

JOURNEY TO THE HEART OF BIOMASS

SYLVAIN RENARD



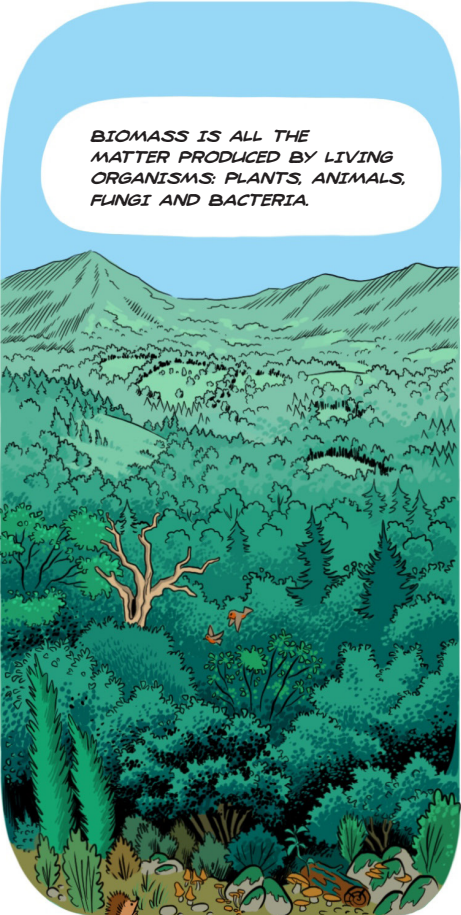
INRAE



BIA
Biopolymères
Interactions
Assemblages



IN THE COURSE OF THE EVOLUTION OF LIFE ON EARTH, A WHOLE RANGE OF ORGANISMS HAVE APPEARED AND, AS THEY HAVE DEVELOPED, HAVE BECOME ESSENTIAL TO THE PROPER FUNCTIONING OF ECOSYSTEMS.



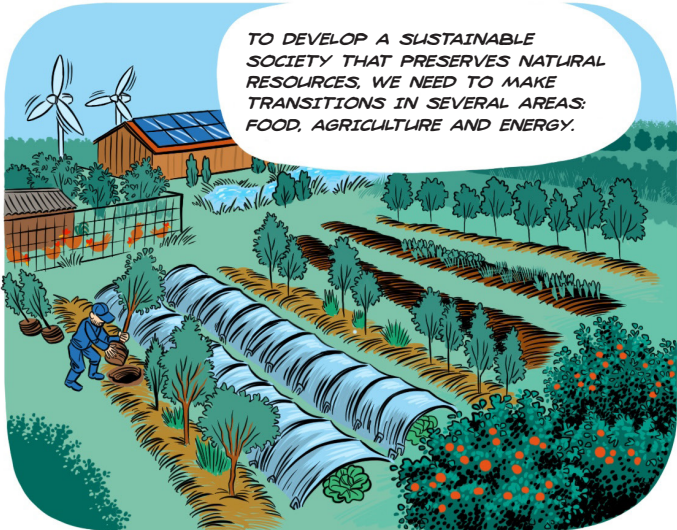
BIOMASS IS ALL THE MATTER PRODUCED BY LIVING ORGANISMS: PLANTS, ANIMALS, FUNGI AND BACTERIA.



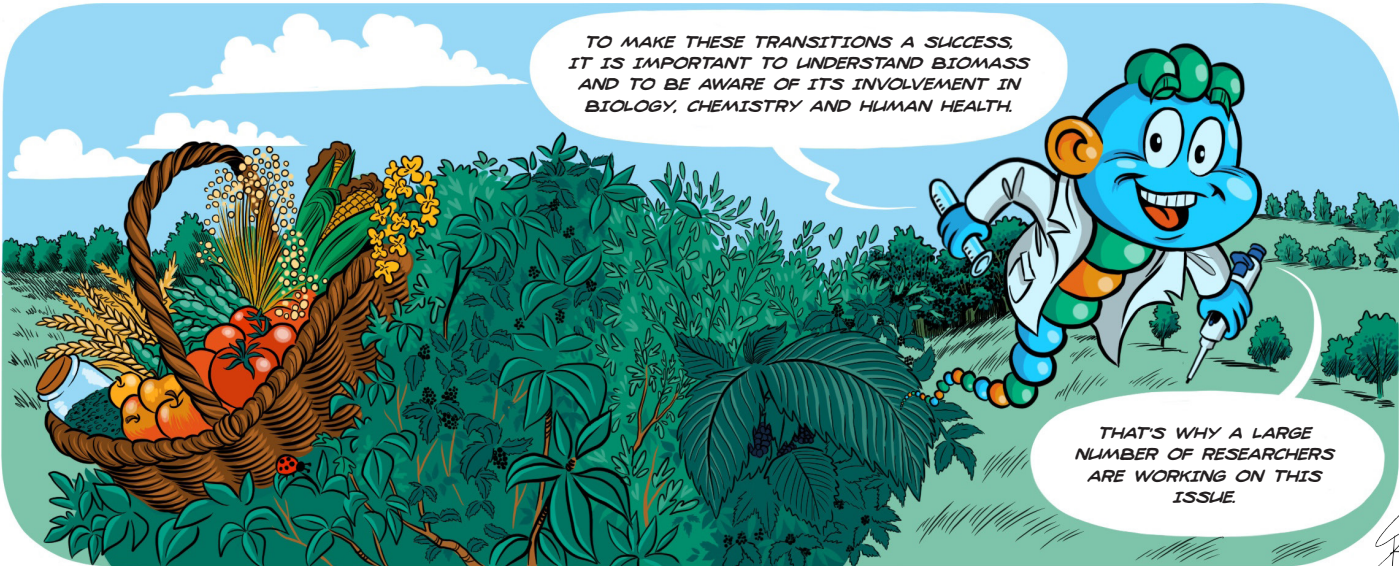
AND WE HUMANS EXPLOIT BIOMASS AS A NATURAL RESOURCE (DOMESTICATED PLANTS, FUELS, ETC.) FOR OUR BASIC NEEDS.



INTENSIVE EXPLOITATION OF BIOMASS AND HUMAN ACTIVITY ARE HAVING WORRYING CONSEQUENCES FOR THE ENVIRONMENT, CLIMATE AND HEALTH.



TO DEVELOP A SUSTAINABLE SOCIETY THAT PRESERVES NATURAL RESOURCES, WE NEED TO MAKE TRANSITIONS IN SEVERAL AREAS: FOOD, AGRICULTURE AND ENERGY.



TO MAKE THESE TRANSITIONS A SUCCESS, IT IS IMPORTANT TO UNDERSTAND BIOMASS AND TO BE AWARE OF ITS INVOLVEMENT IN BIOLOGY, CHEMISTRY AND HUMAN HEALTH.

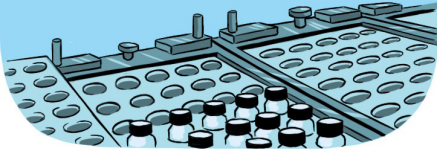
THAT'S WHY A LARGE NUMBER OF RESEARCHERS ARE WORKING ON THIS ISSUE.

SR



BIA
Biopolymères
Interactions
Assemblages

BIA IS A RESEARCH
LABORATORY OF THE
FRENCH NATIONAL
RESEARCH INSTITUTE FOR
AGRICULTURE, FOOD AND
THE ENVIRONMENT (INRAE).

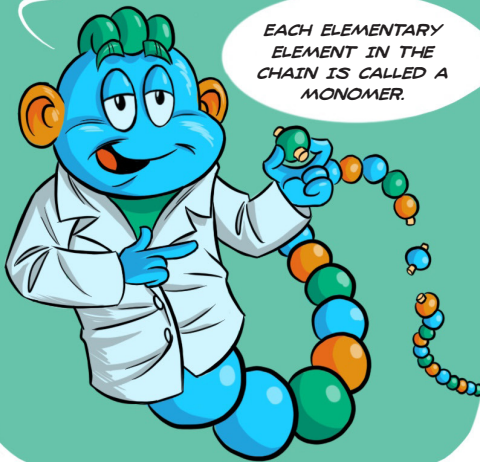


THE LABORATORY'S RESEARCH
EXPLORES BIOMASS, FROM
MOLECULES (BIOPOLYMERS) TO
OBJECTS (BIOBASED FOODS AND
MATERIALS).

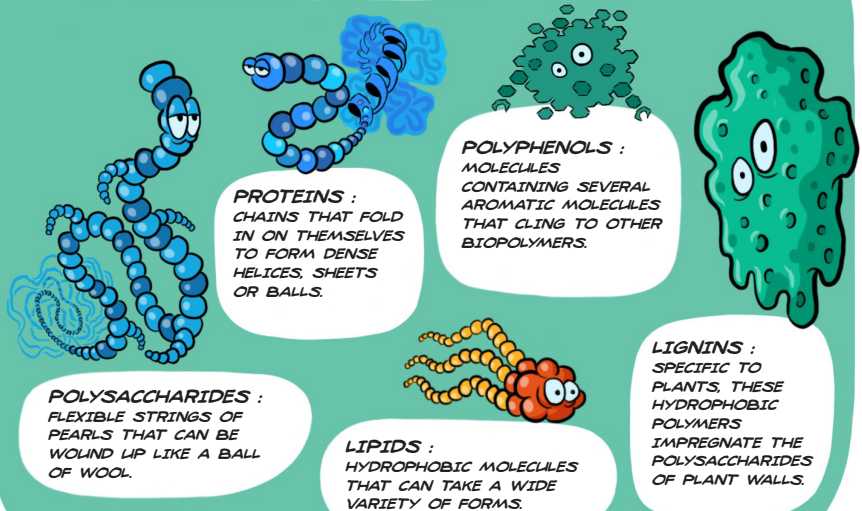


TO BEGIN WITH, WHAT IS A
BIOPOLYMER? 'BIO' MEANS
DERIVED FROM LIVING
ORGANISMS, AND A POLYMER IS
A LARGE CHAIN OF MOLECULES!

EACH ELEMENTARY
ELEMENT IN THE
CHAIN IS CALLED A
MONOMER.



THERE ARE SEVERAL TYPES OF
BIOPOLYMERS :



POLYPHENOLS :
MOLECULES
CONTAINING SEVERAL
AROMATIC MOLECULES
THAT CLING TO OTHER
BIOPOLYMERS.

