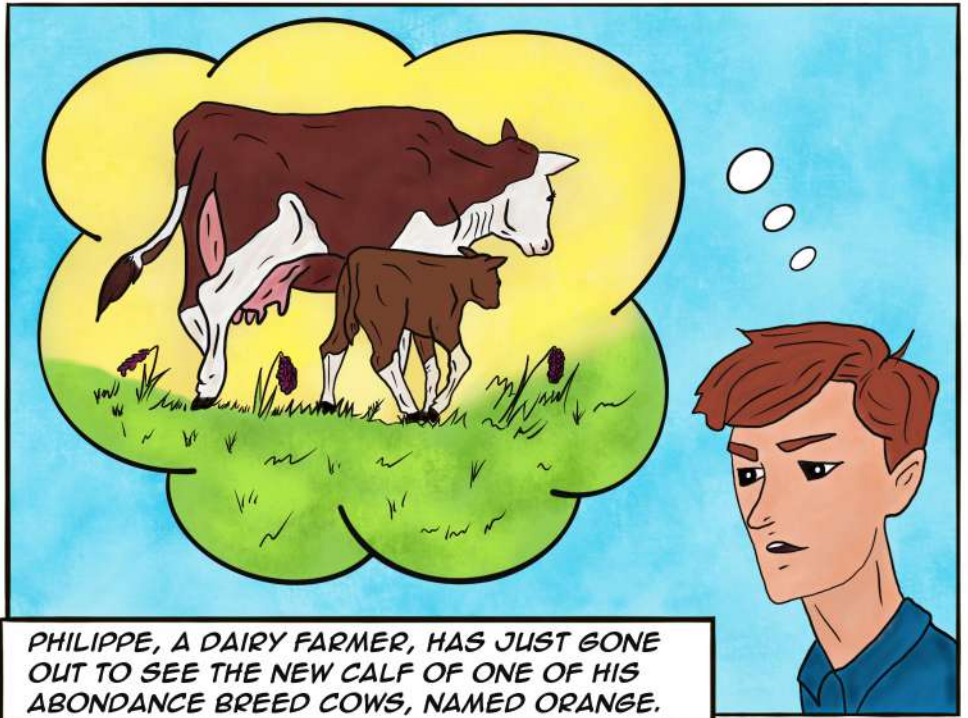


USE OF CRYOPRESERVED SEMEN FROM AN ANCIENT BULL: A WAY TO MANAGE THE GENETIC DIVERSITY OF A LOCAL BREED ?



SOMEWHERE IN THE FRENCH CHABLAIS REGION...



PHILIPPE, A DAIRY FARMER, HAS JUST GONE OUT TO SEE THE NEW CALF OF ONE OF HIS ABONDANCE BREED COWS, NAMED ORANGE.



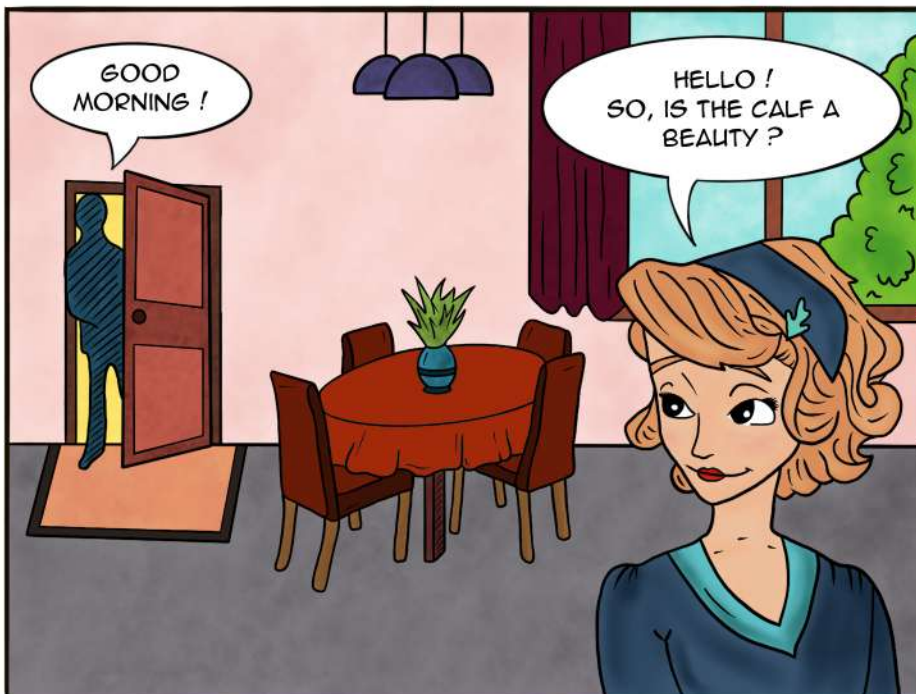
COME ON CRAPULE, LET'S GO HOME !



