

RecerCòmics no. 7

WALKING AGAIN WITH

ABLE



Generalitat
de Catalunya

XAVIER ROCA
LAURA BENEDITO

The ideas developed at universities and research centres can end up as part of our everyday lives in the form of products, services and other innovations that make our lives easier. The *RecerCòmics* collection gives visibility to a selection of research centre spin-offs and knowledge transfer projects. A case in point, and the subject of this comic, is **ABLE HUMAN MOTION S.L.**, which grew out of the Biomechanical Engineering Laboratory (**BIOMECH**), a Universitat Politècnica de Catalunya–BarcelonaTech (**UPC**) research group and one of the seven areas of the Research Centre for Biomedical Engineering (**CREB**). The comics also showcase the work of young illustrators. This time it featured the work of illustrator **Laura Benedito Bernat**, former student of Plastic Arts and Comic Design at the Escola d'Art Pau Gargallo.

<http://universitatsirecerca.gencat.cat/recercomics>



Xavier Roca (Barcelona, 1966). His first interest was in becoming a comic book artist, but, looking for job stability and showing incredible foresight, he decided to study journalism. He has written cultural pieces and film reviews for the newspapers *Avui* and *El Punt Avui* and writes for *Catorze*, *El Temps de les Arts* and *Gran enciclopèdia catalana*. As a comic book and graphic humour scriptwriter he has had work published in *El Jueves*, *Avui*, *El Periódico* and *La Vanguardia* and currently writes and draws a monthly strip for the magazine *El Castell*.



Laura Benedito Bernat (Barcelona, 1998). Drawing and design have always been one of the most important parts of her life. She wholeheartedly believes her training began with her father (a graphic designer), when he taught her how to draw a water jug when she was eight. After that she spent all her free time, summer and holidays pencil in hand, making up characters for whom she imagined worlds she could not yet draw. With the support and trust of her parents, she studied Fine Arts at the University of Barcelona and, following a pandemic and a rediscovery of her interest in comics, went on to study Comic Design at Escola d'Art Pau Gargallo. Today she combines a boring part-time job with one that is much more stimulating: that of a commissioned illustrator. In the future she sees herself working as a character designer and illustrator for a studio, surrounded by fantastic worlds.

Script: Xavier Roca.

Illustrations and cover: Laura Benedito Bernat.

In conjunction with: Toni Benages, teacher of Plastic Arts and Comic Design at the Escola d'Art Pau Gargallo; Ivan Camps Rivas (first person with a spinal cord injury to test pilot the ABLE exoskeleton); Alfons Carnicero Carmona (co-founder and CEO of ABLE Human Motion); Alex Garcia Farreny (co-founder and technical director of ABLE Human Motion); Josep Maria Font Llagunes (co-founder of ABLE Human Motion, full professor of Mechanical Engineering and director of the UPC BIOMECH research group) and Maria Shulaeva (marketing expert at ABLE Human Motion).

Editorial board: Joan Gómez Pallarès, Olga Alay, Salvador Maturana, Olga Campillo, Oriol Homar.

Translation and correction: Tys 96, SL.

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STORY:
XAVIER ROCA

ART:
LAURA BENEDITO



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THIS IS IVAN CAMPS - HE HAS A PARTNER AND A SON, HE WORKS IN A MULTINATIONAL LOGISTICS COMPANY AND HE'S VERY KEEN ON SPORTS, ESPECIALLY ADVENTURE SPORTS.



HOW ARE YOU DOING, IVAN?

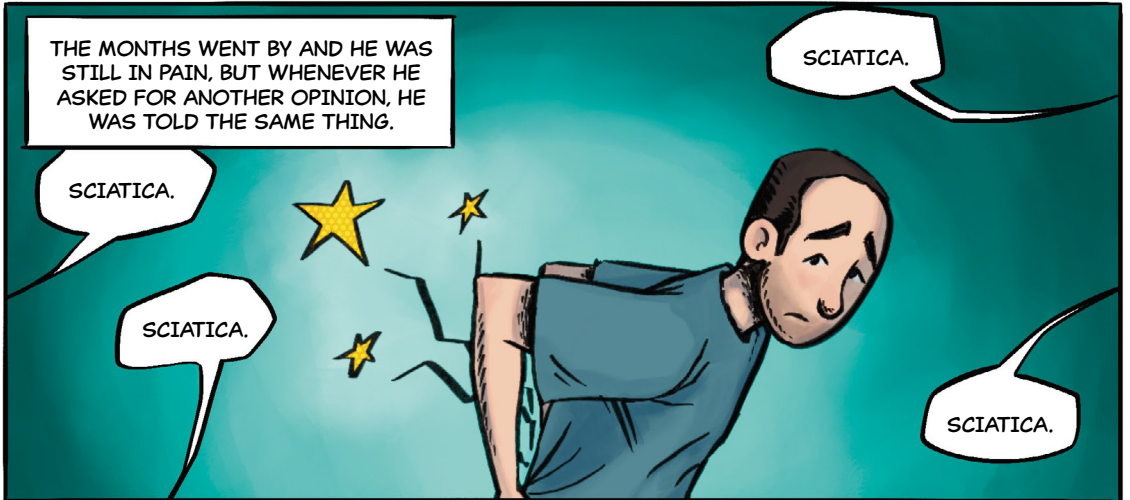
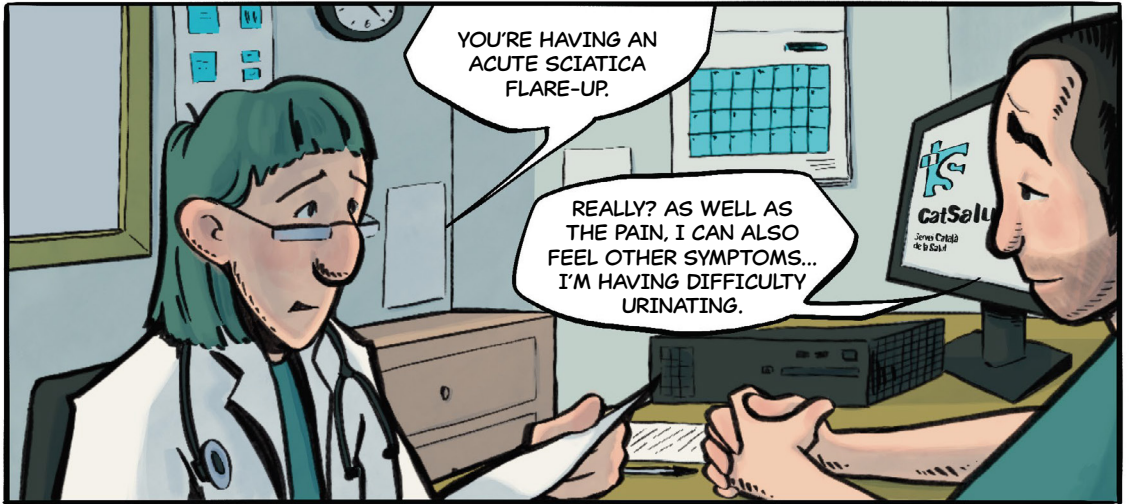
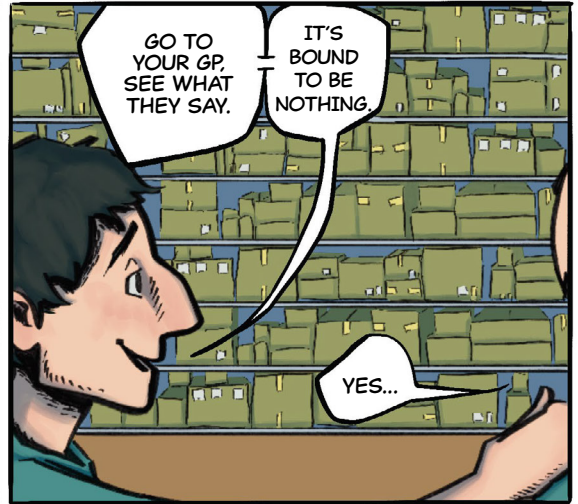
BUT HE DOESN'T KNOW THAT HIS LIFE IS ABOUT TO BE TURNED UPSIDE DOWN.



WELL, MY HOLIDAYS ARE ABOUT TO START. I'M KNOCKING OFF IN A FEW HOURS! THEN I'M OFF TO THE COUNTRY WITH THE FAMILY.



OUCH!!!



UNTIL, AS THEY COULDN'T FIND THE CAUSE OF THE PAIN, HIS TRAUMA DOCTOR DECIDED TO SCAN A LARGER AREA.