PROTEINS :
CHAINS THAT FOLD
IN ON THEMSELVES
TO FORM DENSE
HELICES, SHEETS
OR BALLS.

POLYSACCHARIDES :
FLEXIBLE STRINGS OF
PEARLS THAT CAN BE
WOUND UP LIKE A BALL
OF WOOL.

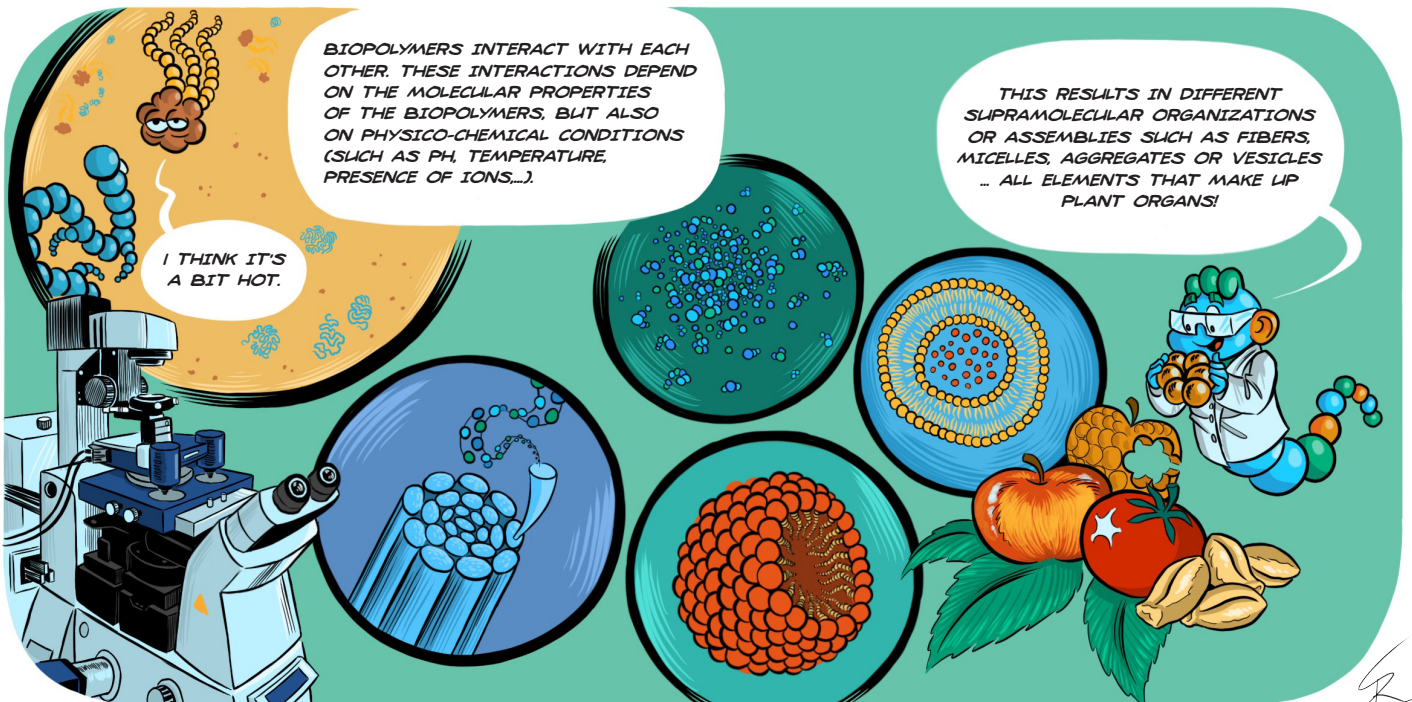
LIPIDS :
HYDROPHOBIC MOLECULES
THAT CAN TAKE A WIDE
VARIETY OF FORMS.

LIGNINS :
SPECIFIC TO
PLANTS, THESE
HYDROPHOBIC
POLYMERS
IMPREGNATE THE
POLYSACCHARIDES
OF PLANT WALLS.

BIOPOLYMERS INTERACT WITH EACH
OTHER. THESE INTERACTIONS DEPEND
ON THE MOLECULAR PROPERTIES
OF THE BIOPOLYMERS, BUT ALSO
ON PHYSICO-CHEMICAL CONDITIONS
(SUCH AS PH, TEMPERATURE,
PRESENCE OF IONS...).

I THINK IT'S
A BIT HOT.

THIS RESULTS IN DIFFERENT
SUPRAMOLECULAR ORGANIZATIONS
OR ASSEMBLIES SUCH AS FIBERS,
MICELLES, AGGREGATES OR VESICLES
... ALL ELEMENTS THAT MAKE UP
PLANT ORGANS!



PVPP

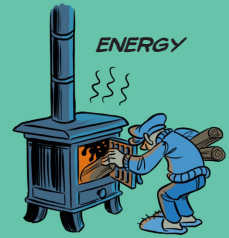
PLANT WALLS AND PARIETAL POLYMERS

THIS TEAM TAKES A CLOSE INTEREST IN PLANT BIOMASS, A NEW ALTERNATIVE RESOURCE TO FOSSIL FUELS.

THE TEAM FOCUSES ON THE PLANT CELL WALL, A PROTECTIVE SHIELD, AND THE BIOPOLYMERS THAT MAKE IT UP.



BIOMASS, RICH IN PLANT CELL WALL, IS VALORIZED FOR VARIOUS USES :

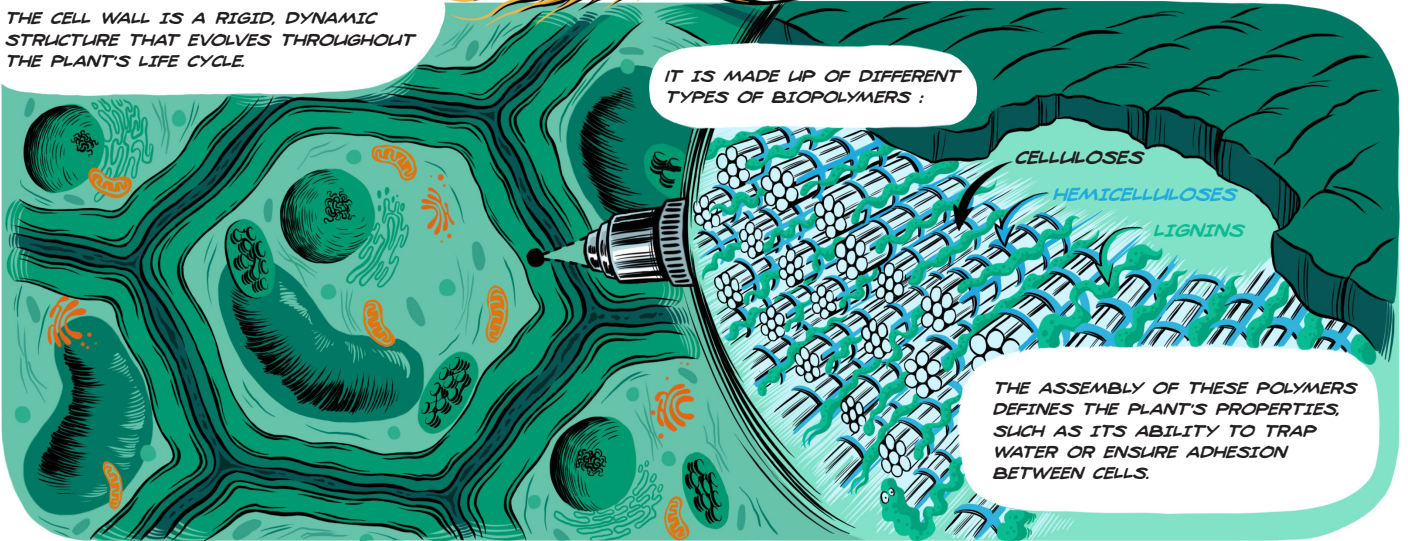


THE TEAM'S AIM IS TO OPTIMIZE THE QUALITY AND USE OF PLANT PRODUCTS. TO ACHIEVE THIS, IT IS IMPORTANT TO KNOW AND CONTROL THE COMPOSITION OF THE CELL WALL.



THE CELL WALL IS A RIGID, DYNAMIC STRUCTURE THAT EVOLVES THROUGHOUT THE PLANT'S LIFE CYCLE.

IT IS MADE UP OF DIFFERENT TYPES OF BIOPOLYMERS :



CELLULOSES
HEMICELLULOSES
LIGNINS

THE ASSEMBLY OF THESE POLYMERS DEFINES THE PLANT'S PROPERTIES, SUCH AS ITS ABILITY TO TRAP WATER OR ENSURE ADHESION BETWEEN CELLS.

THE AIM IS THEREFORE TO CONTROL THE WALL STRUCTURE FOR THE PRODUCER AND THE CONSUMER.

DEPENDING ON THE ASSEMBLY, THE PRODUCT WILL HAVE A DIFFERENT QUALITY.

FOR EXAMPLE, IN FOOD PRODUCTS, THE CELL WALL AFFECTS THE TEXTURE OF THE FRUIT AND ITS POST-HARVEST PRESERVATION.



FOR MATERIALS DERIVED FROM RENEWABLE PLANT SOURCES, SUCH AS FLAX OR HEMP FIBERS, THE CELL WALL PROVIDES MECHANICAL STIFFNESS.

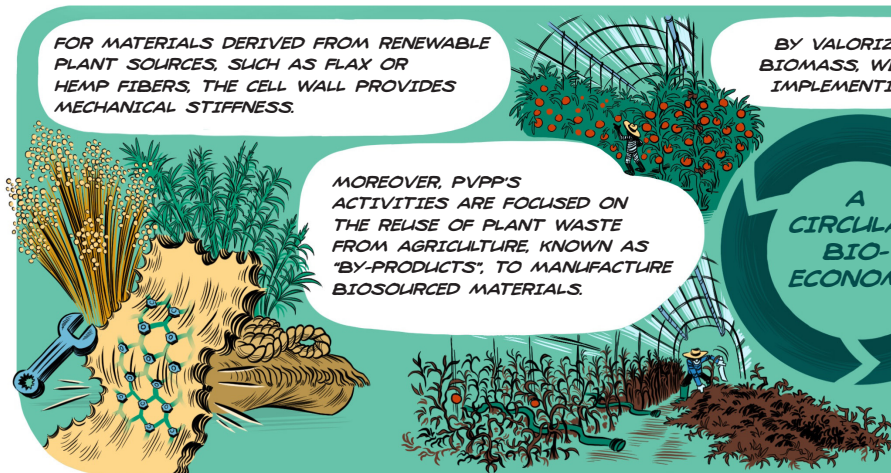
BY VALORIZING BIOMASS, WE ARE IMPLEMENTING :

MOREOVER, PVPP'S ACTIVITIES ARE FOCUSED ON THE REUSE OF PLANT WASTE FROM AGRICULTURE, KNOWN AS "BY-PRODUCTS", TO MANUFACTURE BIOSOURCED MATERIALS.