IT'S ABOUT TIME... I'M DREAMING OF A LONG NAP ON THE SOFA...



PHILIPPE AND CRAPULE HEAD BACK HOME.



GOOD MORNING !

HELLO ! SO, IS THE CALF A BEAUTY ?



MMM, OHHH, FINALLY... I DON'T WANT TO BE DISTURBED UNDER ANY CIRCUMSTANCES !



BOOM !!!

DADDY, DADDY !
YOU'RE HOME !



HUH ?!
WHAT THE HECK IS
HAPPENING ?!



SO, DID ORANGE
HAVE HER BABY ?

CAN I GO SEE
THEM ?

PRETTY
PLEASE ??



IT CAN'T BE
TIME TO GET UP
YET...

I HATE HER !!!



HELLO JADE !
YES, IT ARRIVED AROUND
6AM THIS MORNING.



ALTHOUGH THE CALF
DOESN'T SEEM AS
VIGOROUS THIS TIME...



AND ARE THE HEIFERS THAT
YOU INSEMINATED PREGNANT ?

WILL THERE SOON BE
LOTS OF BABY CALVES ?!?



NOT ALL OF THEM...
IT'S EVEN WORSE
THAN THE LAST FEW
YEARS...



REALLY ?!
COULD IT BE A CONSEQUENCE
OF THE REDUCED GENETIC
DIVERSITY ?



THE WHAT ?!



GENETIC DIVERSITY - IT'S THE AMOUNT OF GENOMIC VARIABILITY ACROSS INDIVIDUALS IN OUR HERD.

IT'S AN ESSENTIAL CONCEPT IN BREEDING !



DIVERSITY IS VERY IMPORTANT AT DIFFERENT TIME SCALES.

IN THE SHORT TERM, IT PREVENTS INBREEDING DEPRESSION.



THAT'S WHEN THE VALUE OF INDIVIDUALS HAS BEEN REDUCED DUE TO INCREASED INBREEDING IN A POPULATION.