WE'LL DO AN MRI OF YOUR WHOLE BACK, NOT JUST THE LOWER BACK, TO SEE IF WE CAN FIND THE SOURCE OF THE PAIN.

YES, BECAUSE IT'S JUST GETTING WORSE AND WORSE...

HERE IN THE DORSAL AREA I CAN SEE SOMETHING I DON'T REALLY LIKE THE LOOK OF, BETWEEN VERTEBRAE 10 AND 11...

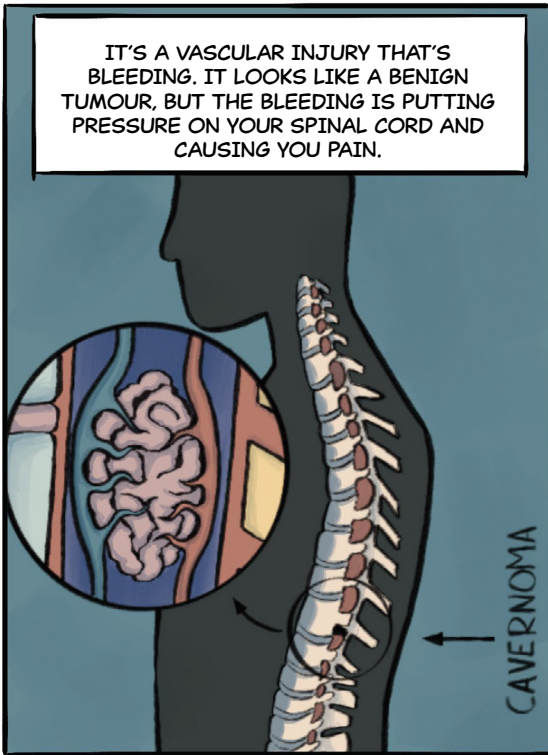
I WANT SOMEONE FROM NEUROSURGERY TO TAKE A LOOK AT IT.

AND FINALLY THE NEUROSURGEON GAVE HIM A DIAGNOSIS.

THAT IMAGE YOU SAW IS A **CAVERNOMA** ON THE SPINAL CORD.

CAVERNOMA? I'VE NEVER HEARD OF IT, BUT I DON'T LIKE THE SOUND OF IT.

WHAT IS IT??



SO ON 15 JANUARY 2015, THEY OPERATED ON IVAN. AND, JUST AS THEY HAD SAID COULD HAPPEN, HE LEFT THE OPERATING ROOM WITH NO MOVEMENT IN HIS LEGS.

LET'S TAKE IT ONE STEP AT A TIME... WE'RE GOING TO KEEP YOU IN HOSPITAL FOR A FEW DAYS AND THEN WE'LL REFER YOU TO THE GUTTMANN INSTITUTE, A HOSPITAL WHERE THEY ARE EXPERTS IN NEUROREHABILITATION.

WILL I EVER BE ABLE TO LIVE THE LIFE I USED TO LIVE? AND WHAT ABOUT SPORT?

WHILE HE WAS AT THE GUTTMANN INSTITUTE, HE WAS DOING FIVE HOURS OF REHABILITATION A DAY.

HOW ARE YOU FEELING, IVAN?

WELL, SINCE I ARRIVED I'VE BEEN ABLE TO MOVE MY LEFT LEG A LITTLE BIT, ALTHOUGH I DON'T HAVE ENOUGH STRENGTH TO STAND UP.

BUT I CAN'T DO ANYTHING WITH THE RIGHT LEG.

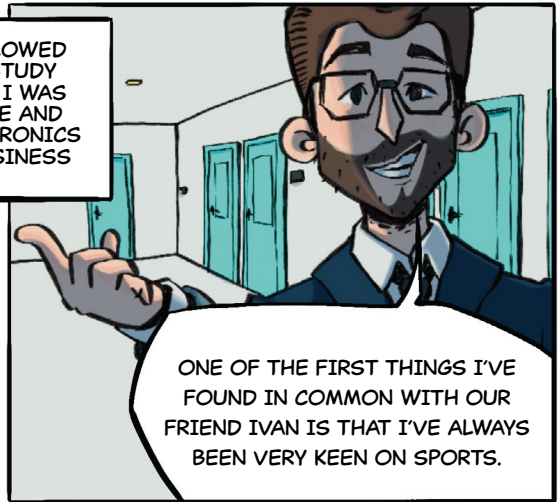
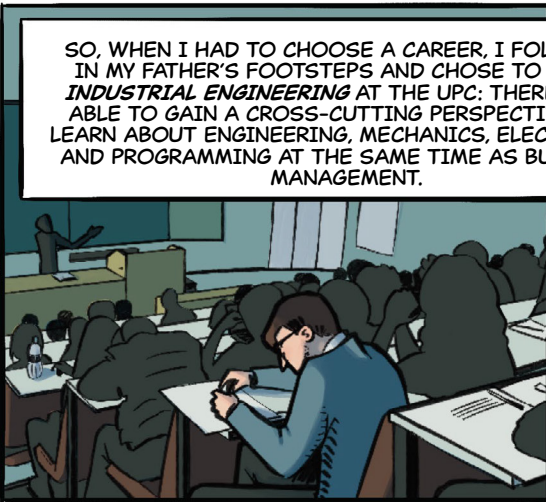
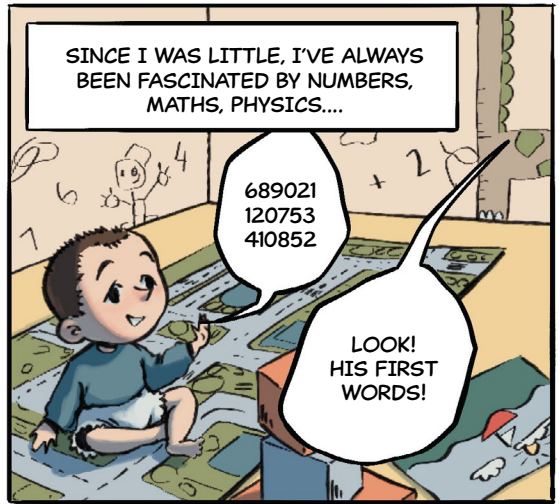
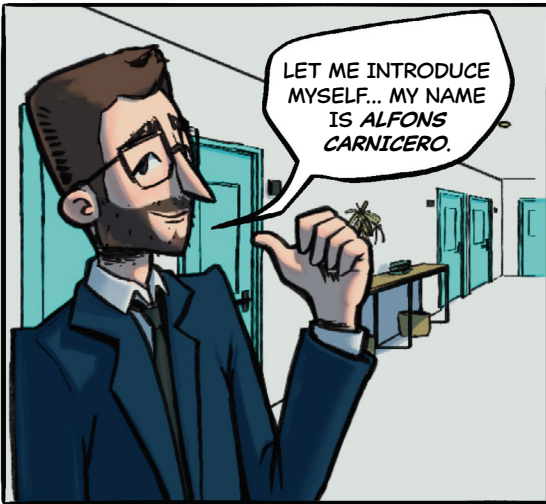
AFTER HE WAS DISCHARGED, IVAN CONTINUED TO GO TO THE GUTTMANN FOR A FEW HOURS A WEEK. AND ONE DAY, DURING A CHECK-UP...

IVAN, RESEARCHERS FROM THE UPC*, ARE LOOKING FOR SOMEONE WITH A SPINAL CORD INJURY TO TAKE PART IN A PROJECT.

WOULD YOU BE INTERESTED?

WHY NOT? I'VE GOT NOTHING TO LOSE.

*UPC: UNIVERSITAT POLITÈCNICA DE CATALUNYA-BARCELONATECH.



SO, LIKE I HAD ALREADY DONE IN SECONDARY SCHOOL, IN THE FINAL PROJECT FOR MY INDUSTRIAL ENGINEERING DEGREE, I WANTED TO COMBINE MY TWO GREAT PASSIONS: SCIENCE AND SPORTS.

SO, THE IDEA I HAVE IS TO APPLY MY KNOWLEDGE OF BIOMECHANICS TO IMPROVE THE SHOOTING PERFORMANCE OF PROFESSIONAL BASKETBALL PLAYERS.

THIS IS *JOSE MARIA FONT*, ONE OF MY UNIVERSITY LECTURERS; REMEMBER HIS NAME, BECAUSE YOU'LL HEAR IT AGAIN.

BUT THERE'S SOMETHING ELSE I HAVE IN COMMON WITH IVAN - MY LIFE WAS ALSO SUDDENLY TURNED UPSIDE DOWN.

