNDERSTAND.

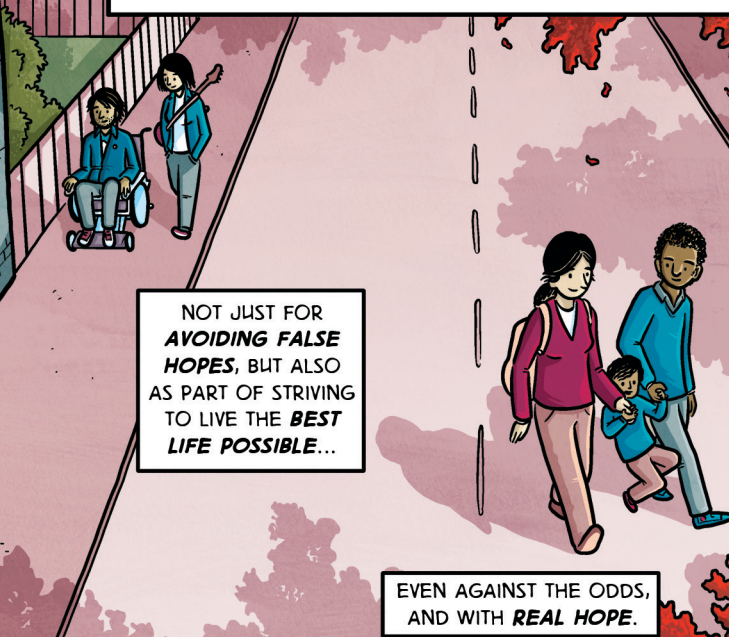
MEANWHILE, **SOCIETY** IS COMING TO GRIPS WITH SOME COMPLEX **ETHICAL ISSUES**, AND OUR **LEGAL SYSTEMS** ARE ONLY SLOWLY **CATCHING UP**.

THE MOST IMPORTANT THING IS TO **EDUCATE OURSELVES**, NOT JUST IN THE **SCIENCE** OF STEM CELLS, BUT ALSO IN THE **POLITICS** AND **ETHICS** SURROUNDING IT.



NOTHING COULD **IMPROVE** THE PROSPECTS FOR THIS NEW FIELD OF MEDICINE MORE THAN A **WELL-INFORMED PUBLIC**.

FOR THOSE OF US DIRECTLY AFFECTED AS **PATIENTS** OR AS **CARERS**, BECOMING BETTER INFORMED IS EVEN **MORE IMPORTANT...**



NOT JUST FOR **AVOIDING FALSE HOPES**, BUT ALSO AS PART OF STRIVING TO LIVE THE **BEST LIFE POSSIBLE...**

EVEN AGAINST THE ODDS, AND WITH **REAL HOPE**.

FOR MORE INFORMATION, AND DOWNLOADABLE  
AND INTERACTIVE VERSIONS OF THIS COMIC:



**[WWW.EUROSTEMCELL.ORG/HOPEBEYONDHYPE](http://WWW.EUROSTEMCELL.ORG/HOPEBEYONDHYPE)**

OR CONTACT: [CATHY.SOUTHWORTH@ED.AC.UK](mailto:CATHY.SOUTHWORTH@ED.AC.UK)

THIS COMIC IS AVAILABLE IN FIVE LANGUAGES:  
ENGLISH, FRENCH, GERMAN, ITALIAN AND SPANISH.

MORE FROM THE CREATORS AT THEIR WEBSITES AND TWITTER:

**[WWW.KENMACLEOD.BLOGSPOT.CO.UK](http://WWW.KENMACLEOD.BLOGSPOT.CO.UK)**

**[WWW.EDWARDROSS.CO.UK](http://WWW.EDWARDROSS.CO.UK)**

**[@AMENDLOCKE](https://twitter.com/AMENDLOCKE)**

**[@JPJHALL](https://twitter.com/JPJHALL)**

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THE CREATORS WOULD LIKE TO THANK THE FOLLOWING FOR THEIR HELP IN DEVELOPING THE COMIC:

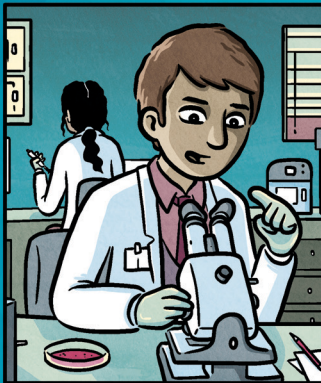
**PROFESSOR GIULIO COSSU** AND **PROFESSOR MICHELE DE LUCA** WHO SHARED STORIES  
OF THEIR SCIENCE FROM THE LAB BENCH TO THE HOSPITAL BEDSIDE.

**PROFESSOR CLARE BLACKBURN** FOR HER EDITING OF THE COMIC. **DR JAN BARFOOT,**  
**INGRID HEERSCHKE** AND **EMMA KEMP** FOR THEIR EDITING AND SUPPORT. **KATE DOHERTY**  
FOR HER WORK IN WEB MOUNTING THE COMIC AND MAKING IT INTERACTIVE.



# FROM LAB BENCH TO HOSPITAL BEDSIDE

Stem cells are found throughout our bodies. They hold the key to how we grow and heal. In the lab, scientists are trying to discover the secrets of these cells and put them to use treating diseases. This story follows the scientific journey from lab bench to hospital bedside.



A comic written by Ken MacLeod, with Jamie Hall, Edward Ross and Cathy Southworth.  
Illustrated and designed by Edward Ross.