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OCT
2009

LABONFOIL

Integrated Project

LABORATORY
SKIN PATCHES
AND SMARTCARDS
BASED ON FOILS AND
COMPATIBLE WITH
A SMARTPHONE



www.labonfoil.eu

20500



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Deliverable D2.3

LABONFOIL

Laboratory Skin Patches and SmartCards based on foils and compatible with a Smartbiophone.

INSTRUMENT: Large-scale integrating project (IP)

D2.3 Scenarios of Labcard and Skin Patch

Due Date of Deliverable:	1-7-2008	
Completion Date of Deliverable:	28-9-2008	
Start date of project:	1-5-2008	Duration: 31-4-2012
Responsible partner for deliverable:	IKERLAN	Revision: v3.1

Project co-funded by the European Commission within the 7th Framework Programme

Dissemination Level

PU	Public	<input checked="" type="checkbox"/>
PP	Restricted to other programme participants (including the Commission Services)	<input type="checkbox"/>
RE	Restricted to a group specified by the consortium (including Commission Services)	<input type="checkbox"/>
CO	Confidential, only for members of the consortium (including Commission Services)	<input type="checkbox"/>



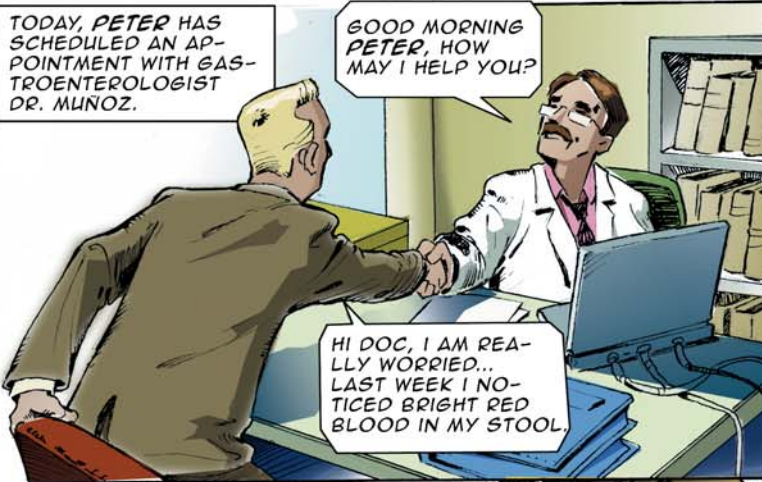
THE LABONFOIL PROJECT

CHAPTER 1



PETER IS 54 YEARS OLD

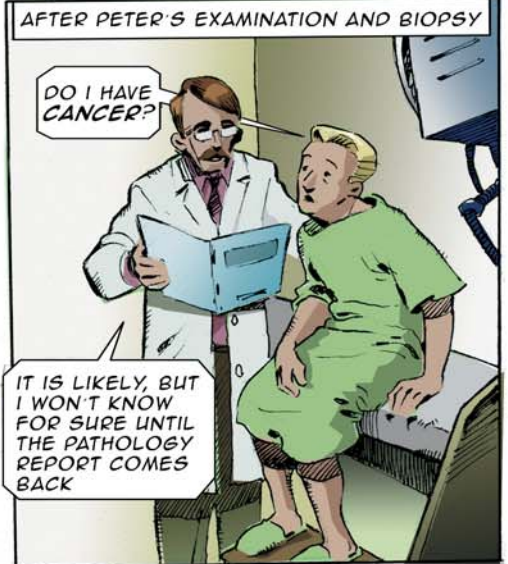
HE LIVES HAPPILY WITH HIS FAMILY ON THE BEAUTIFUL BASQUE COAST. LATELY, HOWEVER, PETER HAS BEEN FEELING ILL.



TODAY, PETER HAS SCHEDULED AN APPOINTMENT WITH GASTROENTEROLOGIST DR. MUNOZ.

GOOD MORNING PETER, HOW MAY I HELP YOU?

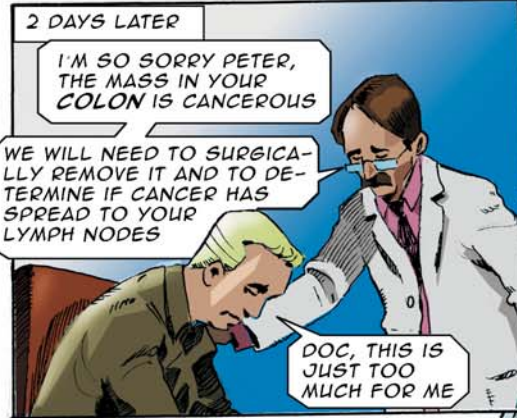
HI DOC, I AM REALLY WORRIED... LAST WEEK I NOTICED BRIGHT RED BLOOD IN MY STOOL.



AFTER PETER'S EXAMINATION AND BIOPSY

DO I HAVE CANCER??

IT IS LIKELY, BUT I WON'T KNOW FOR SURE UNTIL THE PATHOLOGY REPORT COMES BACK

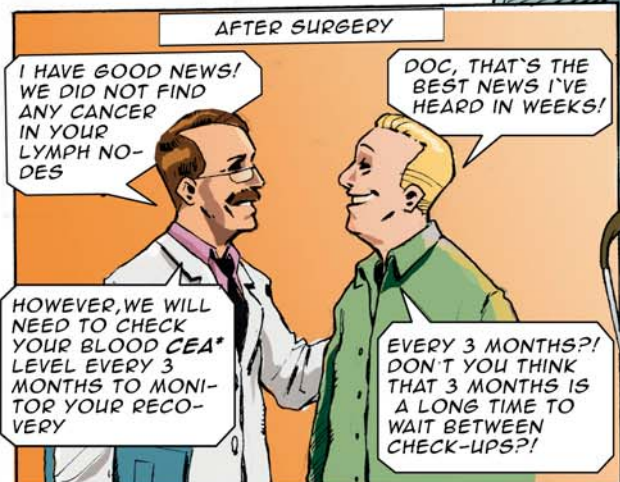
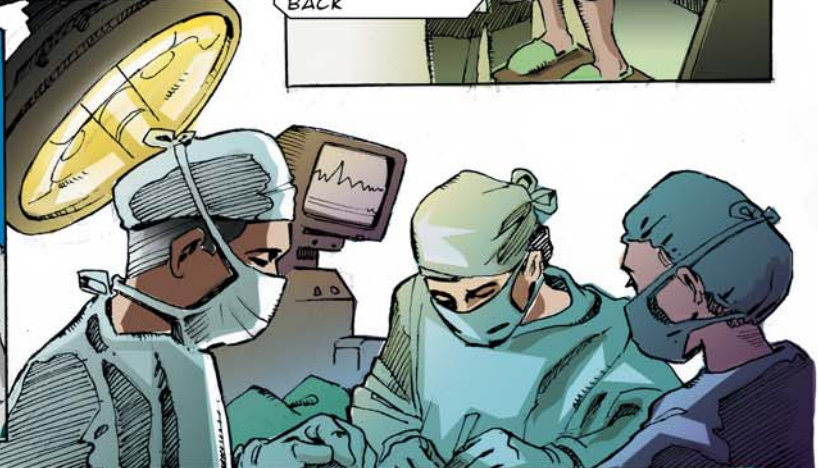