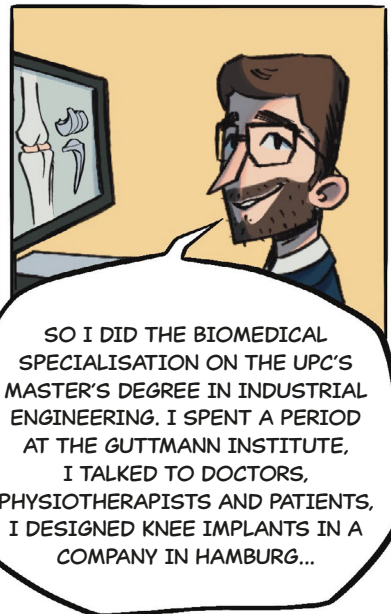
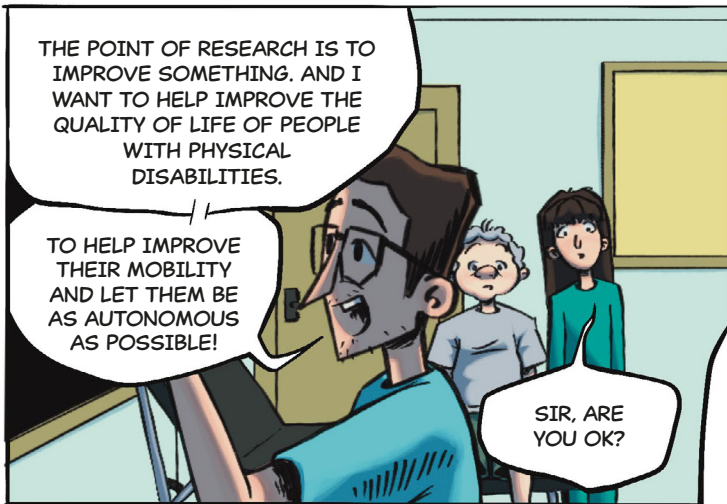
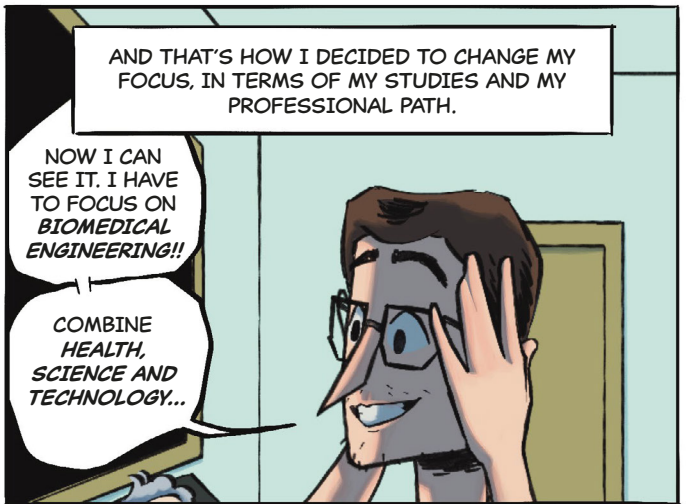
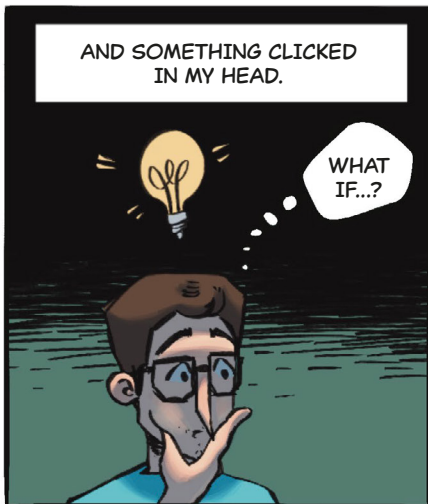
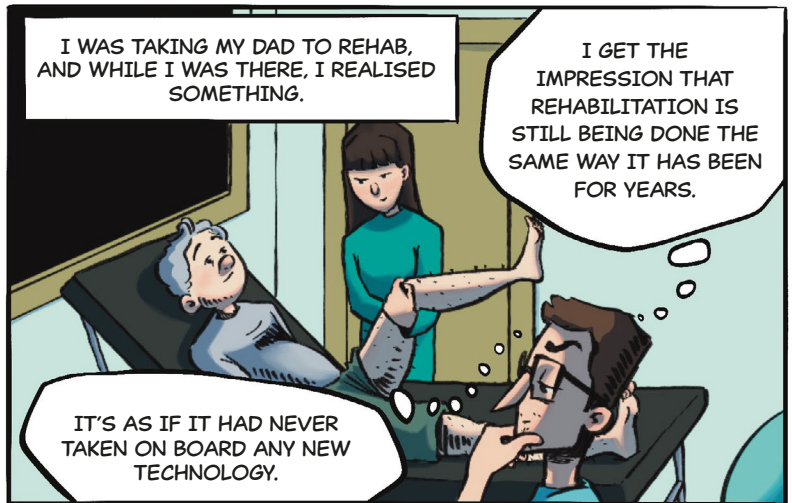
THAT WAS THE DAY I RECEIVED SOME UNEXPECTED NEWS.

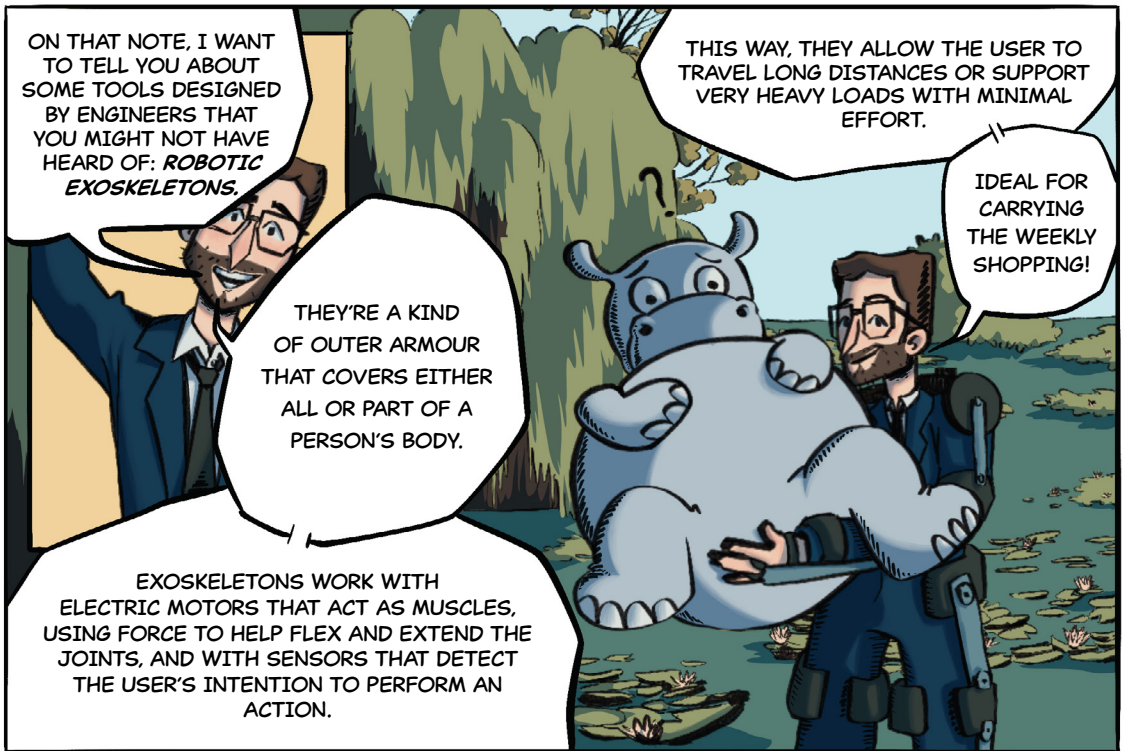
WHAT'S UP? I'M IN CLASS.

ALFONS... SOMETHING'S HAPPENED.

DAD HAS HAD A **STROKE**.

WHAT???





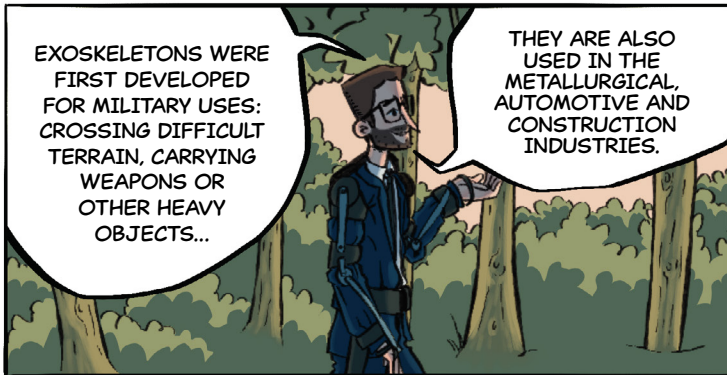
ON THAT NOTE, I WANT TO TELL YOU ABOUT SOME TOOLS DESIGNED BY ENGINEERS THAT YOU MIGHT NOT HAVE HEARD OF: **ROBOTIC EXOSKELETONS**.