A
CIRCULAR
BIO-
ECONOMY



IN THIS WAY, WE'RE BUILDING A ZERO-WASTE, LOW-ENVIRONMENTAL-IMPACT APPROACH.



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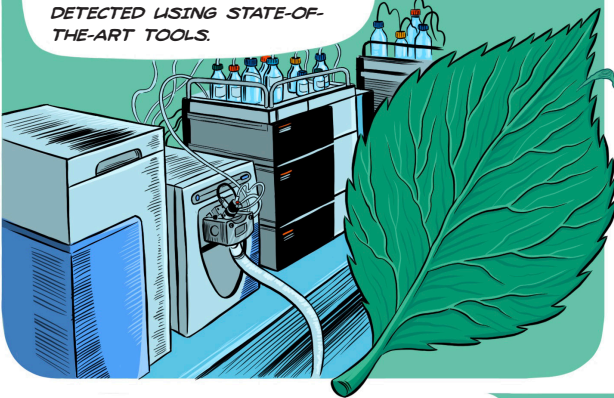
PRP

POLYPHENOLS, REACTIVITY, PROCESSES

THIS RESEARCH TEAM FOCUSES ON POLYPHENOLS, PARTICULARLY DURING FOOD PROCESSING.

PRP AIMS TO UNDERSTAND POLYPHENOL MODIFICATIONS AND THEIR CONTRIBUTION TO QUALITY DURING FOOD AND BEVERAGE PRODUCTION.

POLYPHENOLS ARE PLANT COMPOUNDS WITH COMPLEX STRUCTURES. THEY CAN BE DETECTED USING STATE-OF-THE-ART TOOLS.



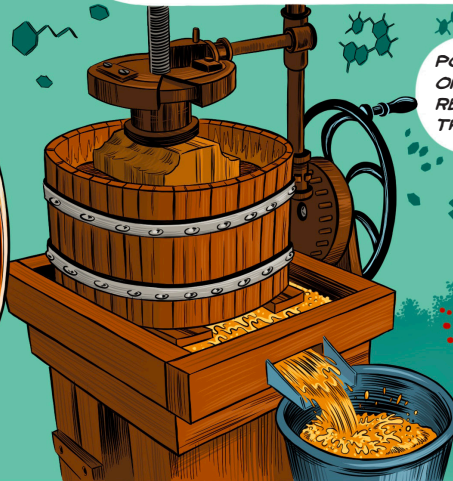
MAINLY LOCATED IN A CELLULAR ZONE CALLED THE VACUOLE, POLYPHENOLS PROTECT PLANTS AGAINST BIOAGGRESSORS THANKS TO THEIR ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES.



IN THIS WAY, THEY CONTRIBUTE TO PLANT HEALTH, AS WELL AS TO HUMAN HEALTH THROUGH FOOD.

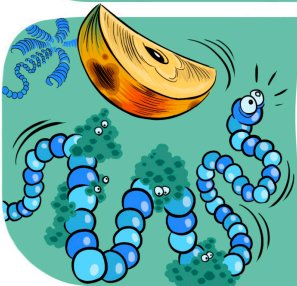
PRP IS INTERESTED IN APPLE POLYPHENOLS BECAUSE THEY ARE INVOLVED IN THE COLOR AND TASTE OF FRUIT, JUICES AND CIDERS.

PRP STUDIES BIOCHEMICAL REACTIONS DURING FOOD PROCESSING: POLYPHENOL STRUCTURES ARE MODIFIED AND ACQUIRE COLORING PROPERTIES, FOR EXAMPLE.



POLYPHENOL-RICH VARIETIES OF CIDER APPLES ARE MORE RESISTANT TO DISEASE. THERE'S LESS NEED TO TREAT.

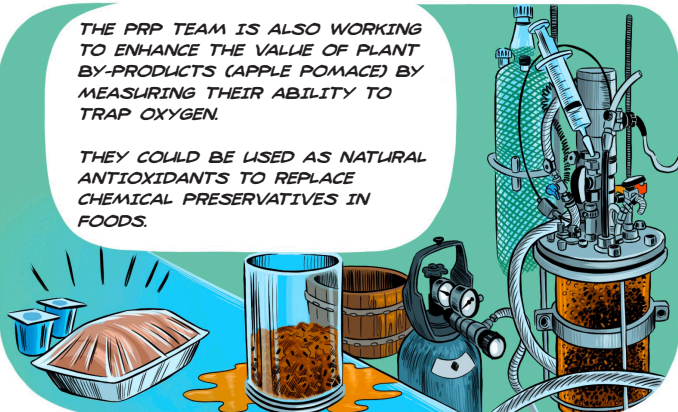
SO I PUT THE SPRAYER AWAY!



SOME POLYPHENOLS ARE TANNINS: IN OTHER WORDS, THEY HAVE THE ABILITY TO INTERACT WITH PROTEINS. THESE INTERACTIONS CONTRIBUTE TO ASTRINGENCY, BUT ALSO TO DIGESTIBILITY AND THE REDUCTION OF FOOD ALLERGIES.

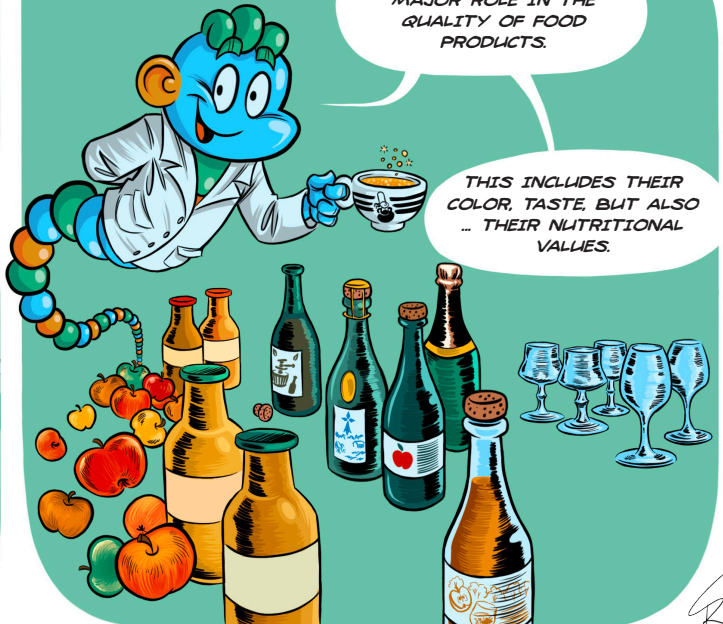
THE PRP TEAM IS ALSO WORKING TO ENHANCE THE VALUE OF PLANT BY-PRODUCTS (APPLE POMACE) BY MEASURING THEIR ABILITY TO TRAP OXYGEN.

THEY COULD BE USED AS NATURAL ANTIOXIDANTS TO REPLACE CHEMICAL PRESERVATIVES IN FOODS.



POLYPHENOLS PLAY A MAJOR ROLE IN THE QUALITY OF FOOD PRODUCTS.

THIS INCLUDES THEIR COLOR, TASTE, BUT ALSO ... THEIR NUTRITIONAL VALUES.



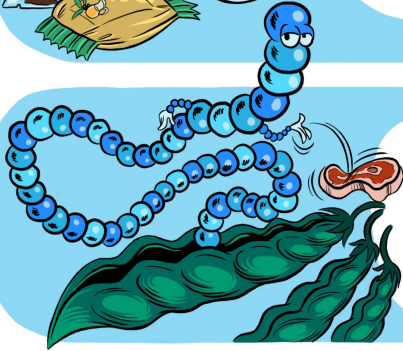
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ISD

INTERFACES & DISPERSED SYSTEMS

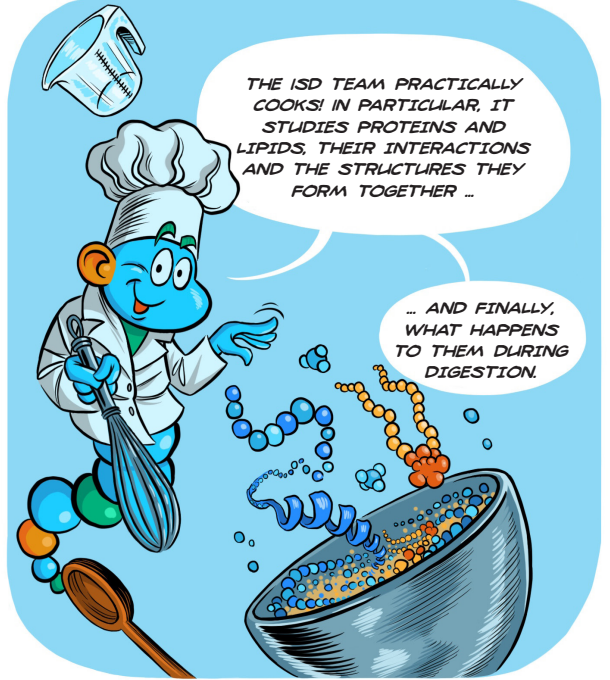


AS PART OF ITS RESEARCH INTO HEALTHIER, MORE SUSTAINABLE FOOD, THIS TEAM USES DIFFERENT INGREDIENTS AND EXPLORES HOW THEY CAN BE ASSEMBLED TO FORM TECHNOLOGICALLY ADVANCE FOODS OF HIGH NUTRITIONAL VALUE.