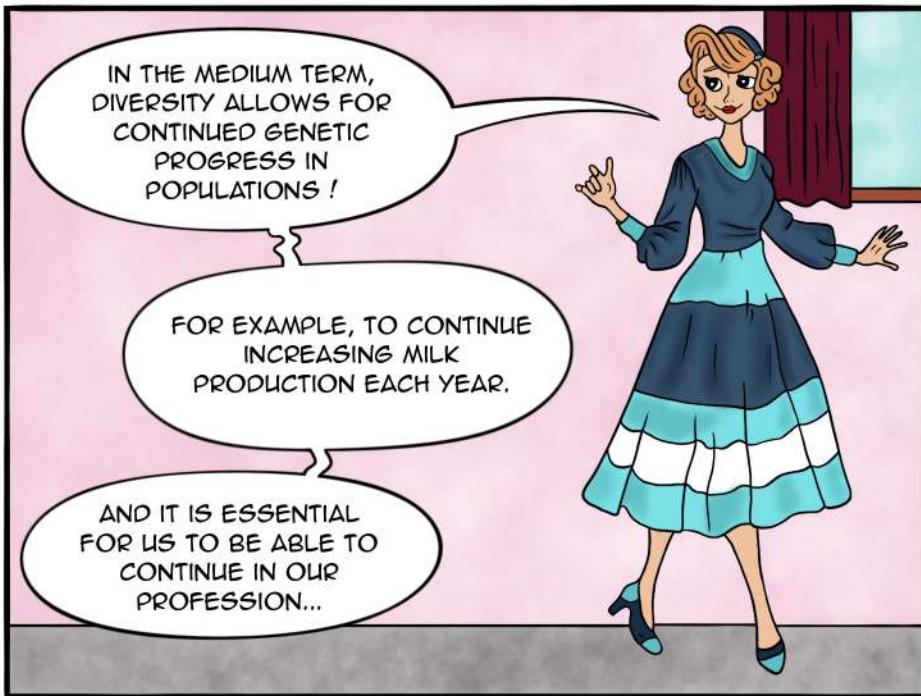


OH RIGHT ! INBREEDING... THAT'S WHEN INDIVIDUALS FROM THE SAME FAMILY HAVE KIDS TOGETHER.

LIRE IF ORANGE HAD A BABY WITH HER FATHER !



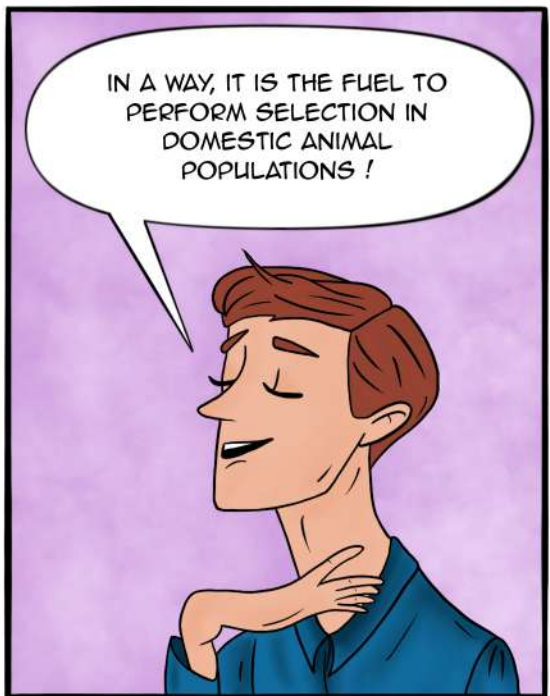
EXACTLY ! AND THAT WOULD DECREASE THE GENETIC DIVERSITY...