THEY'RE A KIND OF OUTER ARMOUR THAT COVERS EITHER ALL OR PART OF A PERSON'S BODY.

EXOSKELETONS WORK WITH ELECTRIC MOTORS THAT ACT AS MUSCLES, USING FORCE TO HELP FLEX AND EXTEND THE JOINTS, AND WITH SENSORS THAT DETECT THE USER'S INTENTION TO PERFORM AN ACTION.

THIS WAY, THEY ALLOW THE USER TO TRAVEL LONG DISTANCES OR SUPPORT VERY HEAVY LOADS WITH MINIMAL EFFORT.

IDEAL FOR CARRYING THE WEEKLY SHOPPING!



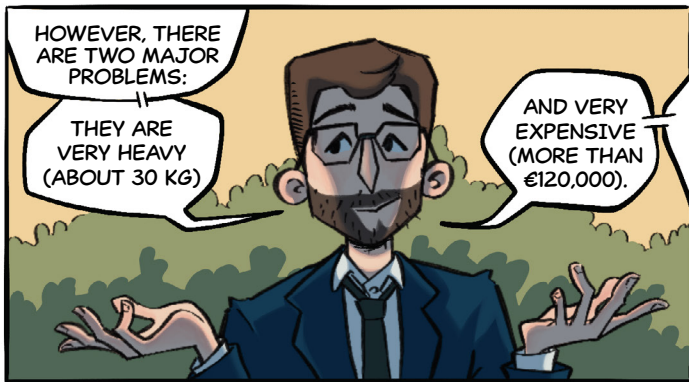
EXOSKELETONS WERE FIRST DEVELOPED FOR MILITARY USES: CROSSING DIFFICULT TERRAIN, CARRYING WEAPONS OR OTHER HEAVY OBJECTS...

THEY ARE ALSO USED IN THE METALLURGICAL, AUTOMOTIVE AND CONSTRUCTION INDUSTRIES.



BUT LET'S FOCUS ON WHAT WE'RE INTERESTED IN HERE:

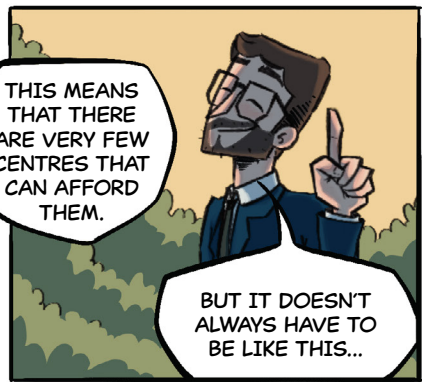
EXOSKELETONS ARE MAINLY USED TO IMPROVE THE MOBILITY OF DISABLED PEOPLE AND HELP THEM WITH THEIR REHABILITATION.



HOWEVER, THERE ARE TWO MAJOR PROBLEMS:

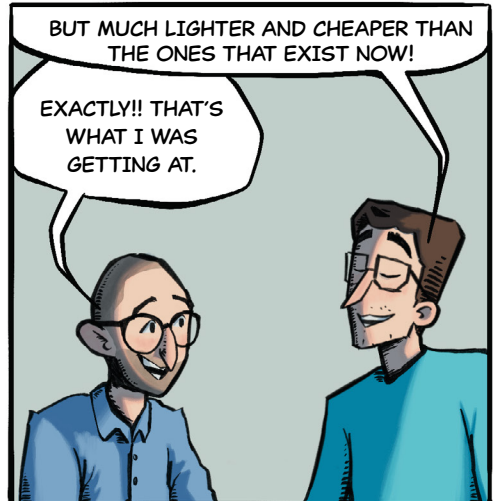
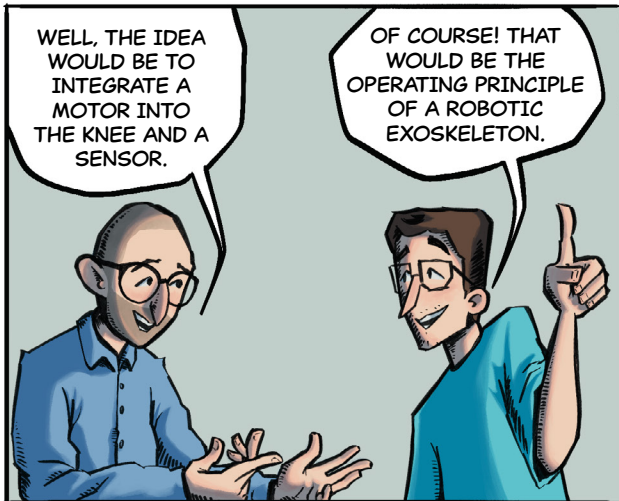
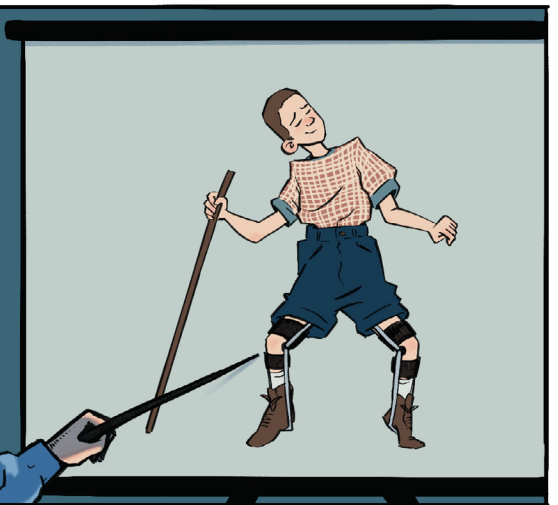
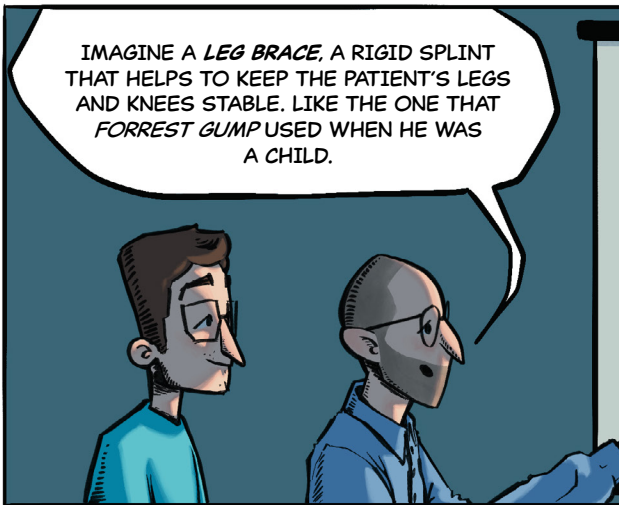
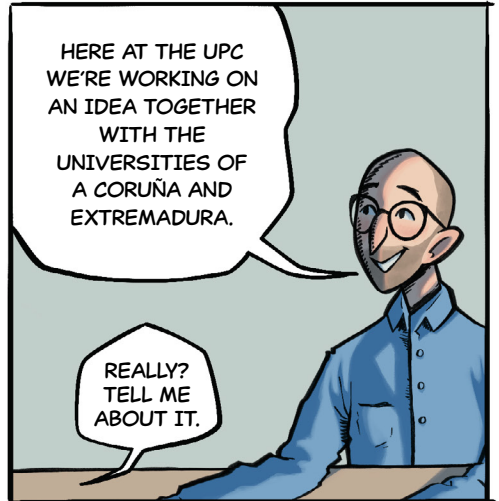
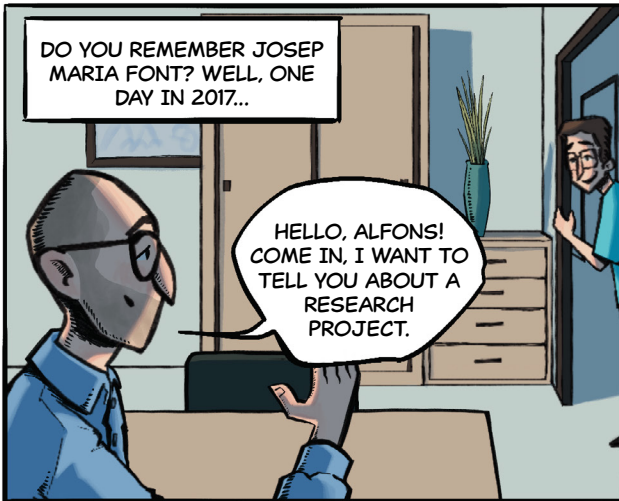
THEY ARE VERY HEAVY (ABOUT 30 KG)