2 DAYS LATER

I'M SO SORRY PETER, THE MASS IN YOUR COLON IS CANCEROUS

WE WILL NEED TO SURGICALLY REMOVE IT AND TO DETERMINE IF CANCER HAS SPREAD TO YOUR LYMPH NODES

DOC, THIS IS JUST TOO MUCH FOR ME



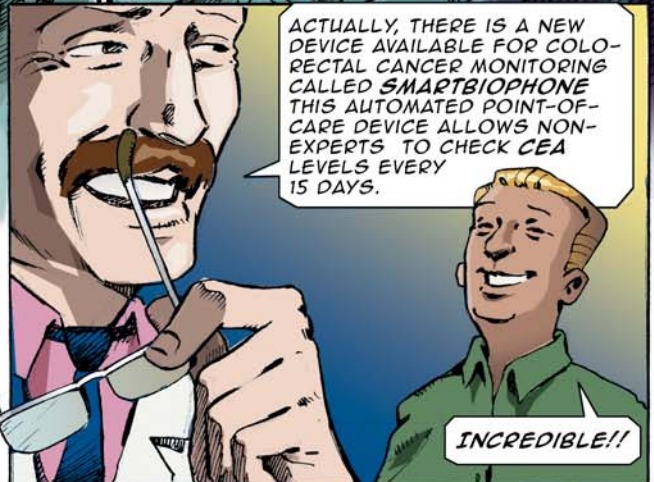
AFTER SURGERY

I HAVE GOOD NEWS! WE DID NOT FIND ANY CANCER IN YOUR LYMPH NODES

DOC, THAT'S THE BEST NEWS I'VE HEARD IN WEEKS!

HOWEVER, WE WILL NEED TO CHECK YOUR BLOOD CEA* LEVEL EVERY 3 MONTHS TO MONITOR YOUR RECOVERY

EVERY 3 MONTHS?! DON'T YOU THINK THAT 3 MONTHS IS A LONG TIME TO WAIT BETWEEN CHECK-UPS?!



ACTUALLY, THERE IS A NEW DEVICE AVAILABLE FOR COLORECTAL CANCER MONITORING CALLED SMARTBIOPHONE THIS AUTOMATED POINT-OF-CARE DEVICE ALLOWS NON-EXPERTS TO CHECK CEA LEVELS EVERY 15 DAYS.

INCREDIBLE!!

15 DAYS LATER, PETER RECEIVES A TEXT MESSAGE FROM THE HEALTH CENTER



HE HAS AN APPOINTMENT EVERY OTHER WEEK WITH DR. MUNOZ'S NURSE, JANE



HELLO PETER HOW ARE YOU TODAY?

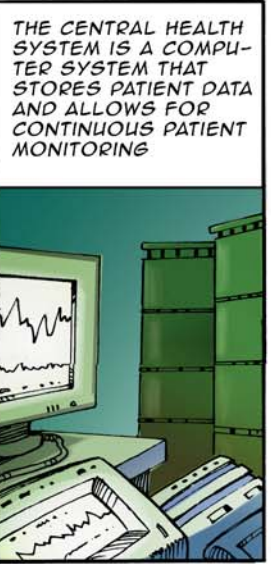
NEVER BEEN BETTER, THANK YOU

LET'S GET STARTED THEN. YOU ARE MY FIRST SMARTPHONE ASSAY THIS MORNING

JANE PLACES HER FINGER ON THE SMARTPHONE FINGERPRINT RECOGNITION COMPONENT TO GAIN ACCESS TO THE SYSTEM



PETER, PLEASE PLACE YOUR FINGER ON THE SMARTPHONE TO FIND YOUR RECORD IN THE CENTRAL HEALTH SYSTEM



THE CENTRAL HEALTH SYSTEM IS A COMPUTER SYSTEM THAT STORES PATIENT DATA AND ALLOWS FOR CONTINUOUS PATIENT MONITORING



ONCE BOTH FINGERPRINTS ARE RECOGNIZED, THE SYSTEM LAUNCHES ASSAY INSTRUCTIONS...

insert the crc* labcard into the reader slot



THE READER IDENTIFIES THE LABCARD AND ASKS JANE TO PRICK PETER'S FINGER AND EXTRACT A DROPLET OF BLOOD



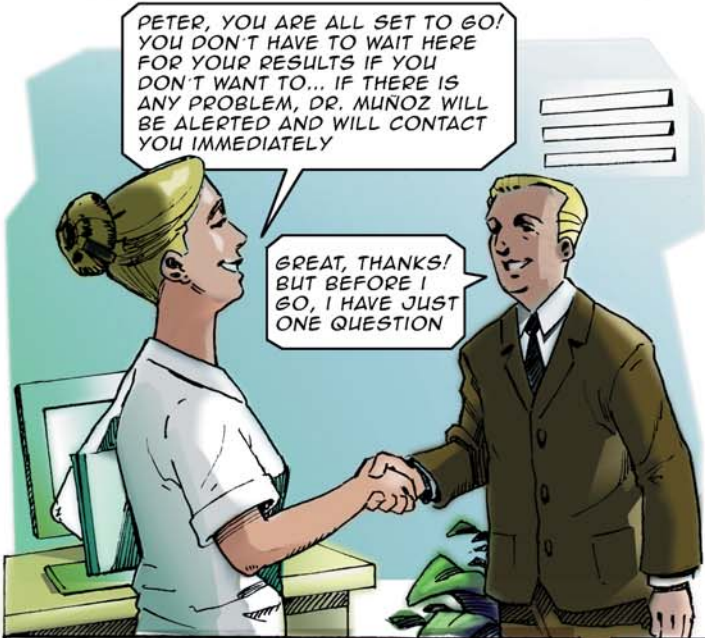
LET ME SEE YOUR FINGER. DON'T WORRY... I WILL BE USING AN AUTOMATIC AND PAINLESS LANCET.

*: COLORECTAL CANCER



JANE PRICKS AND GENTLY PRESSES PETER'S FINGER ONTO A SMALL SLIT IN THE LABCARD.

CAPILLARY ACTION SUCKS PETER'S BLOOD DROPLET INSIDE

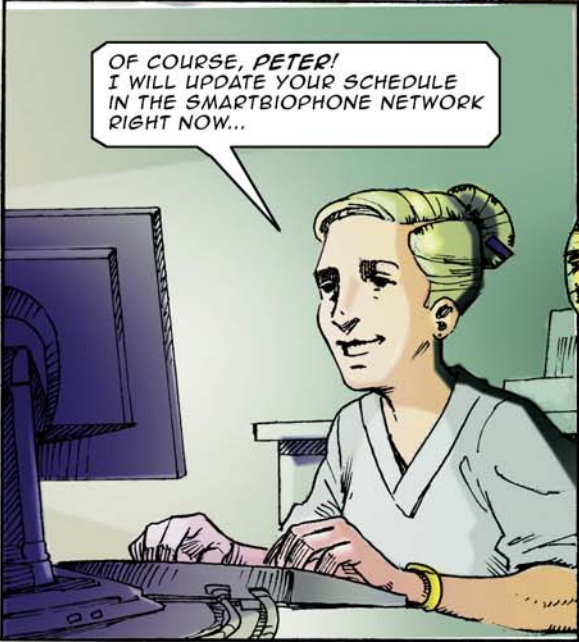


PETER, YOU ARE ALL SET TO GO! YOU DON'T HAVE TO WAIT HERE FOR YOUR RESULTS IF YOU DON'T WANT TO... IF THERE IS ANY PROBLEM, DR. MUNOZ WILL BE ALERTED AND WILL CONTACT YOU IMMEDIATELY

GREAT, THANKS! BUT BEFORE I GO, I HAVE JUST ONE QUESTION



... I AM HOPING TO GO WITH MY WIFE TO CADIZ FOR THREE WEEKS. IS IT POSSIBLE TO HAVE MY CEA LEVELS ASSAYED WHILE I AM ON VACATION?