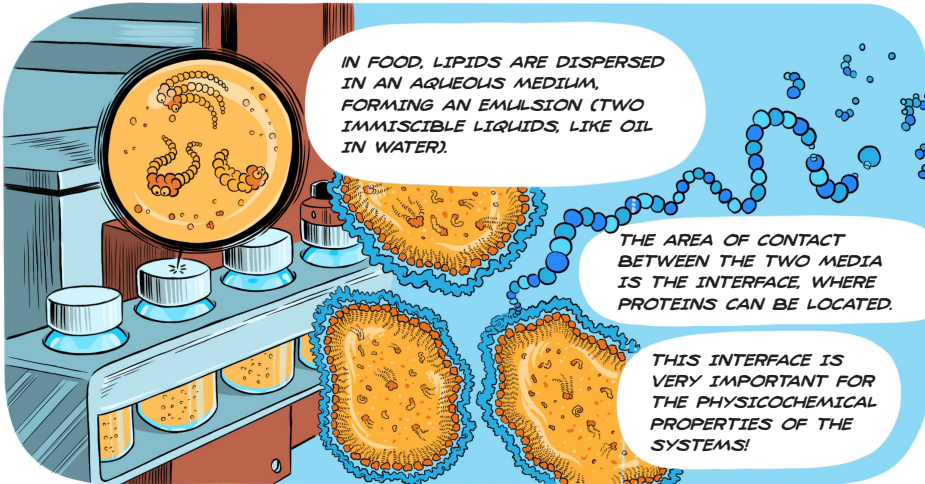
THE AIM IS TO ALSO REPLACE SOME INGREDIENTS OF ANIMAL ORIGIN, OR ARTIFICIAL ADDITIVES, BY PLANT-BASED ALTERNATIVES.

FOR EXAMPLE, THE ISD TEAM IS VERY INTERESTED IN PLANT PROTEINS.



THE ISD TEAM PRACTICALLY COOKS! IN PARTICULAR, IT STUDIES PROTEINS AND LIPIDS, THEIR INTERACTIONS AND THE STRUCTURES THEY FORM TOGETHER ...

... AND FINALLY, WHAT HAPPENS TO THEM DURING DIGESTION.



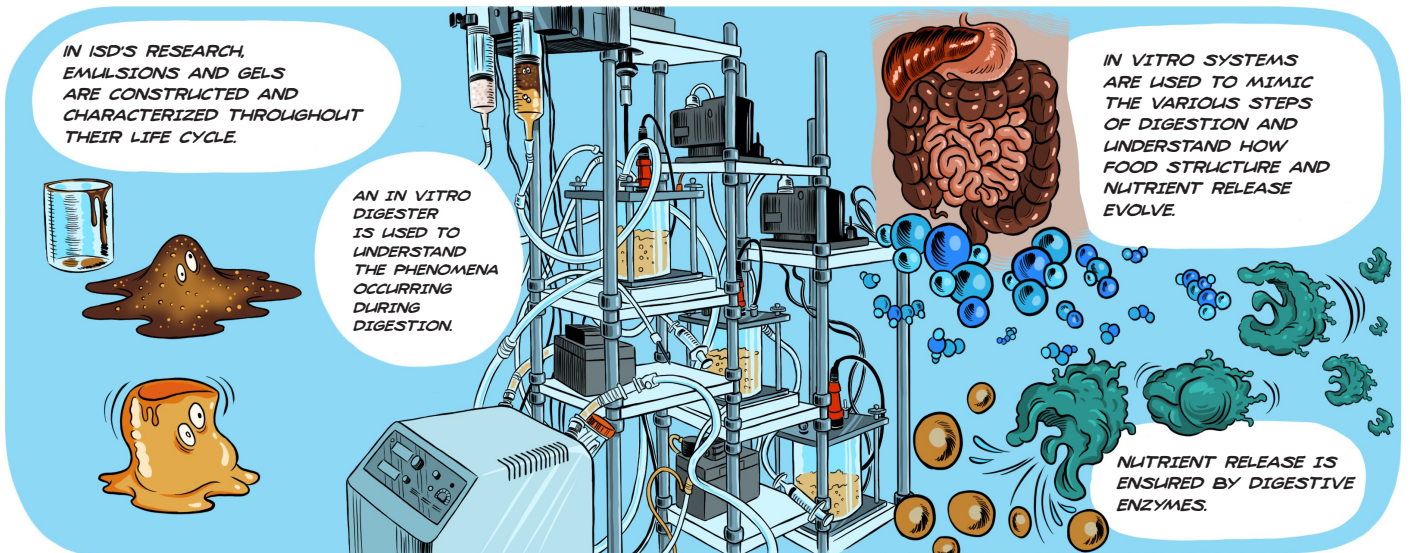
IN FOOD, LIPIDS ARE DISPERSED IN AN AQUEOUS MEDIUM, FORMING AN EMULSION (TWO IMMISCIBLE LIQUIDS, LIKE OIL IN WATER).

THE AREA OF CONTACT BETWEEN THE TWO MEDIA IS THE INTERFACE, WHERE PROTEINS CAN BE LOCATED.

THIS INTERFACE IS VERY IMPORTANT FOR THE PHYSICO-CHEMICAL PROPERTIES OF THE SYSTEMS!



BY USING DIFFERENT TYPES OF PROTEIN, WE CAN MODULATE THE COMPOSITION OF THE INTERFACE AND THE STRUCTURE OF THE FOOD.



IN ISD'S RESEARCH, EMULSIONS AND GELS ARE CONSTRUCTED AND CHARACTERIZED THROUGHOUT THEIR LIFE CYCLE.

AN IN VITRO DIGESTER IS USED TO UNDERSTAND THE PHENOMENA OCCURRING DURING DIGESTION.

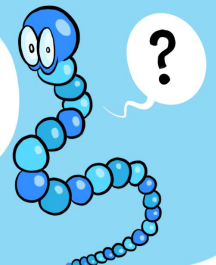
IN VITRO SYSTEMS ARE USED TO MIMIC THE VARIOUS STEPS OF DIGESTION AND UNDERSTAND HOW FOOD STRUCTURE AND NUTRIENT RELEASE EVOLVE.

NUTRIENT RELEASE IS ENSURED BY DIGESTIVE ENZYMES.

BY MASTERING THESE ASPECTS, WE CAN IMPROVE THE NUTRITIONAL PROPERTIES OF FOODS. FOR EXAMPLE, WE CAN INCORPORATE "BETTER" LIPIDS, SUCH AS OMEGA 3.



MANY QUESTIONS REMAIN, HOWEVER, SUCH AS THE IMPACT ON HEALTH, WITH THE RISK OF ALLERGENICITY, OR THE DIGESTIVE DISORDERS ASSOCIATED WITH PROTEINS.

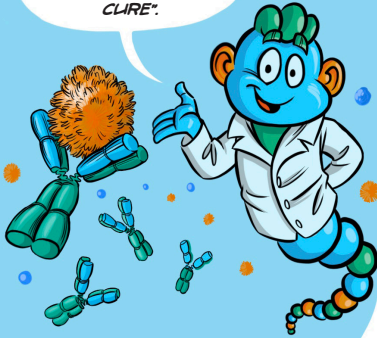


ALLERGIE

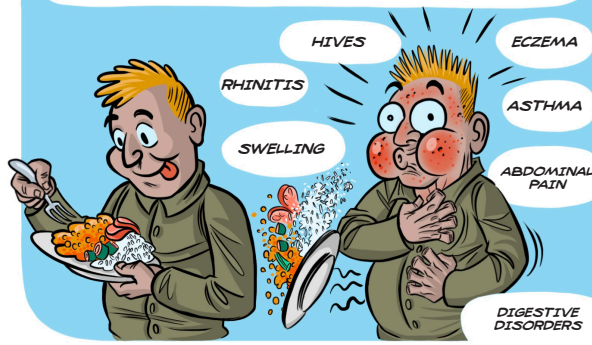
A TEAM DEDICATED TO UNDERSTANDING THE DEVELOPMENT OF FOOD ALLERGIES AND ESTABLISHING STRATEGIES TO PREVENT THEM. ALLERGY IS A PUBLIC HEALTH PROBLEM IN INDUSTRIALIZED COUNTRIES.

THE WORLD HEALTH ORGANIZATION ESTIMATES THAT BY 2050, 50% OF THE POPULATION WILL BE ALLERGIC.

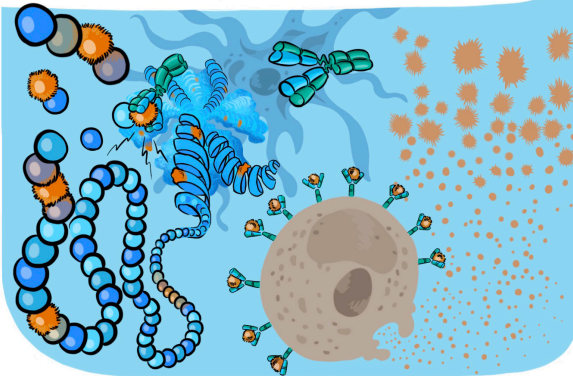
AS THE SAYING GOES, "PREVENTION IS BETTER THAN CURE".



ALLERGIC REACTIONS CAN BE RECOGNIZED BY THE FOLLOWING SYMPTOMS :



THE REACTION IS TRIGGERED BY SEQUENCES OF AMINO ACIDS FOUND IN PROTEINS. ANTIBODIES REGISTER THESE SEQUENCES AND DELIVER THE INFORMATION TO IMMUNE CELLS, WHICH RELEASE CHEMICAL MOLECULES (HISTAMINES) RESPONSIBLE FOR THE SYMPTOMS.



THE INCREASE IN ALLERGIES IS LINKED TO A NUMBER OF FACTORS :

HEALTH FACTORS = DYSFUNCTION OF THE IMMUNE SYSTEM, MICROBIOTA, ETC.

ENVIRONMENTAL FACTORS = THE PRESENCE OF POLLUTANTS, ANTIBIOTICS OR ULTRA-PROCESSED FOODS.

IN ADDITION, WITH THE INCREASING USE OF PLANT PROTEINS, WE'RE NOTICING THE EMERGENCE OF "NEW ALLERGENS".