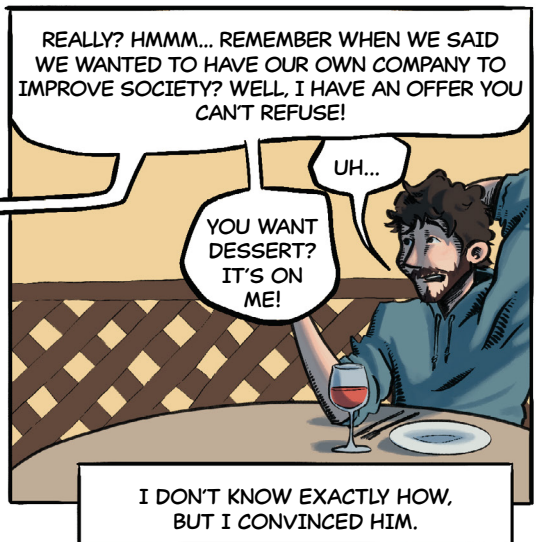
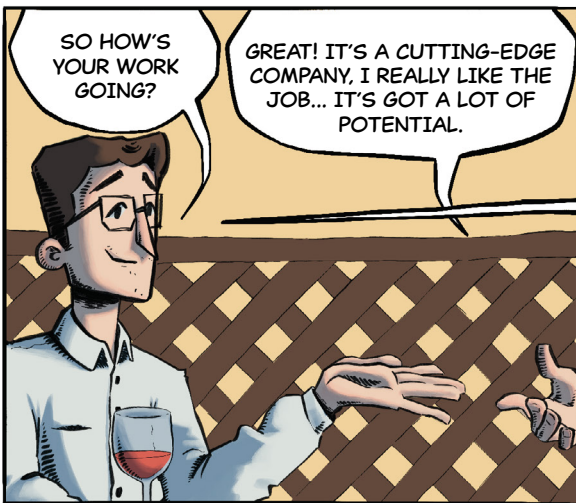
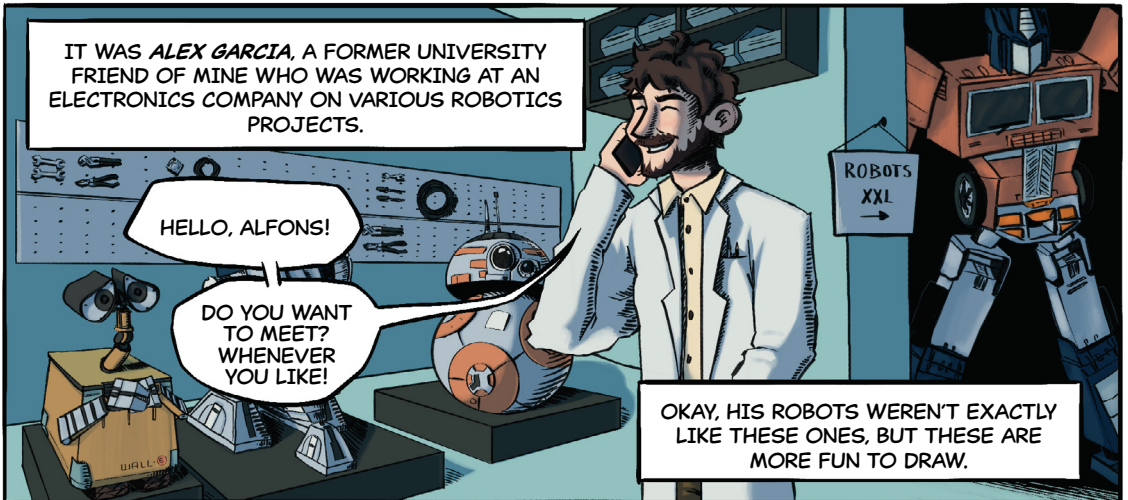
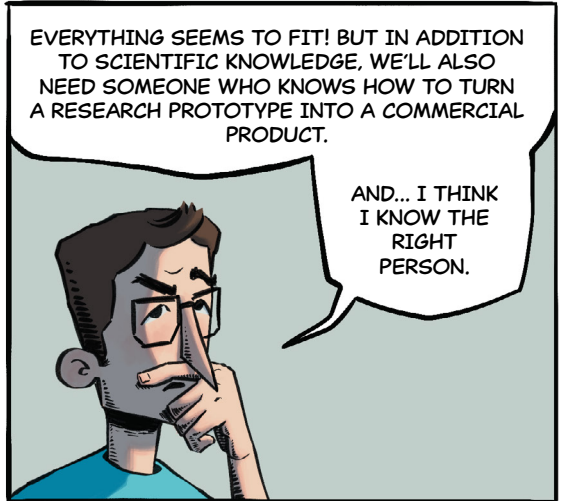
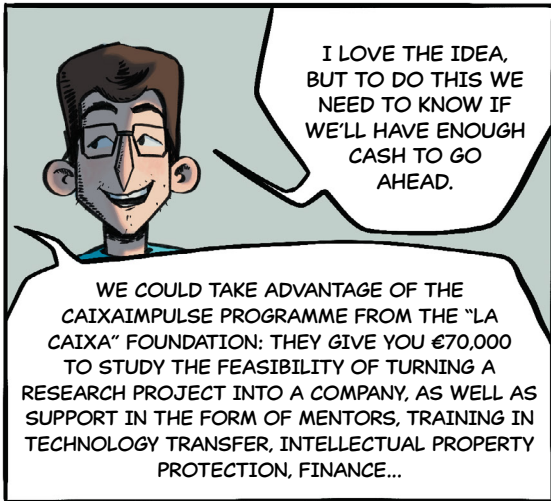
AND VERY EXPENSIVE (MORE THAN €120,000).

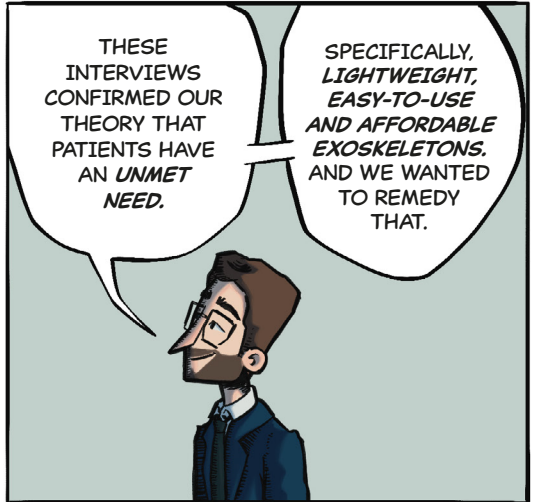
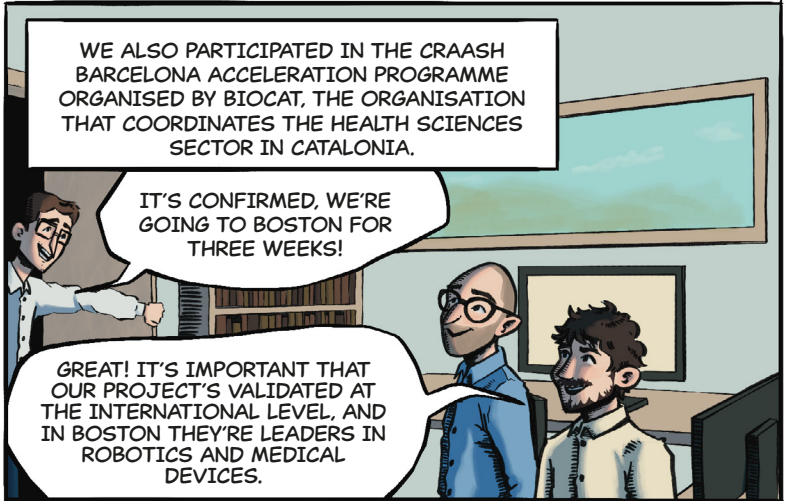