OF COURSE, PETER! I WILL UPDATE YOUR SCHEDULE IN THE SMARTBIOPHONE NETWORK RIGHT NOW...



WOULD AN APPOINTMENT IN 15 DAYS AT "LA COMARCA" HOSPITAL IN CADIZ WORK FOR YOU?

PERFECT!

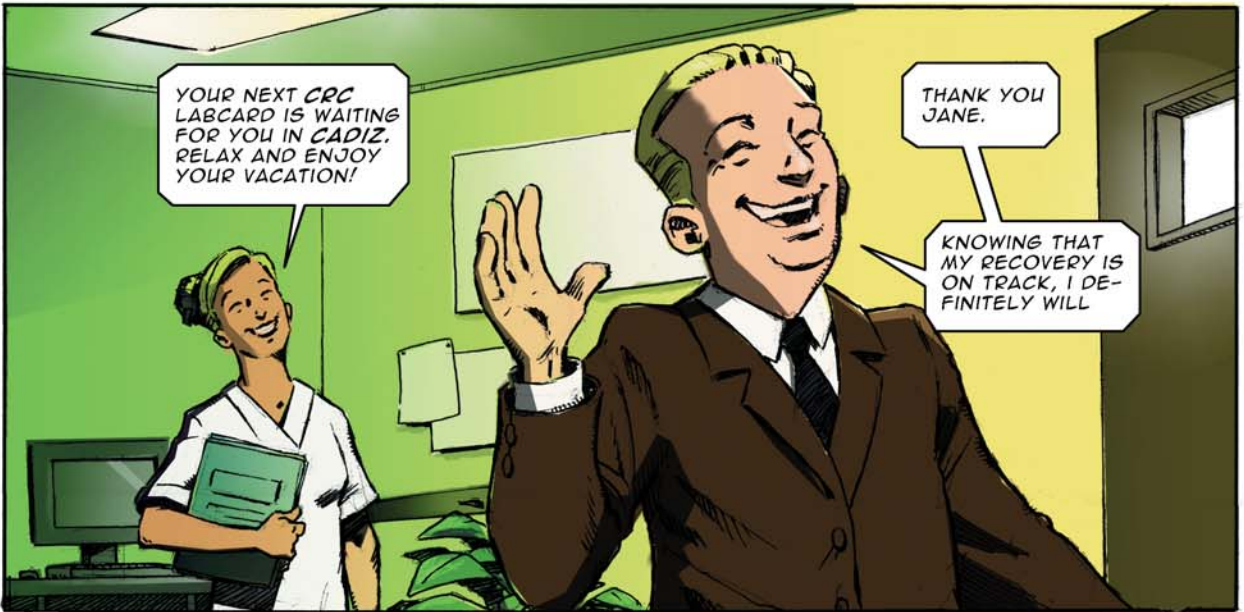
THE SMARTBIOPHONE BEEPS, CONFIRMING THAT PETER'S ASSAY RESULTS HAVE BEEN STORED IN THE CENTRAL HEALTH SYSTEM



YOUR ASSAY RESULTS ARE JUST IN YOUR BLOOD CEA LEVELS IS WITHIN THE NORMAL RANGE, INDICATING THAT CANCER HAS NOT RECURRENT SINCE YOUR SURGERY

GOOD NEWS!

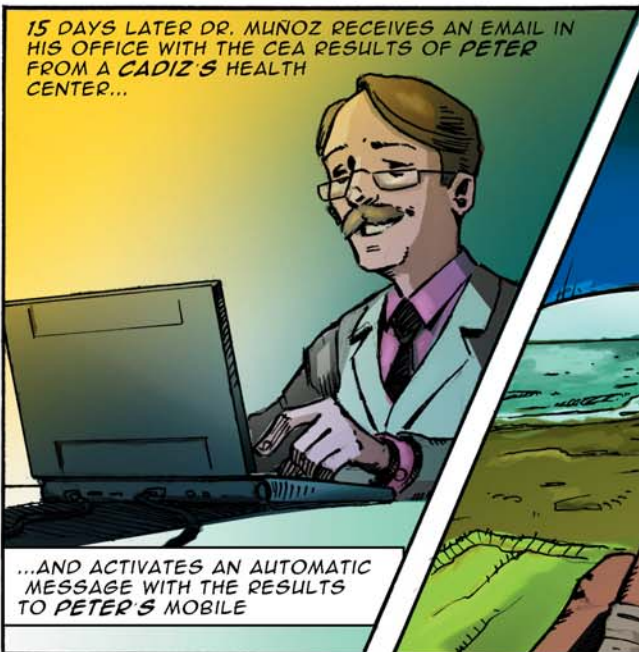
YOUR NEXT CRC LABCARD IS WAITING FOR YOU IN CADIZ. RELAX AND ENJOY YOUR VACATION!



THANK YOU JANE.

KNOWING THAT MY RECOVERY IS ON TRACK, I DEFINITELY WILL

15 DAYS LATER DR. MUÑOZ RECEIVES AN EMAIL IN HIS OFFICE WITH THE CEA RESULTS OF PETER FROM A CADIZ'S HEALTH CENTER...



...AND ACTIVATES AN AUTOMATIC MESSAGE WITH THE RESULTS TO PETER'S MOBILE

PETER AND HIS WIFE ARE VERY HAPPY, THE CEA RESULTS ARE NORMAL ONCE MORE.



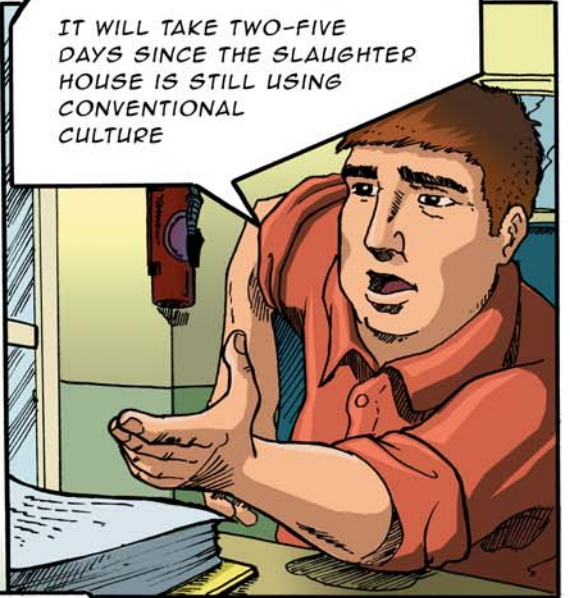
THE LABONFOIL PROJECT

CHAPTER 2

THIS STORY TAKES PLACE AT A BIG CHICKEN FARM IN THE NORTH OF JUTLAND IN DENMARK. TODAY THE FARM OWNER, ANJA, IS WORRIED BECAUSE THE FARM IS CONTAMINATED WITH A PATHOGEN....