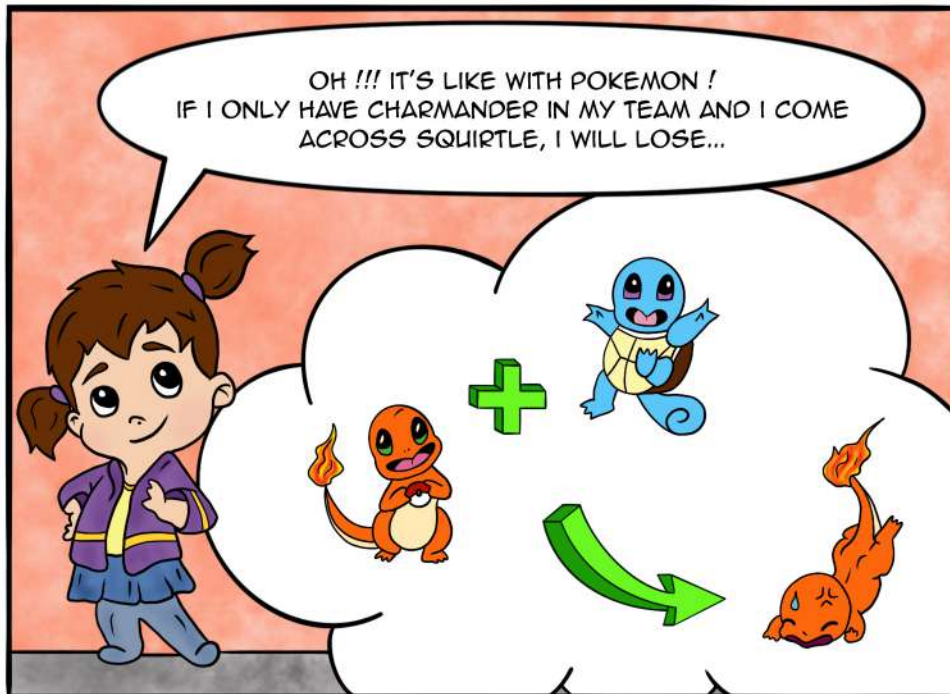
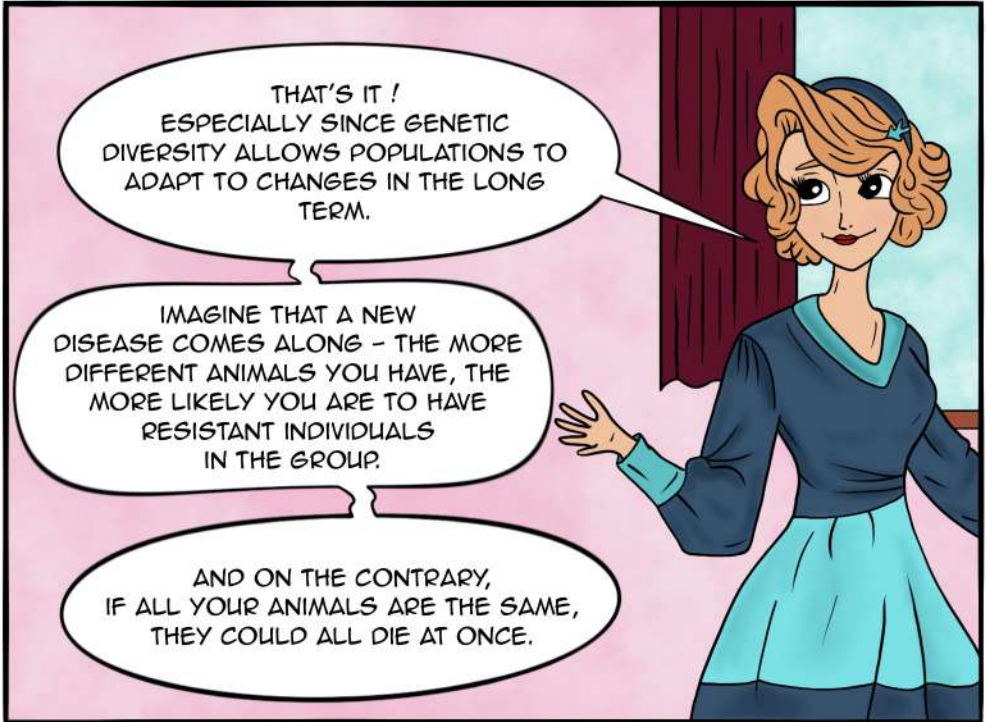
IN THE MEDIUM TERM, DIVERSITY ALLOWS FOR CONTINUED GENETIC PROGRESS IN POPULATIONS !

FOR EXAMPLE, TO CONTINUE INCREASING MILK PRODUCTION EACH YEAR.

AND IT IS ESSENTIAL FOR US TO BE ABLE TO CONTINUE IN OUR PROFESSION...



IN A WAY, IT IS THE FUEL TO PERFORM SELECTION IN DOMESTIC ANIMAL POPULATIONS !





AND CONSUMER DEMANDS ARE ALSO CHANGING... FOR EXAMPLE, MORE AND MORE PEOPLE WANT TO BUY LOCAL PRODUCTS.

FOR ALL THESE REASONS, IT IS VERY IMPORTANT TO MAINTAIN GENETIC DIVERSITY IN ANIMAL POPULATIONS !

OUR ANIMALS MUST BE ABLE TO ADAPT TO ALL OF THIS IF WE ARE TO CONTINUE TO DO OUR JOB.



ESPECIALLY SINCE DIVERSITY WILL BE ERODED AS SOON AS WE CARRY OUT SELECTION TO IMPROVE CERTAIN CHARACTERISTICS !

SO WE MUST TRY TO SLOW DOWN THIS EROSION !!!



AND DIVERSITY ERODES FASTER IF THE POPULATION ONLY HAS A SMALL NUMBER OF INDIVIDUALS...