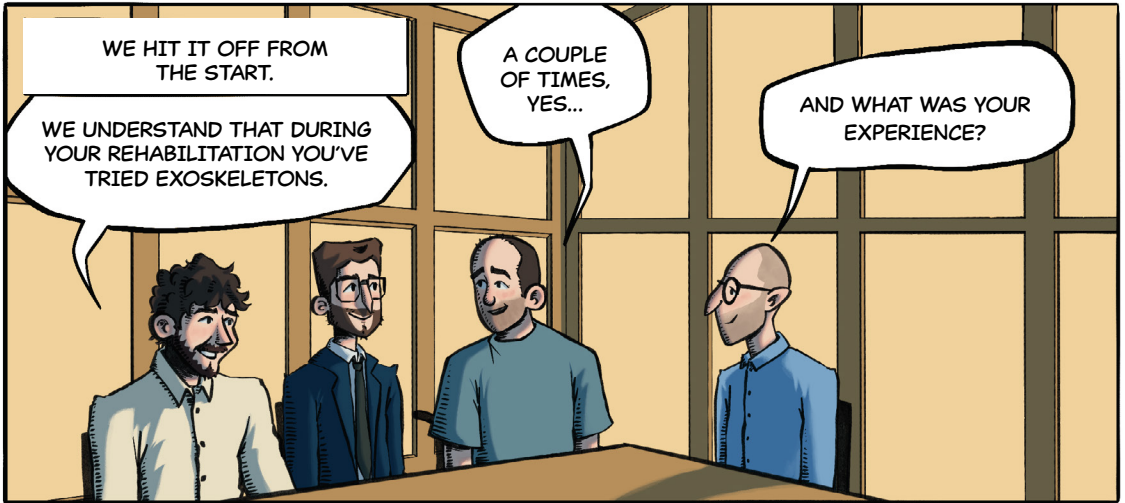
THIS MEANS THAT THERE ARE VERY FEW CENTRES THAT CAN AFFORD THEM.

BUT IT DOESN'T ALWAYS HAVE TO BE LIKE THIS...



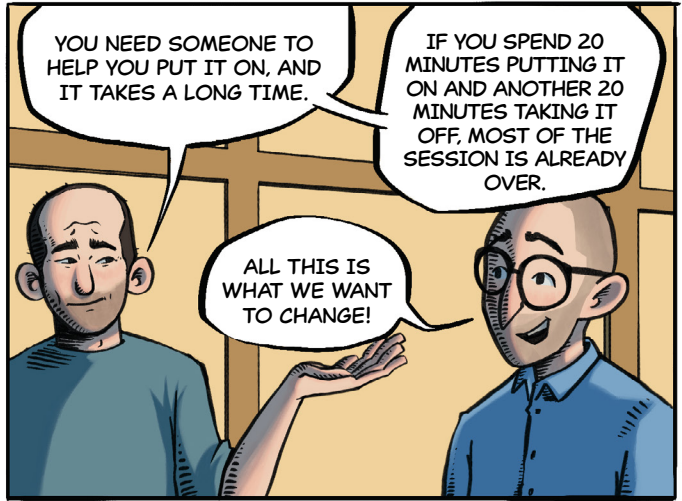


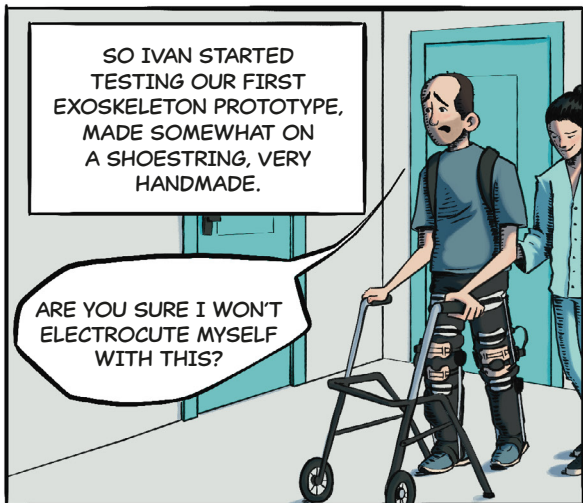




WELL, WHEN THEY TOLD ME WHAT IT WAS, I COULD ALMOST IMAGINE MYSELF AS *IRON MAN*...







SO IVAN STARTED TESTING OUR FIRST EXOSKELETON PROTOTYPE, MADE SOMEWHAT ON A SHOESTRING, VERY HANDMADE.

ARE YOU SURE I WON'T ELECTROCUTE MYSELF WITH THIS?

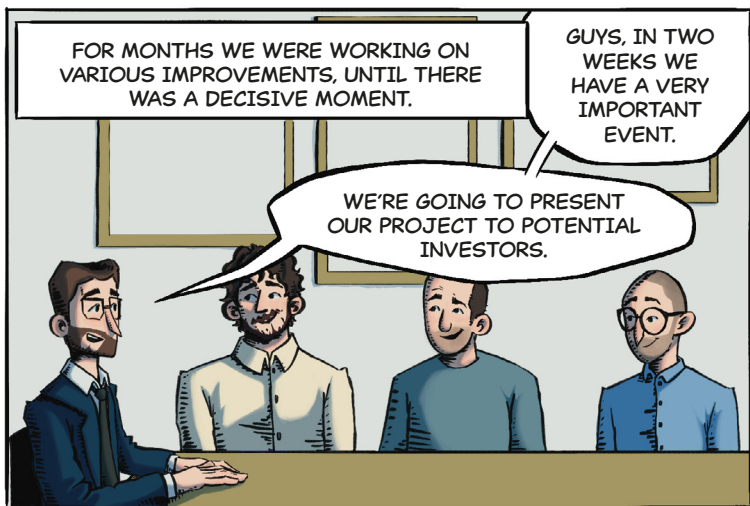


AND THE TRUTH IS THAT IT DIDN'T ALWAYS WORK WHEN I CAME; THERE WERE SESSIONS WHEN HE COULDN'T TAKE A SINGLE STEP BECAUSE, FOR EXAMPLE, A PIECE OF CABLE WAS BADLY SOLDERED.



EVEN SO, THIS FIRST PROTOTYPE WAS ONE OF THE ELEMENTS WITH WHICH WE FOUNDED *ABLE HUMAN MOTION* IN 2018, WITH THE MISSION OF *DEMOCRATISING ROBOTIC EXOSKELETONS!*

WE WERE CREATED AS A SPIN-OFF OF THE UPC; A SPIN-OFF IS A NEWLY CREATED COMPANY THAT TRANSFERS THE KNOWLEDGE AND TECHNOLOGY GENERATED WITHIN A UNIVERSITY TO THE MARKET.



FOR MONTHS WE WERE WORKING ON VARIOUS IMPROVEMENTS, UNTIL THERE WAS A DECISIVE MOMENT.

GUYS, IN TWO WEEKS WE HAVE A VERY IMPORTANT EVENT.

WE'RE GOING TO PRESENT OUR PROJECT TO POTENTIAL INVESTORS.



WHAT DO YOU THINK, IVAN?

I'VE GOT A BIT OF STAGE FRIGHT, BUT I'M SURE EVERYTHING WILL BE FINE.

FINALLY, THE DAY CAME.

DEAR FRIENDS,
COLLEAGUES AND
FAMILY.

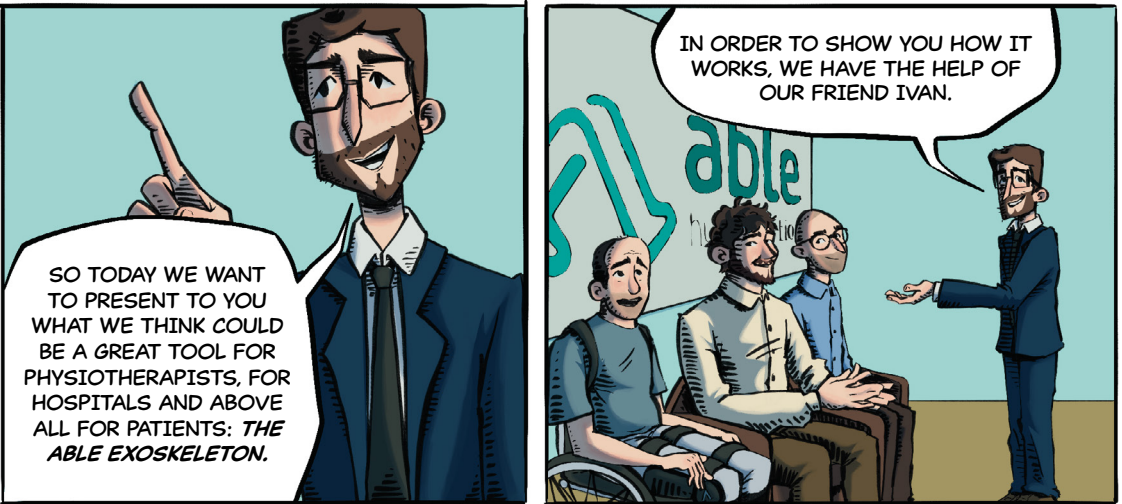
YOU ALL KNOW HOW IMPORTANT IT IS FOR
PEOPLE WITH SPINAL CORD INJURIES TO BE
ABLE TO STAND UP FOR A FEW HOURS A WEEK.