WE NEED TO FIND OUT ASAP THE SOURCE OF CONTAMINATION AND THE SPECIES OF THE PATHOGEN



IT WILL TAKE TWO-FIVE DAYS SINCE THE SLAUGHTER HOUSE IS STILL USING CONVENTIONAL CULTURE

TWO-FIVE DAYS? MICHEL, DO YOU KNOW HOW MUCH MONEY WILL THAT COST?

ALL RIGHT, I WILL CONTACT JONAS FROM THE NATIONAL VETERINARY INSTITUTE TO HELP US

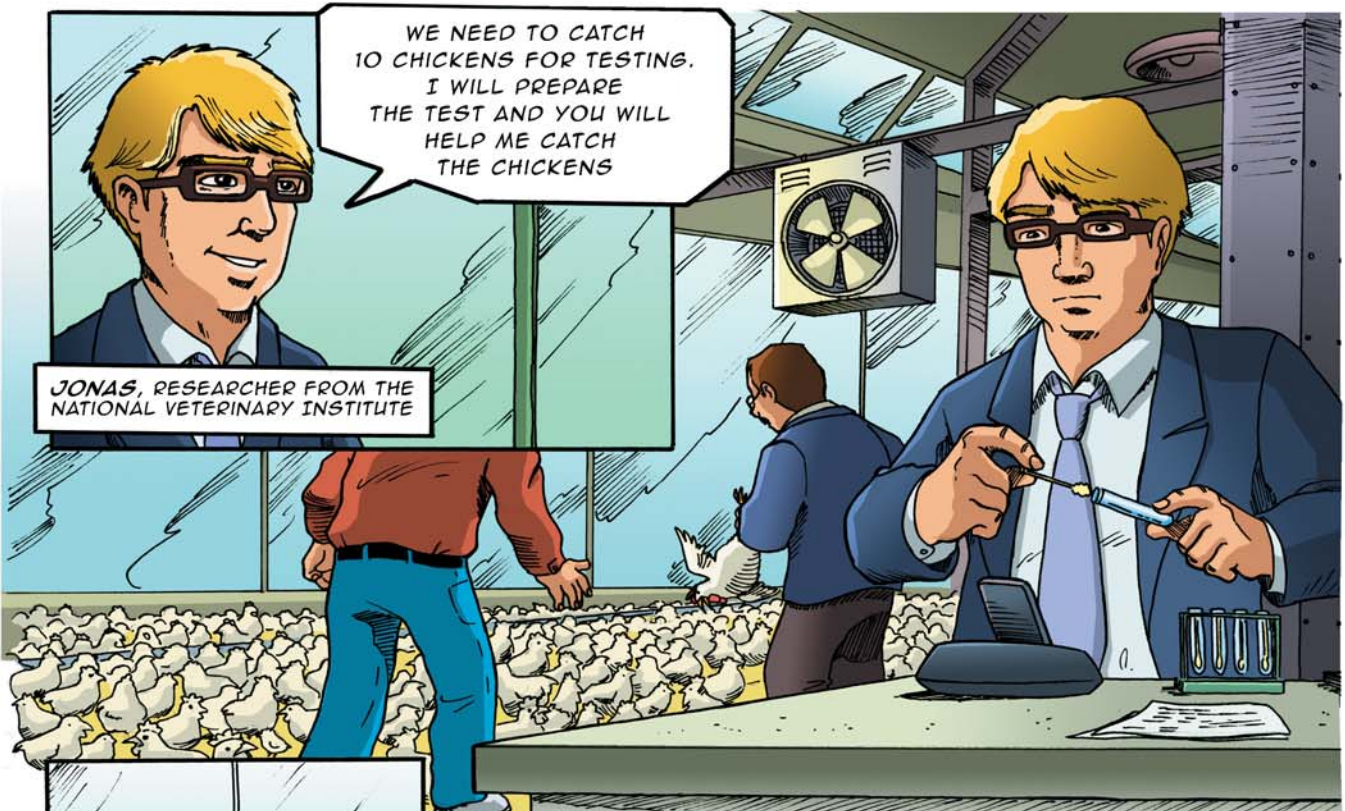


THANKS JONAS, THEN, WE MEET THIS AFTERNOON IN THE FARM



TWO VETERINARY RESEARCHERS ARRIVE AT THE FARM AND GO TO THE CHICKEN HOUSE





WE NEED TO CATCH 10 CHICKENS FOR TESTING. I WILL PREPARE THE TEST AND YOU WILL HELP ME CATCH THE CHICKENS

JONAS, RESEARCHER FROM THE NATIONAL VETERINARY INSTITUTE

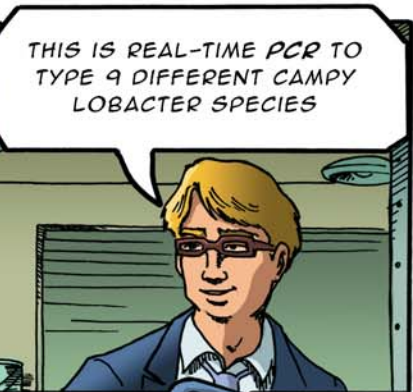


NOW WE ONLY NEED TO WAIT FOR 20 MINUTES

IT'S COOL! PCR INCLUDING SAMPLE PREPARATION WITHIN 20 MINUTES

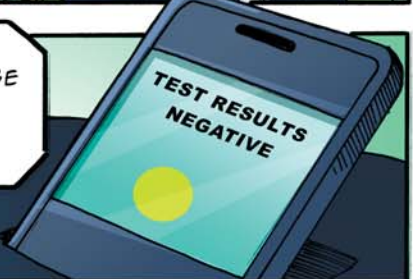


WHAT ABOUT THE RESULTS? HOW CAN WE READ THEM?



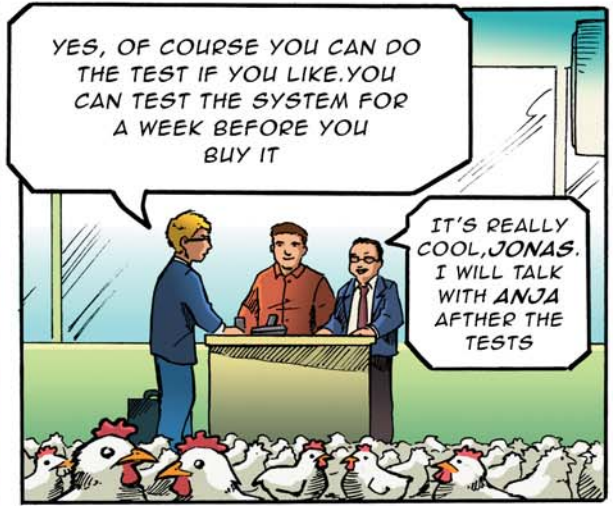
THIS IS REAL-TIME PCR TO TYPE 9 DIFFERENT CAMPY LOBACTER SPECIES

AS YOU CAN SEE WE HAVE NEGATIVE FOR THESE SPECIES. NOW I WILL SEND YOU THE RESULT BY E-MAIL





CAN I DO THE NEXT TEST?
I WOULD LIKE TO ASK ANJA TO HAVE THE SMARTBIOPHONE SYSTEM IN OUR FARM



YES, OF COURSE YOU CAN DO THE TEST IF YOU LIKE. YOU CAN TEST THE SYSTEM FOR A WEEK BEFORE YOU BUY IT

IT'S REALLY COOL, JONAS. I WILL TALK WITH ANJA AFTER THE TESTS



THEY WENT ON TO TEST THE CATCHER AND TRANSPORTATION EQUIPMENTS OF THE SLAUGHTER HOUSE.