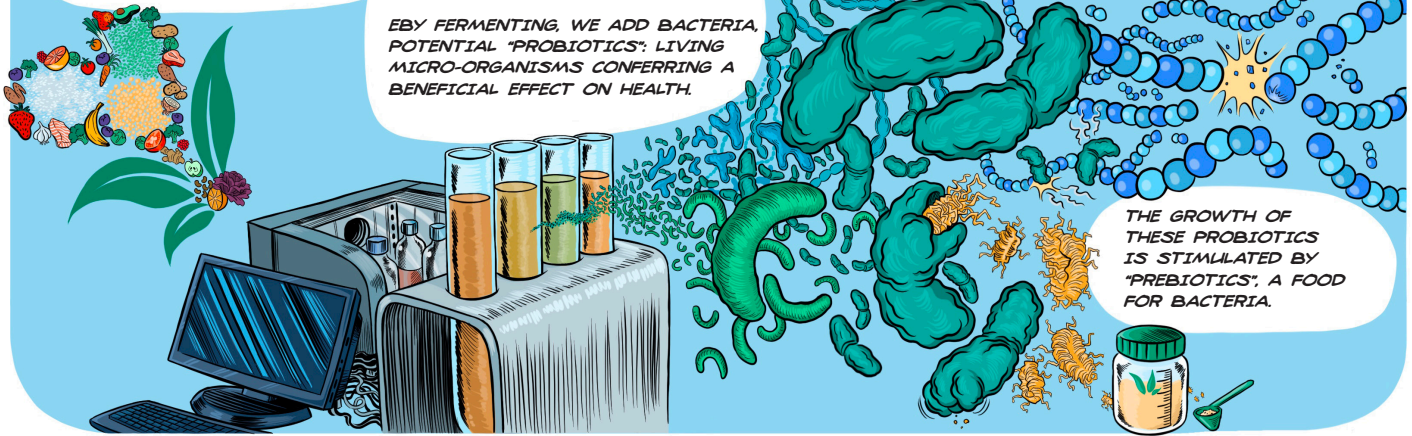
WE ALSO USE FOOD AS A PREVENTIVE STRATEGY, FOR EXAMPLE, BY CHANGING OUR DIET TO MAKE IT HEALTHIER AND MORE SUSTAINABLE.

OR BY BACTERIAL FERMENTATION OF PLANT PROTEINS.

BY FERMENTING, WE ADD BACTERIA, POTENTIAL "PROBIOTICS": LIVING MICRO-ORGANISMS CONFERRING A BENEFICIAL EFFECT ON HEALTH.

PROBIOTICS HYDROLYZE (CUT) ALLERGENIC PROTEINS. THEY WILL THUS BE LESS RECOGNIZED BY THE IMMUNE SYSTEM.

THE GROWTH OF THESE PROBIOTICS IS STIMULATED BY "PREBIOTICS", A FOOD FOR BACTERIA.

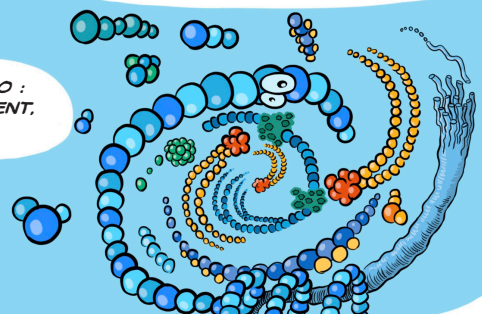
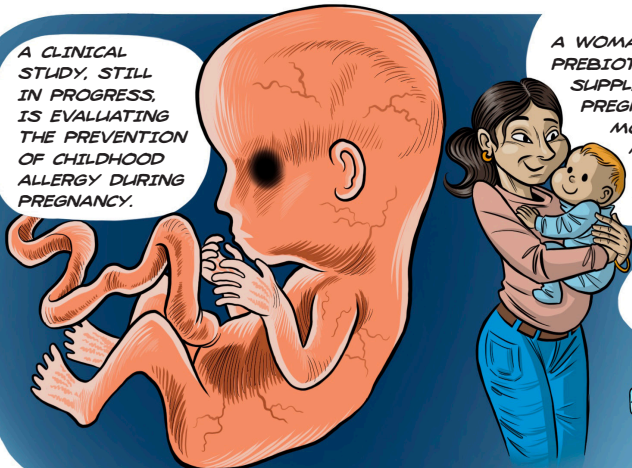


A CLINICAL STUDY, STILL IN PROGRESS, IS EVALUATING THE PREVENTION OF CHILDHOOD ALLERGY DURING PREGNANCY.

A WOMAN IS GIVEN PREBIOTIC NUTRITIONAL SUPPLEMENTS DURING PREGNANCY, WHICH MODIFY HER MICROBIOTA THAT SHE WILL PASS ON TO HER CHILD.

IN FOOD, PROTEIN ALSO INTERACTS WITH LIPIDS, FIBERS, SUGARS AND ADDITIVES, AND WE ARE ALSO TAKING A CLOSE INTEREST IN THESE STRUCTURES.

THE TEAM'S MOTTO : "UNDERSTAND, PREVENT, PREDICT".



SR

ELIPS

LIPIDOPROTEIN AND PROTEIN-SACCHARIDE EDIFICES

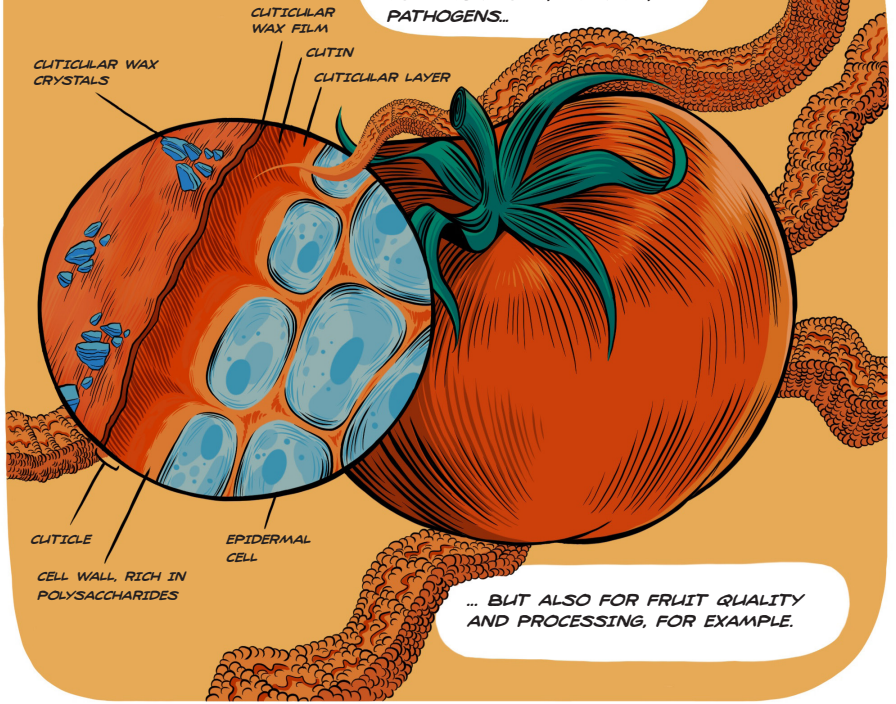
THIS TEAM IS INTERESTED IN THE COMPOSITION OF PLANT ORGANS AND, IN PARTICULAR, THE ARCHITECTURE OF PLANT SKIN : THE CUTICLE.

THE CUTICLE IS A HYDROPHOBIC (WATER-REPELLENT) COMPOSITE OF LIPIDS, POLYSACCHARIDES AND PHENOLIC COMPOUNDS.



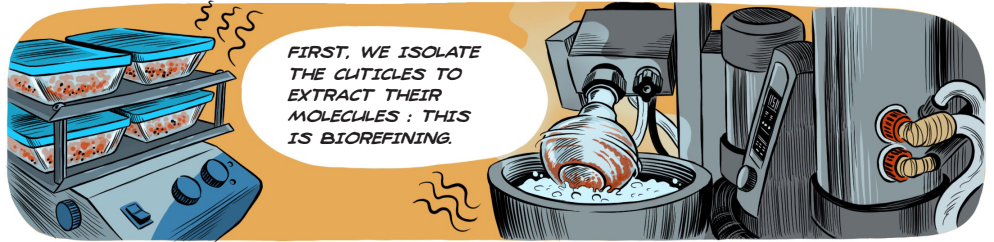
THE CUTICLE IS THE INTERFACE BETWEEN THE PLANT AND ITS ENVIRONMENT.

IT FULFILLS MULTIPLE FUNCTIONS THAT ARE CRUCIAL FOR THE PLANT: RESISTANCE TO WATER LOSS, UV RAYS, PATHOGENS...



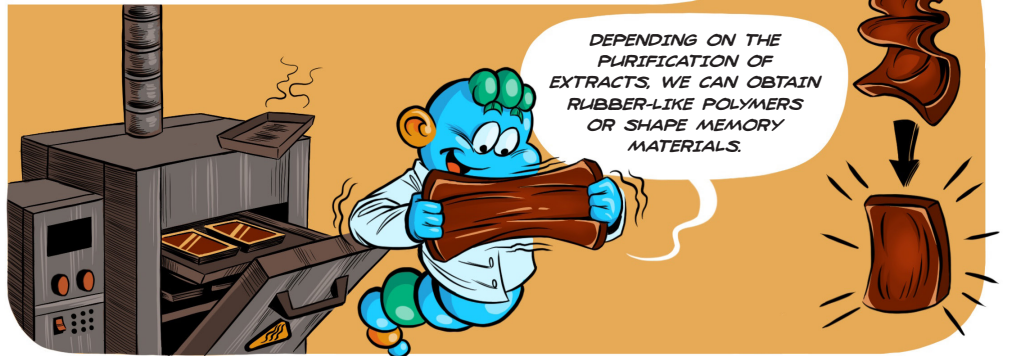
... BUT ALSO FOR FRUIT QUALITY AND PROCESSING, FOR EXAMPLE.

THE ELIPS TEAM IS ALSO LOOKING TO ADD VALUE TO AGRICULTURAL CO-PRODUCTS CONTAINING CUTICLES, SUCH AS SPENT GRAINS FROM THE INDUSTRIAL PROCESSING OF FRUIT (TOMATOES, APPLES, ETC.).



FIRST, WE ISOLATE THE CUTICLES TO EXTRACT THEIR MOLECULES : THIS IS BIOREFINING.

THESE MOLECULES CAN THEN BE VALORIZED. ONE AREA OF RESEARCH IS TO FIND AN ALTERNATIVE TO PLASTIC FILMS DERIVED FROM PETROLEUM CHEMISTRY.