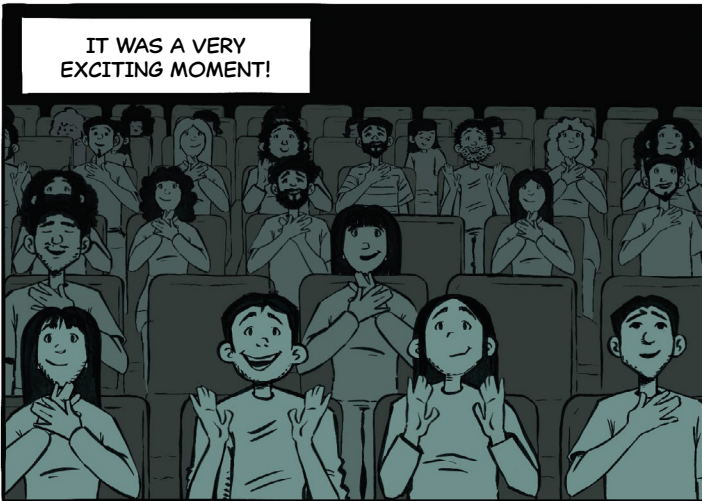
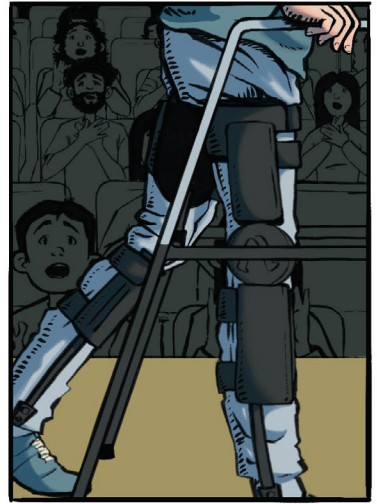
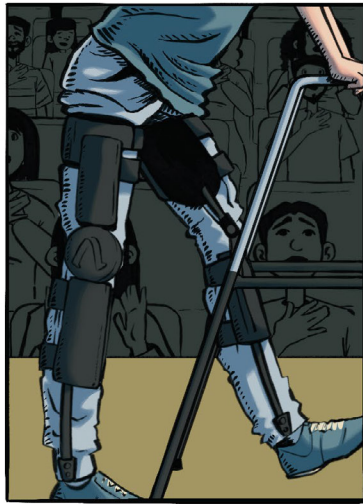
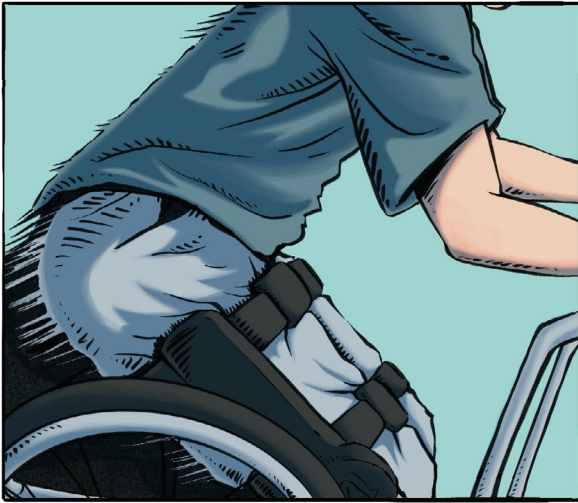
NOT ONLY BECAUSE
IT GIVES THEM THE
CHANCE TO REGAIN THEIR
AUTONOMY AND MOBILITY,
BUT ALSO TO IMPROVE
THEIR SELF-ESTEEM AND
AVOID CIRCULATORY,
DIGESTIVE AND
RESPIRATORY
PROBLEMS...



SO TODAY WE WANT
TO PRESENT TO YOU
WHAT WE THINK COULD
BE A GREAT TOOL FOR
PHYSIOTHERAPISTS, FOR
HOSPITALS AND ABOVE
ALL FOR PATIENTS: *THE
ABLE EXOSKELETON.*

IN ORDER TO SHOW YOU HOW IT
WORKS, WE HAVE THE HELP OF
OUR FRIEND IVAN.



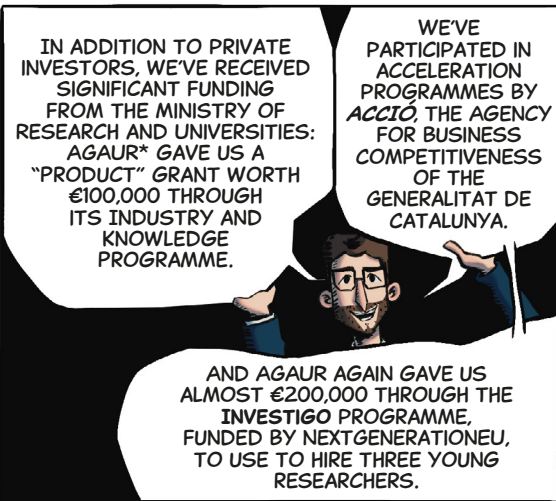


IT WAS A VERY
EXCITING MOMENT!



THAT WAS AMAZING!

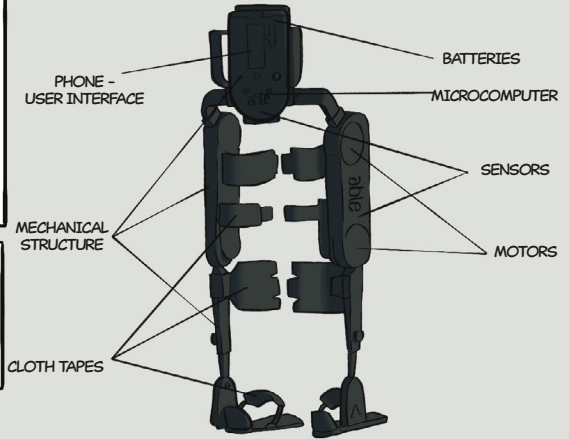
I DON'T KNOW IF
IT WAS A GIANT LEAP
FOR MANKIND, BUT I
ASSURE YOU IT WAS A
BIG STEP FOR ME.



*AGAUR: AGENCY FOR MANAGEMENT OF UNIVERSITY AND RESEARCH GRANTS.

OUR EXOSKELETON IS LIKE ROBOTIC TROUSERS WITH *INERTIAL SENSORS* - LIKE THE ONES IN A MOBILE PHONE - WHICH DETECT THE POSITION AND ACCELERATION OF THE LEGS. BASED ON THIS INFORMATION, ALGORITHMS DECIDE WHEN AND HOW THE USER WANTS TO TAKE EACH STEP.

IN THE HIP AND KNEE JOINTS, FOUR *MOTORS* PERFORM THE FUNCTIONS OF THE MUSCLES, TRYING TO ACHIEVE THE MOST NATURAL MOVEMENT POSSIBLE.



AN APP ALLOWS THE THERAPIST TO *CUSTOMISE* THE SESSION.

DON'T GET DISTRACTED AND GO ON TINDER!

HA, HA, HA!

WE'VE MANAGED TO MAKE THE LIGHTEST NEUROREHABILITATION *EXOSKELETON ON THE MARKET*, AT ONLY 17 KG! HALF OF WHAT THEY USUALLY WEIGH.

I STILL DON'T UNDERSTAND HOW YOU DID THIS.

WELL, WE'VE DONE A LOT OF TESTS TO OPTIMISE THE DESIGN OF THE DIFFERENT PARTS AND ACHIEVE GOOD RESULTS WITH MATERIALS SUCH AS CARBON FIBRE, ALUMINIUM, 3D PRINTING IN PLASTIC...

WE DEVELOPED OUR OWN TECHNOLOGY FOR THE MOTORS, WHICH ARE USUALLY VERY HEAVY, AND SIMPLIFIED THE DEVICE BY REMOVING PARTS THAT WEREN'T VERY USEFUL.

LESS IS MORE! THIS ALSO SHORTENS THE TIME NEEDED TO TAKE IT OFF AND PUT IT ON, LESS THAN 7 MINUTES ON AVERAGE!

AND I IMAGINE ALL OF THIS HAS ALSO MADE IT *MORE AFFORDABLE*.

RIGHT: IT COSTS HALF AS MUCH AS THE OTHER EXOSKELETONS ON THE MARKET!

WE DON'T WANT IT TO BE USED ONLY IN A FEW LEADING, ELITE CLINICS, BUT BY ANYONE WHO COULD BENEFIT FROM IT.