THEY FOUND OUT THAT THE CHICKEN KATCHER WAS A SOURCE OF CAMPYLOBACTER CONTAMINATION.



A WEEK LATER AT THE NATIONAL VETERINARY INSTITUTE

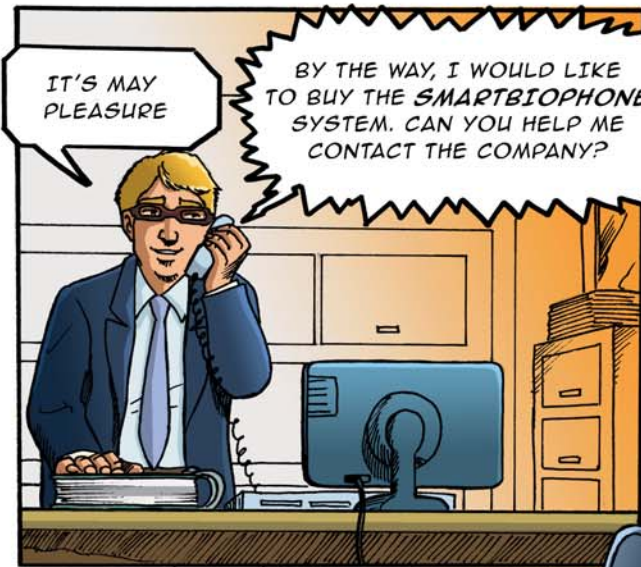


HI JONAS, IT'S MICHEL FROM ANJAS'S CHICKEN FARM

HI MICHEL, HOW ARE THINGS GOING ON?

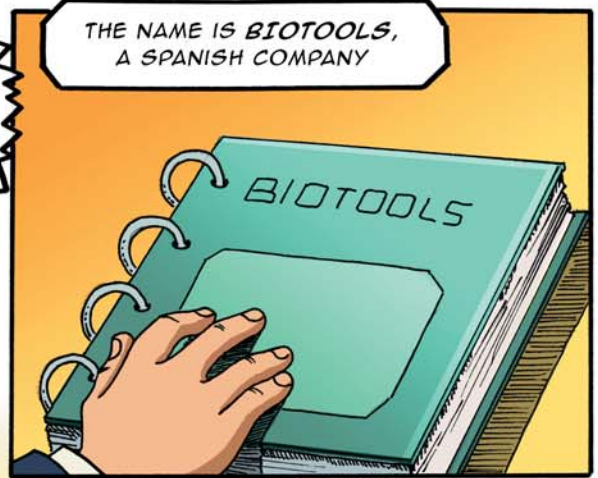


BRILLIANT, THANKS TO THE SMARTBIOPHONE SYSTEM WE'VE REACTED FAST ENOUGH TO CLEAN THE CATCHER TO ENSURE BIO-SECURITY AT LOW COST



IT'S MY PLEASURE

BY THE WAY, I WOULD LIKE TO BUY THE SMARTBIOPHONE SYSTEM. CAN YOU HELP ME CONTACT THE COMPANY?



THE NAME IS BIOTOOLS, A SPANISH COMPANY



DO YOU KNOW HOW MUCH THE SMARTBIOPHONE COST? I MEAN, HOW MUCH DOES IT COST PER ASSAY?

OH...



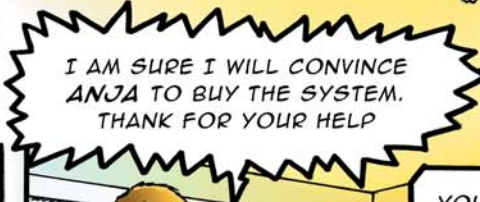
THE SMARTBIOPHONE READER INCLUDING 20 CARDS IS FREE IF YOU MAINTAIN IT FOR AT LEAST TWO YEARS

SO ONCE YOU ORDER THE SYSTEM, YOU ONLY NEED TO BUY THE CARDS AND THE CONSUMABLES, SUCH AS SYRINGE, BUFFER ETC...

THEY HAVE DIFFERENT PRICES DEPENDING ON THE AMOUNT OF TEST



THAT SOUNDS VERY GOOD



I AM SURE I WILL CONVINC ANJA TO BUY THE SYSTEM. THANK FOR YOUR HELP



YOU ARE WELCOME. BYE

THE LABONFOIL PROJECT

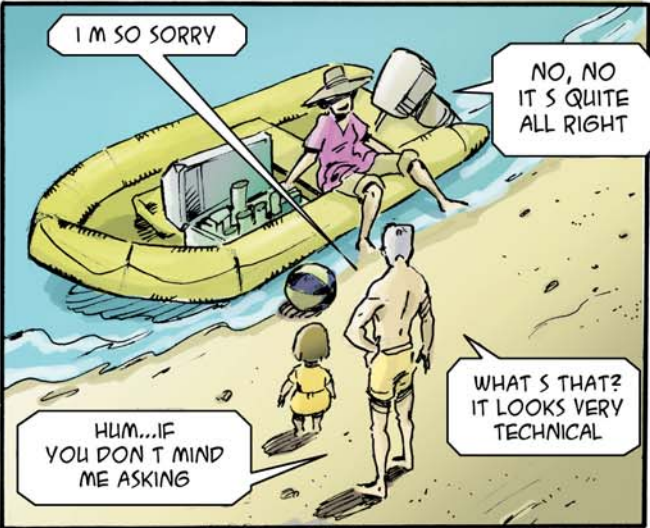
CHAPTER 3



IT'S ANOTHER SUNNY DAY ON A MEDITERRANEAN BEACH IN THE HOLIDAY SEASON

HELLO MY LITTLE DARLING

CECILIA WAIT COME BACK HERE!



I'M SO SORRY

NO, NO IT'S QUITE ALL RIGHT

HUM...IF YOU DON'T MIND ME ASKING

WHAT'S THAT? IT LOOKS VERY TECHNICAL



OH YES, THIS IS NEW PAY TO PLANKTON ANALYZER, I AM SUPPOSED TO BE LOOKING FOR HARMFUL ALGAE WITH IT



AH, I SEE DO YOU THINK THERE IS ANY HARMFUL ALGAE HERE?