DEPENDING ON THE PURIFICATION OF EXTRACTS, WE CAN OBTAIN RUBBER-LIKE POLYMERS OR SHAPE MEMORY MATERIALS.

THE TEAM IS ALSO INVOLVED IN THE SEARCH FOR ALTERNATIVES TO PESTICIDES. CUTIN RELEASES SIGNAL MOLECULES THAT DEFEND PLANTS AGAINST DISEASE. A SUSTAINABLE CROP PROTECTION STRATEGY.



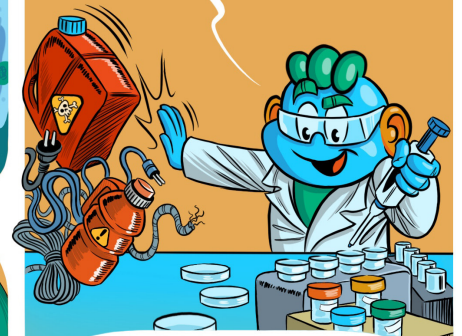
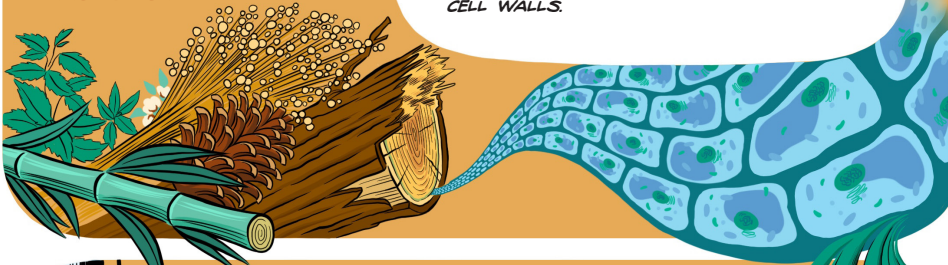
GR

NANO

NANOSTRUCTURED ASSEMBLIES

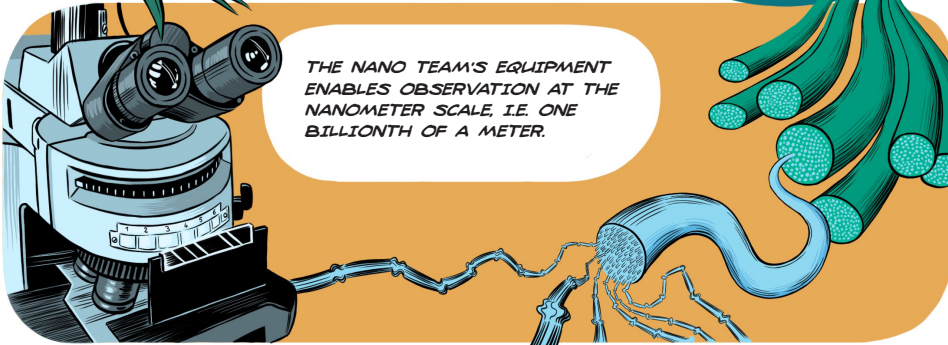
THE TEAM IS INTERESTED IN PLANT BIOPOLYMERS, MORE SPECIFICALLY THE DIFFERENT FORMS OF CELLULOSE, THE MOST ABUNDANT POLYMER IN BIOMASS AND THE MAIN CONSTITUENT OF PLANT CELL WALLS.

THE PRINCIPLE IS TO MASTER THE ASSEMBLY OF THESE BIOPOLYMERS TO DESIGN INNOVATIVE AND SUSTAINABLE BIOBASED MATERIALS.



THE NANO TEAM'S EQUIPMENT ENABLES OBSERVATION AT THE NANOMETER SCALE, I.E. ONE BILLIONTH OF A METER.

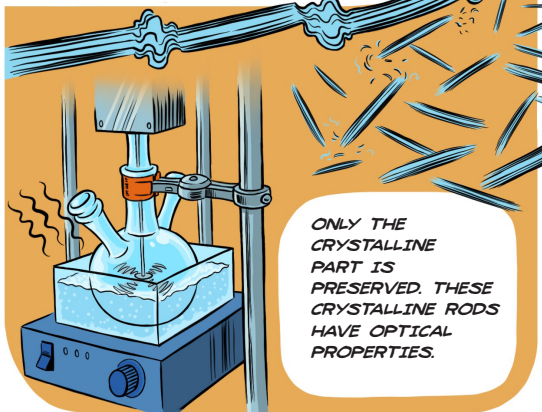
THE TEAM IS THEREFORE PROPOSING ALTERNATIVE SOLUTIONS TO PETRO-BASED MATERIALS (PLASTICS), DEVELOPED USING LOW-ENERGY, LOW-ENVIRONMENTAL-IMPACT PROCESSES.



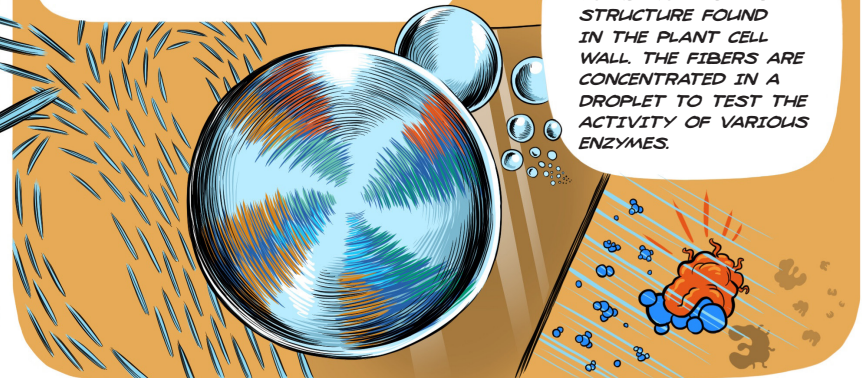
CELLULOSE FIBER IS COMPOSED OF AMORPHOUS AND CRYSTALLINE PARTS.

CELLULOSE RODS HAVE THE PROPERTY OF SELF-ORGANIZING, AS IN THE PLANT CELL WALL.

THE TEAM USES THIS PROPERTY TO REPRODUCE THE STRUCTURE FOUND IN THE PLANT CELL WALL. THE FIBERS ARE CONCENTRATED IN A DROPLET TO TEST THE ACTIVITY OF VARIOUS ENZYMES.

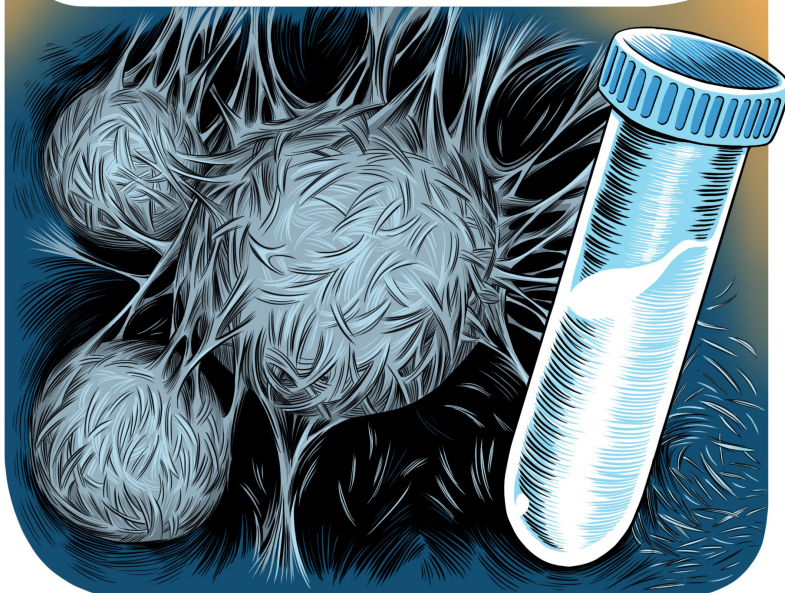


ONLY THE CRYSTALLINE PART IS PRESERVED. THESE CRYSTALLINE RODS HAVE OPTICAL PROPERTIES.



FOR OTHER USES, NANOCELLULOSE FIBERS COAT THE SURFACE OF AN OIL DROPLET, HELPING TO STABILIZE WATER-OIL INTERFACES (USED IN PAINTS AND COSMETICS).

THIS VALORIZATION OF BIOMASS IS A PATH TOWARDS A BIO-ECONOMY, TAKING INTO ACCOUNT THE SUSTAINABILITY OF RESOURCES, HUMAN AND ENVIRONMENTAL SAFETY, AND THE LIFE CYCLE OF THE MATERIAL.



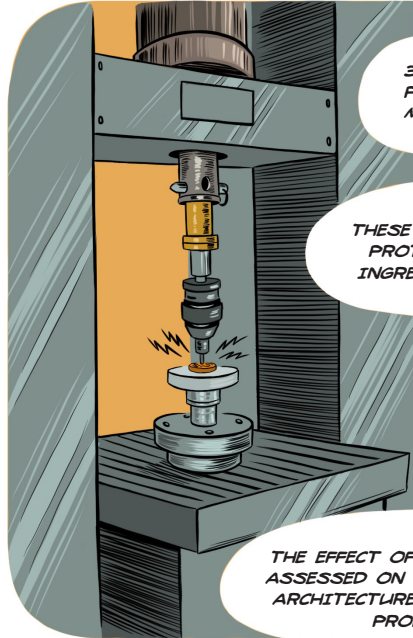
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MC2

MATERIALS, CREATION AND BEHAVIOR.

THE TEAM FOCUSES ON STARCH, PROTEINS AND THEIR TRANSFORMATION PROCESSES.

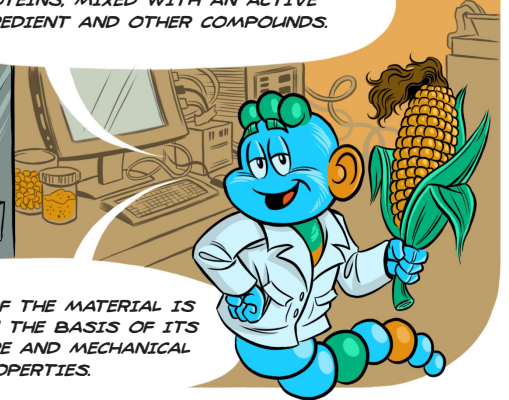
MC2'S CORE ACTIVITY FOCUSES ON LOW-HYDRATION SOLIDS FOR BIO-BASED MATERIALS AND FOODS.