FINALLY, AFTER CREATING 6 INTERNATIONAL PATENTS...

AFTER DOING CLINICAL TRIALS AT THE GUTTMANN INSTITUTE, THE ASEPEYO HOSPITAL, HEIDELBERG UNIVERSITY HOSPITAL IN GERMANY, SINT MAARTENSKLINIEK HOSPITAL IN THE NETHERLANDS...

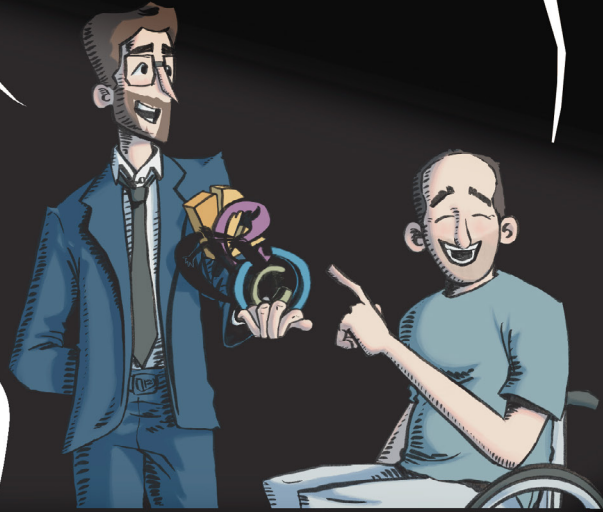
AFTER PUBLISHING THE RESULTS IN LEADING SCIENTIFIC JOURNALS SUCH AS *NATURE*...

AFTER 160 PEOPLE WITH SPINAL CORD INJURIES HAVE TAKEN MORE THAN 350,000 STEPS (ABOUT 260 KM!) WITH OUR EXOSKELETON...

WE'VE SUCCESSFULLY COMPLETED A LONG AND ARDUOUS MEDICAL DEVICE CERTIFICATION PROCESS AND FINALLY STARTED TO MARKET OUR PRODUCT IN EUROPE.

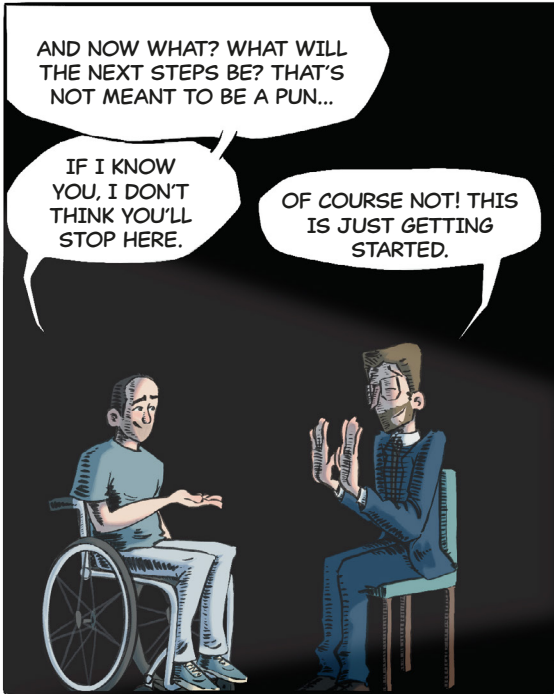
OVER THESE PAST FEW YEARS, WE'VE ALREADY PARTICIPATED IN A LOT OF SPANISH AND INTERNATIONAL COMPETITIONS AND WON A NUMBER OF PRIZES AND GRANTS.

I'VE TRAVELLED A LOT THANKS TO THESE GUYS! PARIS, BRUSSELS, MUNICH...



ABLE HAS BEEN GROWING AND THERE ARE NOW 20 OF US ON THE TEAM! ENGINEERS, PROGRAMMERS, THERAPISTS, PRODUCTION OPERATORS, FINANCE, MARKETING AND REGULATORY EXPERTS...

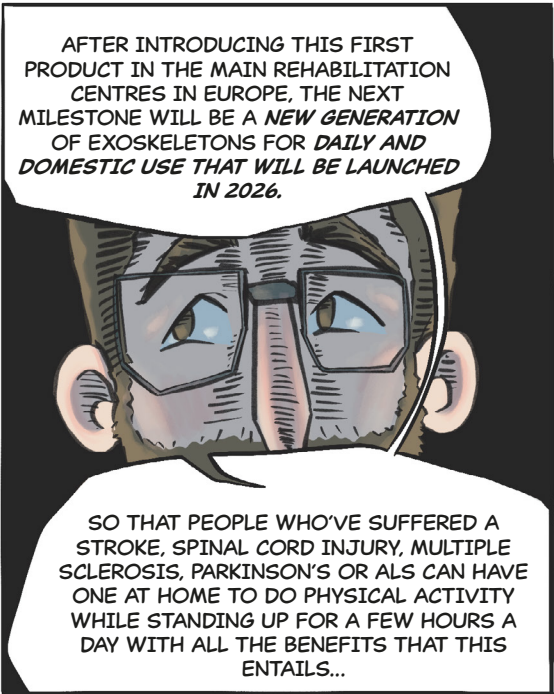




AND NOW WHAT? WHAT WILL THE NEXT STEPS BE? THAT'S NOT MEANT TO BE A PUN...

IF I KNOW YOU, I DON'T THINK YOU'LL STOP HERE.

OF COURSE NOT! THIS IS JUST GETTING STARTED.



AFTER INTRODUCING THIS FIRST PRODUCT IN THE MAIN REHABILITATION CENTRES IN EUROPE, THE NEXT MILESTONE WILL BE A *NEW GENERATION* OF EXOSKELETONS FOR *DAILY AND DOMESTIC USE* THAT WILL BE LAUNCHED *IN 2026*.

SO THAT PEOPLE WHO'VE SUFFERED A STROKE, SPINAL CORD INJURY, MULTIPLE SCLEROSIS, PARKINSON'S OR ALS CAN HAVE ONE AT HOME TO DO PHYSICAL ACTIVITY WHILE STANDING UP FOR A FEW HOURS A DAY WITH ALL THE BENEFITS THAT THIS ENTAILS...



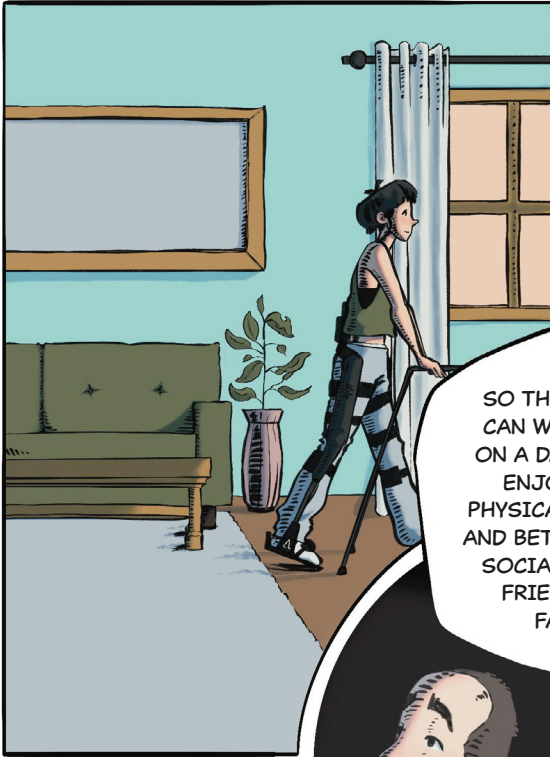
WE'RE WORKING ON AN EVEN LIGHTER (12 KG) AND MORE AFFORDABLE EXOSKELETON WITH A SIMILAR PRICE TO A TOP-OF-THE-RANGE WHEELCHAIR. BUT THE ULTIMATE GOAL IS TO GET CO-PAYMENT FROM HEALTH INSURERS AND EVEN SOCIAL SECURITY!

IT WILL BE A MORE CUSTOMISED DEVICE, ADAPTED TO THE SPECIFIC CHARACTERISTICS OF EACH PATIENT.



THE IDEA IS TO MAKE IT MORE AND MORE DISCREET, SO IT ENDS UP BEING ALMOST LIKE A SIMPLE ACCESSORY.

I'M IMAGINING AN ORTHOPAEDIC SHOP: "SHALL I WRAP IT UP, OR WILL YOU WEAR IT?"



SO THAT PEOPLE
CAN WALK AGAIN
ON A DAILY BASIS,
ENJOY MORE
PHYSICAL ACTIVITY
AND BETTER HEALTH,
SOCIALISE WITH
FRIENDS AND
FAMILY...