NO, NO WELL NOT YESTERDAY ANYWAY. THE GOOD THING ABOUT THE ANALYZER IS THAT IT CAN SPOT THEM BEFORE THEY BLOOM, BEFORE THEY ARE SERIOUS FOR THE TOURIST OR THE FISHERMEN



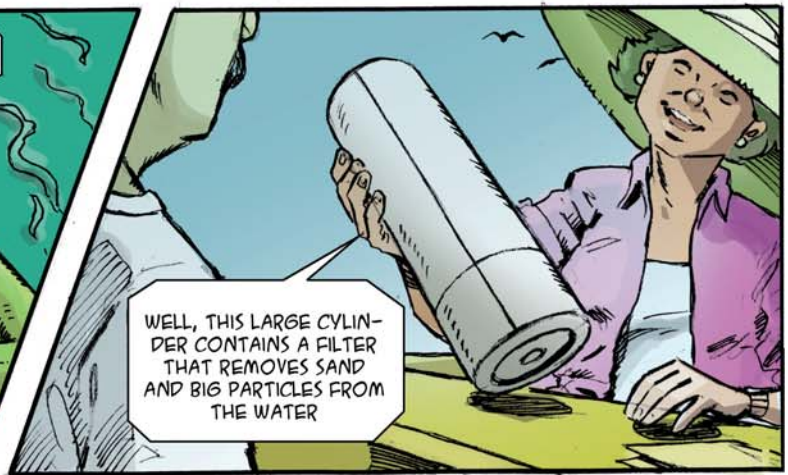
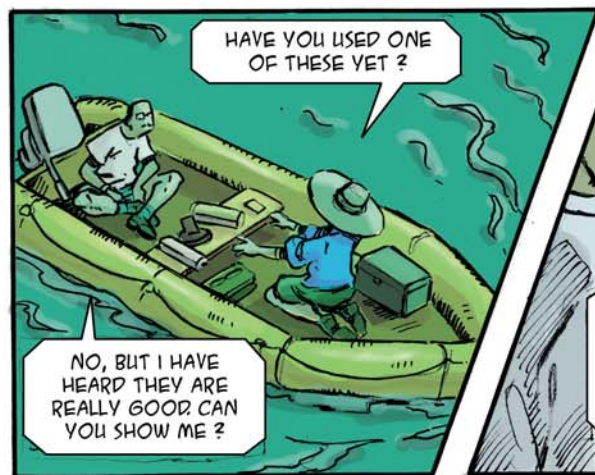
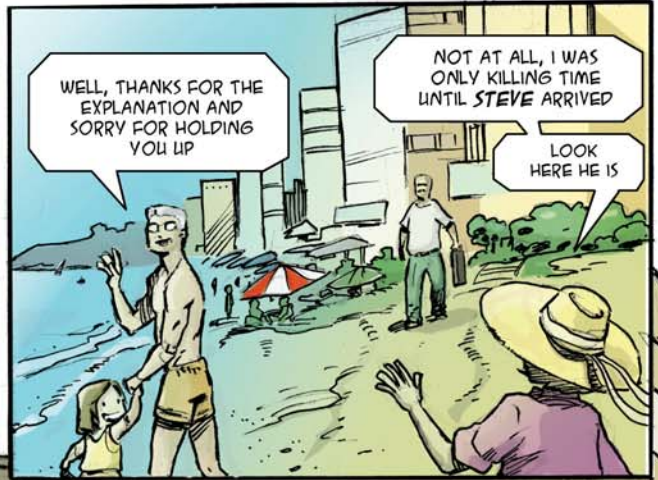
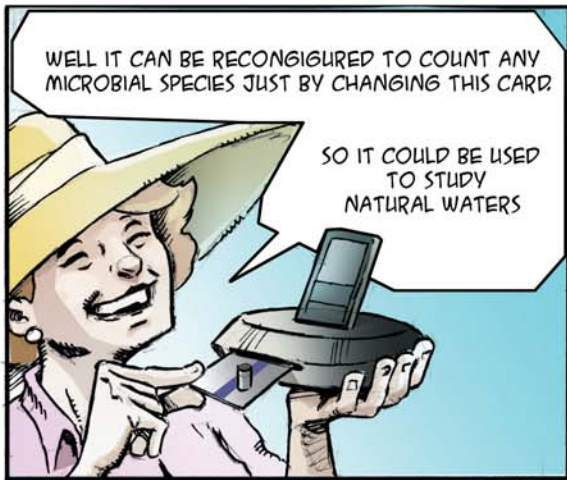
IN THE FUTURE WE SHOULD BE ABLE TO USE THIS RESOURCES TO CREATE...

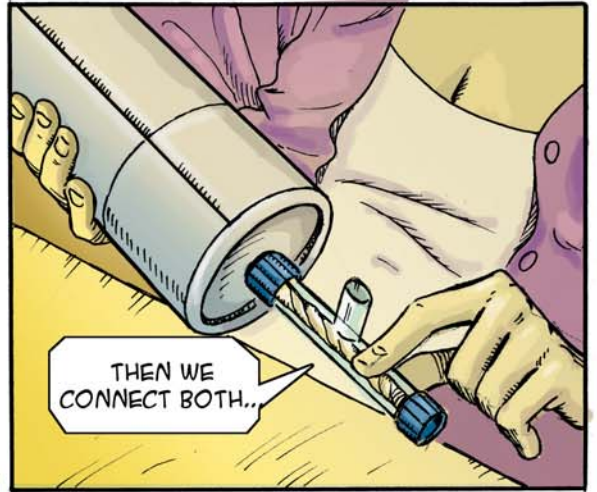
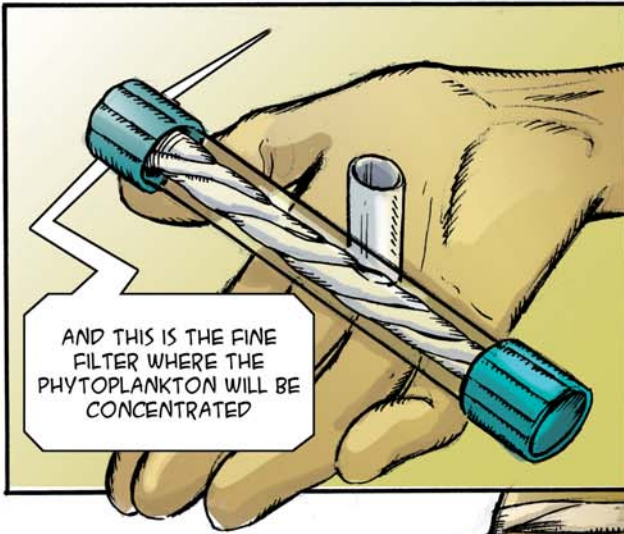
... A WARMING SYSTEM FOR THE LOCAL GOVERNMENT, FISHERIES AND INDUSTRY



THAT SOUNDS QUITE IMPORTANT!

IS THE ANALYZER GOING TO BE USED ELSEWHERE?