3D PRINTING IS USED IN THE PHARMACEUTICAL SECTOR, FOR THE MANUFACTURE OF TABLETS.

THESE TABLETS ARE MADE FROM CORN PROTEINS, MIXED WITH AN ACTIVE INGREDIENT AND OTHER COMPOUNDS.

THE EFFECT OF THE MATERIAL IS ASSESSED ON THE BASIS OF ITS ARCHITECTURE AND MECHANICAL PROPERTIES.



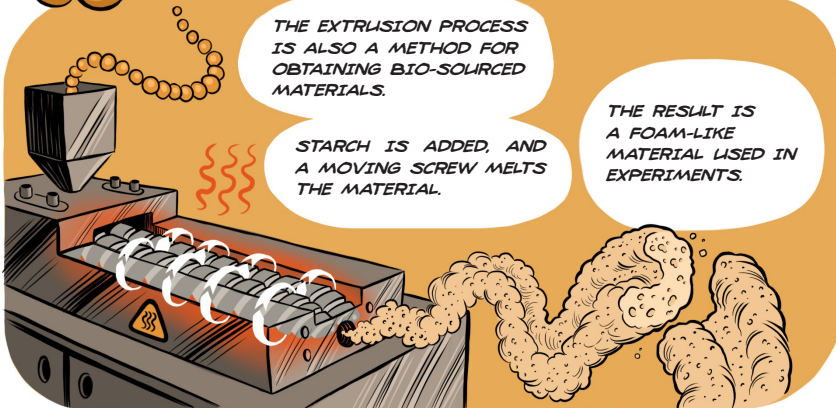
THE APPLICATIONS TARGETED ARE PERSONALIZED DRUGS, WITH A DIFFERENT STRUCTURE AND POROSITY, SINCE THEY ARE NOT ALL DIGESTED IN THE SAME WAY.



THE EXTRUSION PROCESS IS ALSO A METHOD FOR OBTAINING BIO-SOURCED MATERIALS.

STARCH IS ADDED, AND A MOVING SCREW MELTS THE MATERIAL.

THE RESULT IS A FOAM-LIKE MATERIAL USED IN EXPERIMENTS.



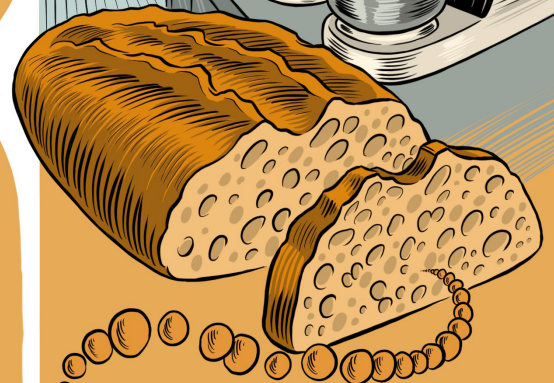
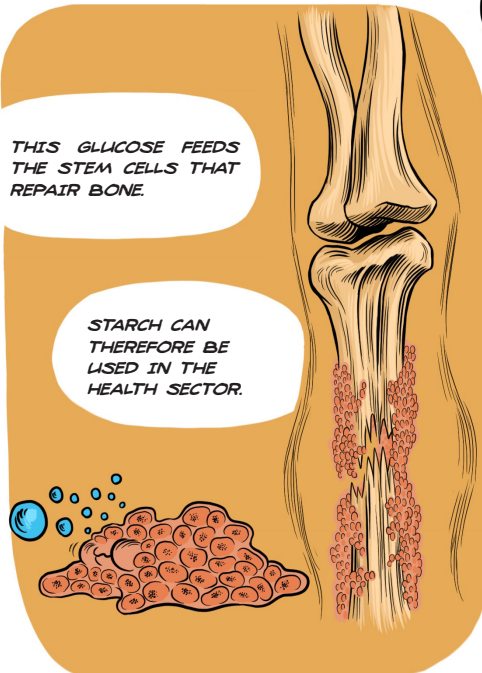
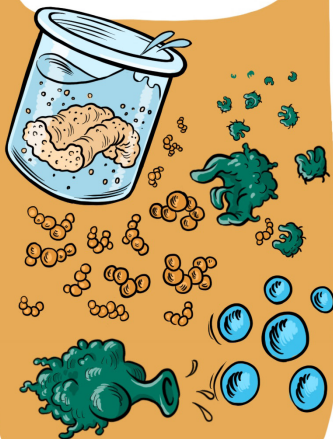
USING AN EXPERIMENTAL BAKERY, MC2 ANALYZES THE BREAD-MAKING PROCESS ACCORDING TO NUTRITIONAL AND SENSORY CRITERIA.



WE THEN EVALUATE THE DEGRADATION OF THIS MATERIAL WITH THE PRESENCE OF ENZYMES THAT TRANSFORM THE STARCH INTO GLUCOSE.

THIS GLUCOSE FEEDS THE STEM CELLS THAT REPAIR BONE.

STARCH CAN THEREFORE BE USED IN THE HEALTH SECTOR.



THE AIM IS TO UNDERSTAND THE BREAD PROPERTIES ACQUIRED DURING THE BREAD-MAKING PROCESS AS A FUNCTION OF VARIOUS PARAMETERS (WATER, WHEAT VARIETY, ETC.).

IN THIS WAY, MC2 OFFERS GUIDELINES FOR THE DEVELOPMENT OF AGRI-FOOD SECTORS.

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BIBS

BIORESOURCES: IMAGING,
BIOCHEMISTRY & STRUCTURE



THIS TEAM IS RENOWNED FOR ITS EXPERTISE AND STATE-OF-THE-ART EQUIPMENT. IT IS ALSO A "PLATFORM" TEAM, WORKING WITH A BROAD SCIENTIFIC COMMUNITY (BIA UNIT, ACADEMIC AND PRIVATE SECTOR PARTNERS).

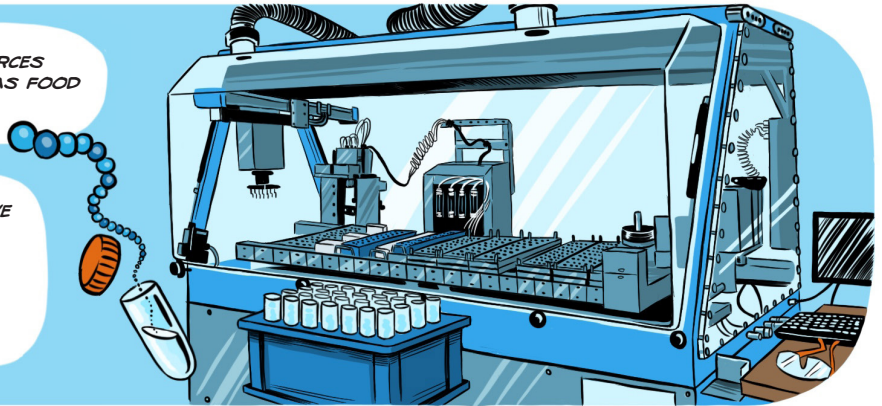
BIBS IS AT A CENTRAL POSITION IN THE ORGANIZATION OF THE BIA UNIT, AS IT WORKS WITH ALL THE OTHER TEAMS.



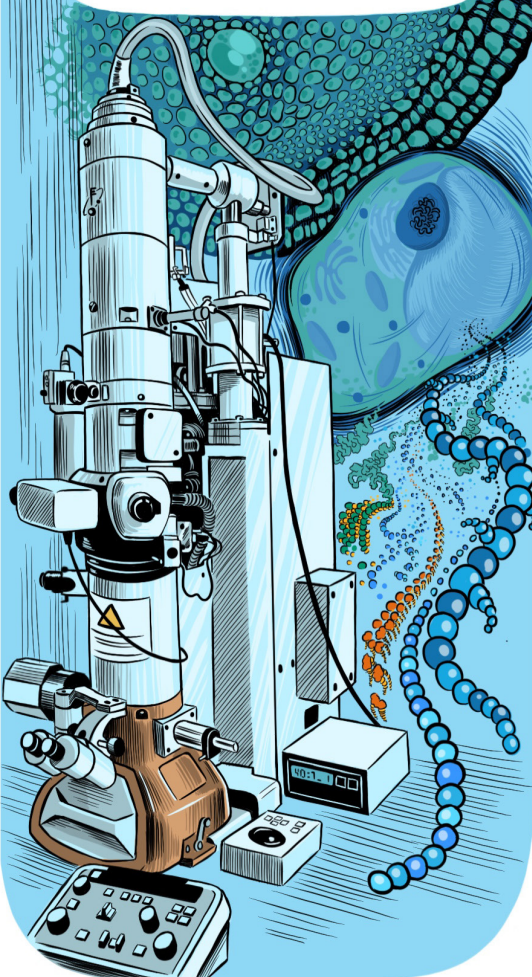
BIBS FOCUSES ON AGRICULTURAL BIORESOURCES AND THEIR PROCESSED DERIVATIVES, SUCH AS FOOD AND BIOMATERIALS.

THE STUDIES CARRIED OUT AT BIBS INVOLVE SEVERAL STEPS :

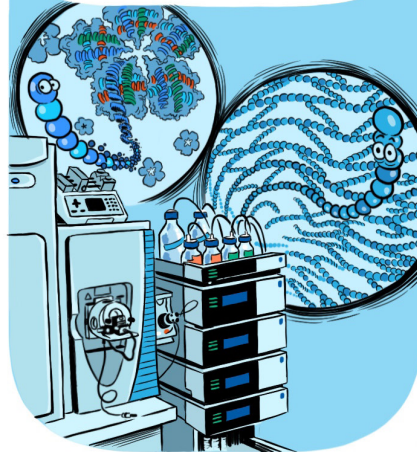
ANALYZE LARGE COLLECTIONS OF SAMPLES ACCORDING TO THEIR BIOPOLYMER COMPOSITION AND STRUCTURE.