THEN WE TURN THE FINE FILTER AND PUT IT IN THE SMARTCARD

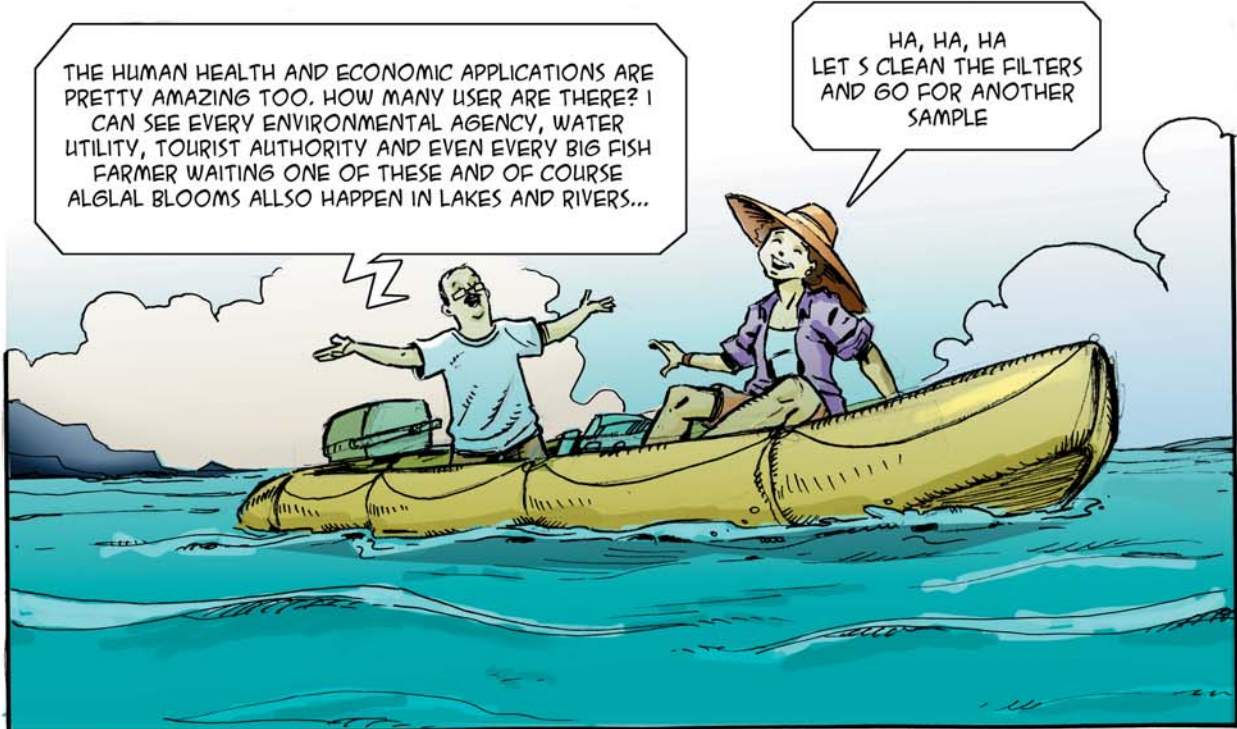
THE MOBILE WILL SEND THE RESULTS TO THE LAB IN A FEW MINUTES AND HE CAN HAVE A LOOK AT THE DATA ON THE SCREEN



THAT S AMAZING !
I THOUGHT RNA ANALYSIS TOOK HOURS AND NEEDED HALF A LAB TO GET A RESULT... I CAN IMAGINE THIS WOULD BE REALLY USEFUL IN ALL SORTS OF APPLICATIONS...



THAT S THE PLAN
IT S VERY EXCITING DON T YOU THINK?



THE HUMAN HEALTH AND ECONOMIC APPLICATIONS ARE PRETTY AMAZING TOO. HOW MANY USER ARE THERE? I CAN SEE EVERY ENVIRONMENTAL AGENCY, WATER UTILITY, TOURIST AUTHORITY AND EVEN EVERY BIG FISH FARMER WAITING ONE OF THESE AND OF COURSE ALGLAL BLOOMS ALLSO HAPPEN IN LAKES AND RIVERS...

HA, HA, HA
LET S CLEAN THE FILTERS AND GO FOR ANOTHER SAMPLE

THE LABONFOIL PROJECT

CHAPTER 4

ROCHESTER BUS COMPANY



GOOD MORNING. ARE YOU THE TESTERS FROM THE COUNCIL?

THAT'S RIGHT. WE HAVE A NUMBER OF PEOPLE TO APPLY THE SKINPACHES TO THIS MORNING.

YES, WE HAVE FIVE DRIVERS DUE FOR TESTING TODAY



LATER IN A NEARBY OFFICE



HOW LONG MUST WE LEAVE THE PATCH ON BEFORE WE CAN TAKE A READING?

AT LEAST 24 HOURS AFTER DRUG USE... HOWEVER, LOCAL REGULATIONS STATE THAT THE PATCH HAS TO BE WORN FOR AT LEAST FOR 5 DAYS



WHAT'S THE LONGEST TIME THAT WE CAN LEAVE THE PATCH ON FOR?

THE FACTOR THAT DETERMINES THE TIME IS HOW LONG IT TAKES FOR ENOUGH SKIN CELLS TO BE SHED... 7 TO 10 DAYS IS THE MAXIMUM



READY?

YES...NAME OF TEST SUBJECT

CLEAN AN AREA OF 10 CM X 10 CM USING THE ALCOHOL WIPES. THE AREA WILL BE CLEAN WHEN THE ALCOHOL PAD APPEARS **CLEAN AND WHITE**



AND THEN YOU PUT ON THE **PATCH**?

NO, YOU HAVE LET THE CLEANED AREA DRY FOR 60 SECONDS. IF IT ISN'T DRY THERE'S A RISK THAT THE **PATCH** WILL NOT STICK, OR THAT THE WEARER WILL DEVELOP A BURN FROM THE ALCOHOL TRAPPED UNDER THE **SKINPATCH**



WHAT HAPPENS IF I'M ALLERGIC TO THE CHEMICALS IN THE **PATCH**? OR THE ADHESIVE?



ALLERGIC REACTIONS ARE VERY RARE, IF YOU HAVE ONE, REMOVE THE **PATCH** AND WASH THE AREA. AFTER THAT YOU NEED TO CONTACT THE **TEST CENTER** AND MAKE ARRANGEMENT TO CALL IN FOR DAILY BLOOD TEST. LET'S CONTINUE...



FIRST, REMOVE THE BACKING FROM THE **PATCH**

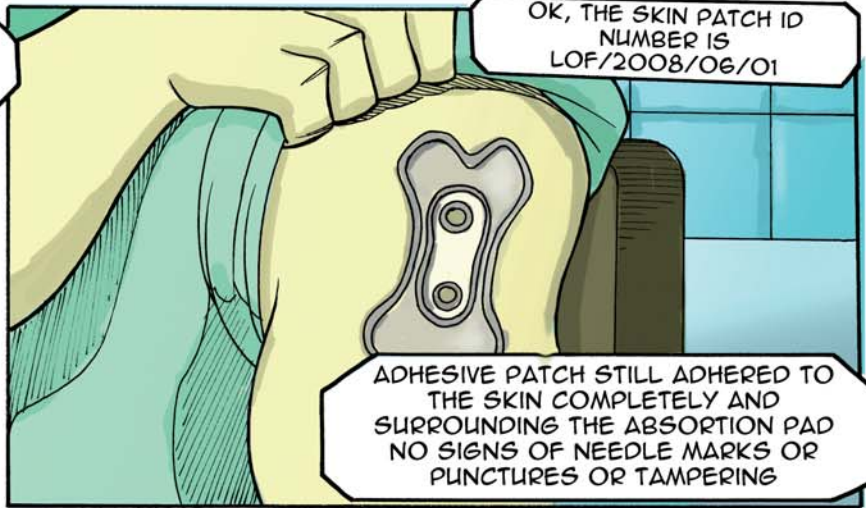


NEXT, PLACE THE **SKINPATCH** OVER THE CLEANED AREA. THE PURPOSE OF FLEXING IS TO STRETCH THE SKIN DURING APPLICATION. PRESS THE **SKIN-PATCH** ONTO THE SKIN AND GENTLY RUB THE AREA OF FILM AROUND THE ABSORPTION PAD FOR ABOUT 10 SECONDS



THANK YOU, MR MAGWITCH WE'LL RETURN NEXT TUESDAY TO REMOVE THE **PATCH**, WEMMICK PUT THE CHAIN-OF-CUSTODY FORM PACK AND CALL IN THE NEXT SUBJECT





AFTER 120 SECONDS THE TEST IS COMPLETED



MR DRUMMLE, THE SMARTBIOPHONE IS GIVING A READING THAT IS CLOSE TO THE THRESHOLD. I'M AFRAID THAT FURTHER TESTING IN LABORATORY IS REQUIRED...