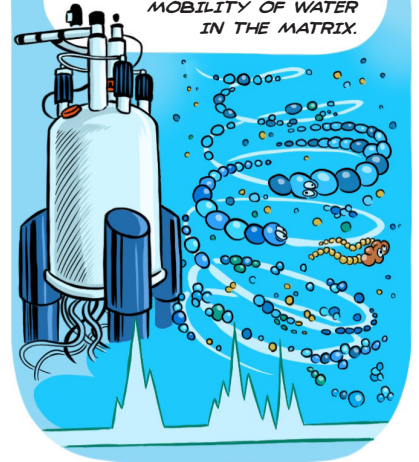
OBSERVE AND LOCALIZE STRUCTURES AND COMPOUNDS OF INTEREST BY IMAGING AT TISSUE, CELLULAR AND MOLECULAR SCALES.



STUDY THE FINE STRUCTURE OF BIOPOLYMERS (PROTEINS AND POLYSACCHARIDES).

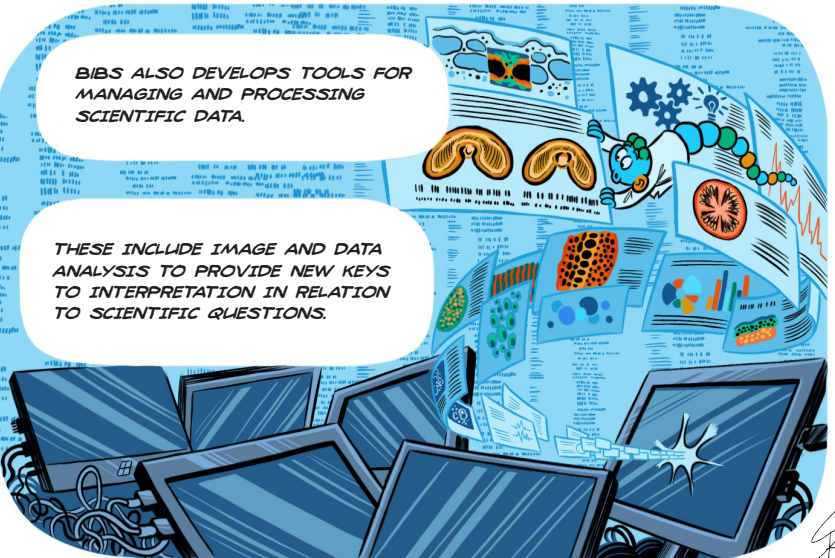


IDENTIFY AND QUANTIFY BIOPOLYMERS, STUDY THEIR INTERACTIONS AND THE MOBILITY OF WATER IN THE MATRIX.



BIBS ALSO DEVELOPS TOOLS FOR MANAGING AND PROCESSING SCIENTIFIC DATA.

THESE INCLUDE IMAGE AND DATA ANALYSIS TO PROVIDE NEW KEYS TO INTERPRETATION IN RELATION TO SCIENTIFIC QUESTIONS.



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CELL LOG

CELLULE LOGISTIQUE



THIS IS A GROUP THAT FACILITATES THE DAY-TO-DAY LIFE OF BIA'S RESEARCH TEAMS.

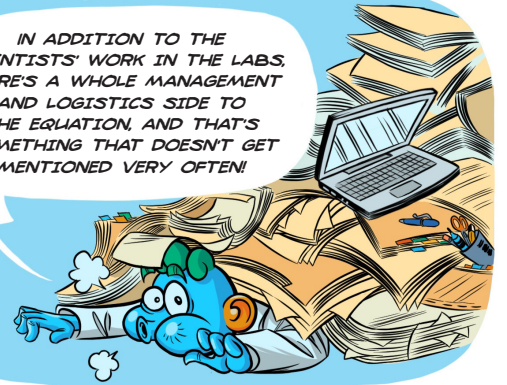
THIS SUPPORT IS ESSENTIAL TO THE DAILY LIVES OF OUR SCIENTISTS AND TECHNICIANS.

CELL LOG IS IN CHARGE OF THE ADMINISTRATIVE AND LOGISTICAL MANAGEMENT...



... FOR STAFF RECRUITMENT, AGENT TRAVEL, ORGANIZATION OF CONFERENCES AND SEMINARS.

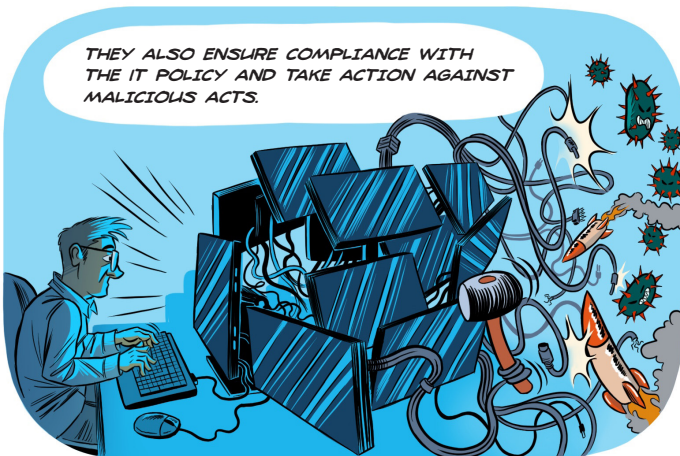
IN ADDITION TO THE SCIENTISTS' WORK IN THE LABS, THERE'S A WHOLE MANAGEMENT AND LOGISTICS SIDE TO THE EQUATION, AND THAT'S SOMETHING THAT DOESN'T GET MENTIONED VERY OFTEN!



WITHIN CELL LOG, THERE ARE ALSO LOCAL IT SPECIALISTS WHO SUPERVISE THE COMPUTER EQUIPMENT AND PROVIDE SUPPORT TO STAFF.



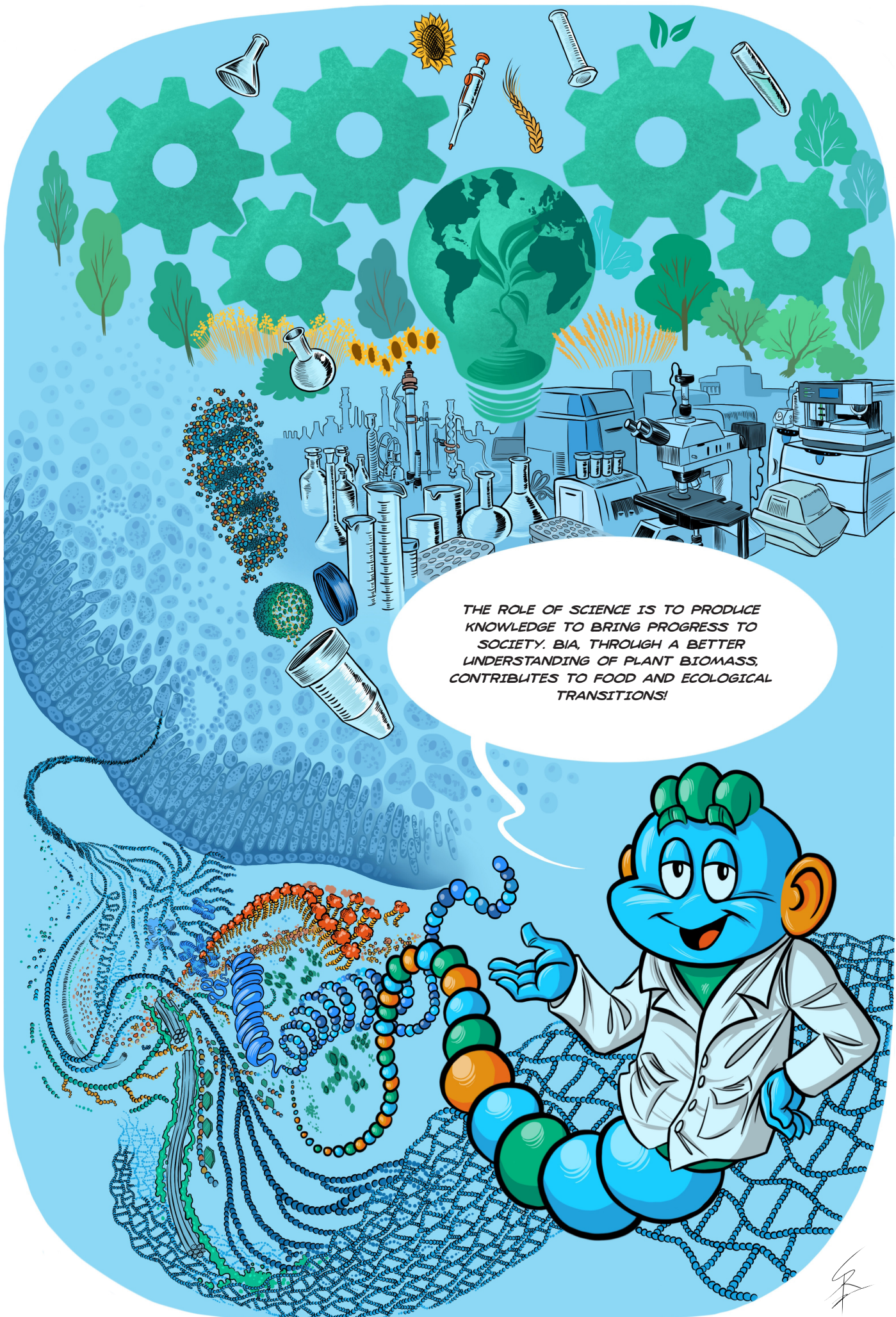
THEY ALSO ENSURE COMPLIANCE WITH THE IT POLICY AND TAKE ACTION AGAINST MALICIOUS ACTS.



THE BUDGET DEPARTMENT MANAGES FINANCIAL RESOURCES, ENABLING SCIENTISTS TO CARRY OUT THEIR RESEARCH.

AFTER ALL, YOU NEED THE MEANS TO FINANCE EQUIPMENT, PRODUCTS AND TOOLS.





THE ROLE OF SCIENCE IS TO PRODUCE KNOWLEDGE TO BRING PROGRESS TO SOCIETY. BIA, THROUGH A BETTER UNDERSTANDING OF PLANT BIOMASS, CONTRIBUTES TO FOOD AND ECOLOGICAL TRANSITIONS!

THIS WORK WAS PRODUCED WITH THE HELP OF ALL BIA LABORATORY STAFF, IN PARTICULAR TEAM LEADERS AND THE MANAGEMENT BOARD.

THANK YOU ALL FOR YOUR AVAILABILITY AND VALUABLE DISCUSSION.