I DON'T TAKE DRUGS!



I'M NOT SAYING THAT YOU TAKE DRUGS. THERE ARE SOME SUBSTANCES THAT CAN GIVE A FALSE POSITIVE READING, THAT'S WHY WE HAVE TO DO FURTHER TESTING



PAY ATTENTION WEMMICK. THE SKINPATCH CONTAINS A SECOND SWEAT COLLECTION PAD FOR CONFIRMATORY TESTING...



...THIS PAD CAN SIMPLY BE REMOVED BY PELLING OFF THE FOIL WHICH COVERS IT



REMOVE THE TAPE AND SEAL THE BAG. THEN PEEL A BARCODE LABEL FROM THE CHAN-OF-CUSTODY FORM AND PLACE IT ON THE OUTSIDE OF THE BAG FINALLY FOLD THE BAG AT ABOUT 1/3 OF ITS LENGTH AND PLACE THE SECURITY SEAL OVER THE EDGE



THANK YOU MR DRUMMLE. YOU SHOULD GET YOUR TEST RESULTS IN APPROXIMATELY 10 DAYS GOODBYE

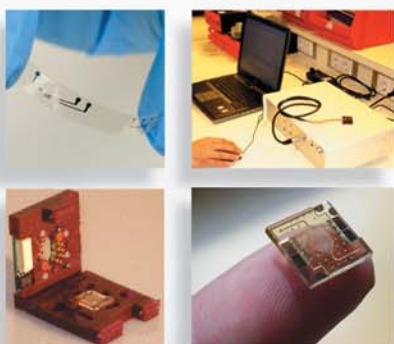


LABONFOIL

Vision

Portable diagnostic tools are urgently required to ensure rapid, affordable and simple analysis in many scenarios that will benefit our society (e.g. in; hospitals, airports, doctor's practice, roadside police controls, natural environment).

However, conventional analytical methods often require a large volume of sample and complicated time-consuming protocols. Current portable devices are based on less sensitive immunochromatographic strips or electrochemical detection systems, whereas desktop systems (though sensitive and semi-automatic) are bulky and heavy.



Objectives

The objective of the LabOnFoil project is to develop ultra-low-cost laboratories on chips (LOC) without compromising time response, sensitivity or simplicity of use. The user will obtain the test results using a very popular interface (a smartphone) and a set of Labcards and skin patches, where the sample preparation and detection take place. The project will validate the devices in four applications:

- Labcard for marine algae analysis, climate change, CO₂ sequestration, and toxic blooms.
- Labcard for *Salmonella* spp. and *Campylobacter* spp. detection in slaughter houses and farms.
- Labcard for Colorectal Cancer monitoring using blood.
- Skin patch for cocaine consumption testing of professional drivers.



Strategy

Due to the biomicrofabrication results achieved within the consortium and remarkable synergy with organic optoelectronics, lamination and biological reactions, the consortium can now seize the opportunity to develop a fully integrated device with ultra-low cost. The combination of these technologies will produce a successful portable diagnostic device able to analyse all major biomolecule classes (proteins, RNA and DNA) in a wide range of applications.

The new testing devices will consist of a lab-on-a-chip (LOC) embedded in a smartcard or a skin patch. The Labcard and Skin Patch components will be manufactured using a reel-to-reel system radically decreasing the price to 1% of existing systems (wafer based).



The future mass production of these novel diagnostic components will be guaranteed by the development of manufacturing equipment. This will provide, at last, a standardised solution to manufacture truly ultra-low-cost Lab-on-a-chip microsystems. The dramatic cost reduction will be based on the use of large films instead of wafer substrates. The smart mobile phone will offer a vast range of straightforward communication and interface capabilities. This strategy will turn a smartphone into a portable diagnostic device. The Labcards and the skin patches will demonstrate the wide range of applications and the potential of the technology.

SmartBioPhon



DTU Nanotech
Department of Micro- and Nanotechnology

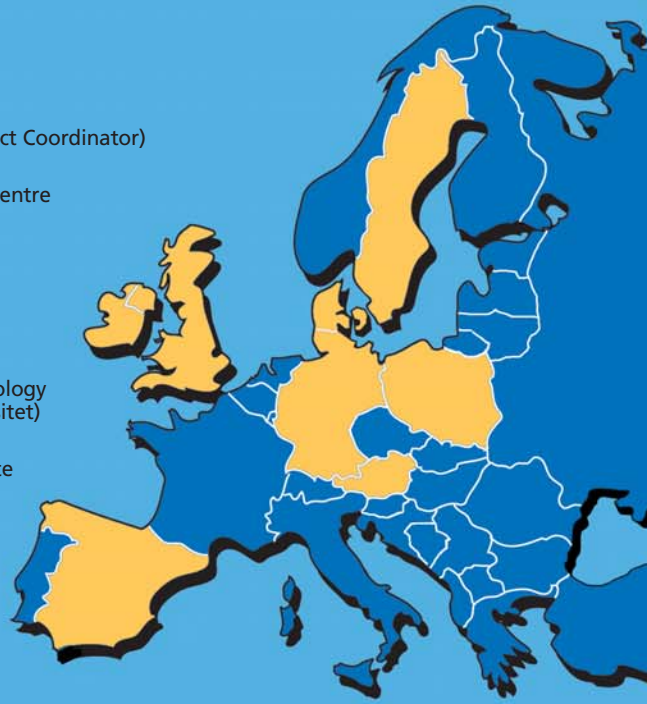
DTU Vet
National Veterinary Institute



GEMA MEDICAL S.L.

Project Partners

- IKERLAN-IK4, S.Coop. (Project Coordinator)
–Spain–
- GAIKER-IK4 Technological Centre
–Spain–
- University Of Southampton
–United Kingdom–
- Natural Environment Research Council
–United Kingdom–
- Dep. Micro and Nanotechnology (Danmarks Tekniske Universitet)
–Denmark–
- National Veterinary Institute (Danmarks Tekniske Universitet)
–Denmark–
- Fundación Vasca De Innovación E Investigación Sanitarias
–Spain–
- Politechnika Wroclawska
–Poland–
- Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V.
–Germany–
- Biosensia Limited
–Ireland–
- TATAA Biocenter AB
–Sweden–
- EVGroup E. Thallner Gmbh
–Austria–
- Biotoools Biotechnological & Medical Laboratories S.A.
–Spain–
- Micro Resist Technology
–Germany–
- Gema Medical S.L.
–Spain–



Deliverable objective

The purpose of the diffusion of these four stories is to obtain a feedback from interested people who read it. Feel free to contact us or send us your opinion about the envisioned device and its applications. It would be highly appreciated.

Contact

Jesús M. Ruano-López
IKERLAN-IK4, S.Coop.
J.M^o Arizmendarrieta, N. 2
20500 Arrasate-Mondragón
SPAIN
e-mail: jmruano@ikerlan.es

www.ikerlan.es

Web site: www.labonfoil.eu

Timeline: Start: 01-05-08
End: 30-04-12

Budget: Overall Cost: 7.097.808 €
EC Funding: 5.300.000 €

Contract number: 224306



Supported by FP7