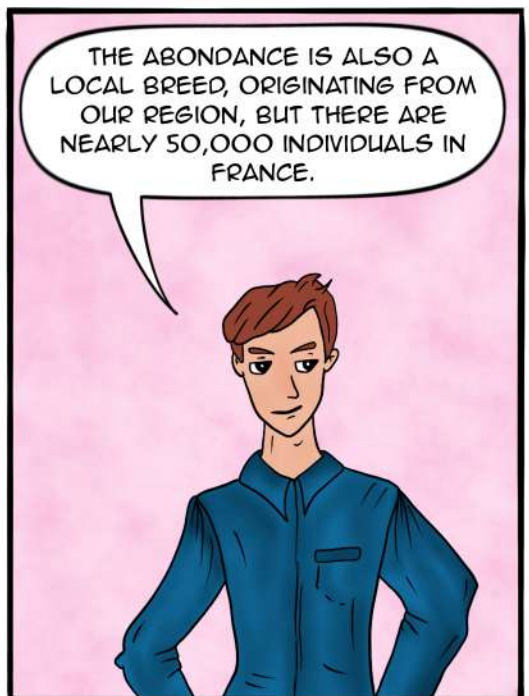
IT'S TRUE THAT WE'RE LUCKY WITH OUR BREED ! LOOK AT OUR FRIEND LÉO WITH HIS FROMENT DU LÉON BREED... IT IS NOT THE SAME !



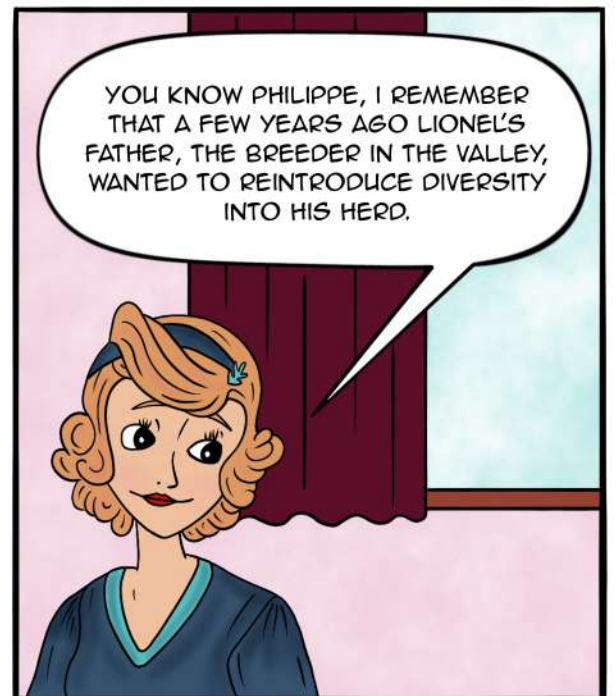
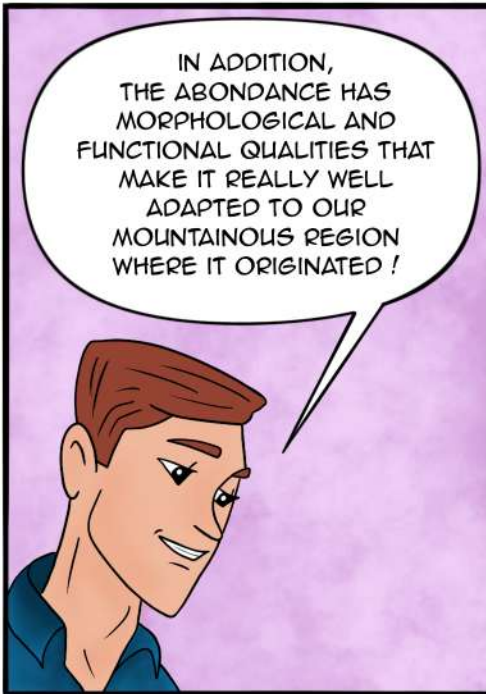
EXACTLY ! THAT'S A LOCAL BREED FROM BRITTANY, WITH VERY FEW INDIVIDUALS. IT'S ACTUALLY IN A CONSERVATION PROGRAM !

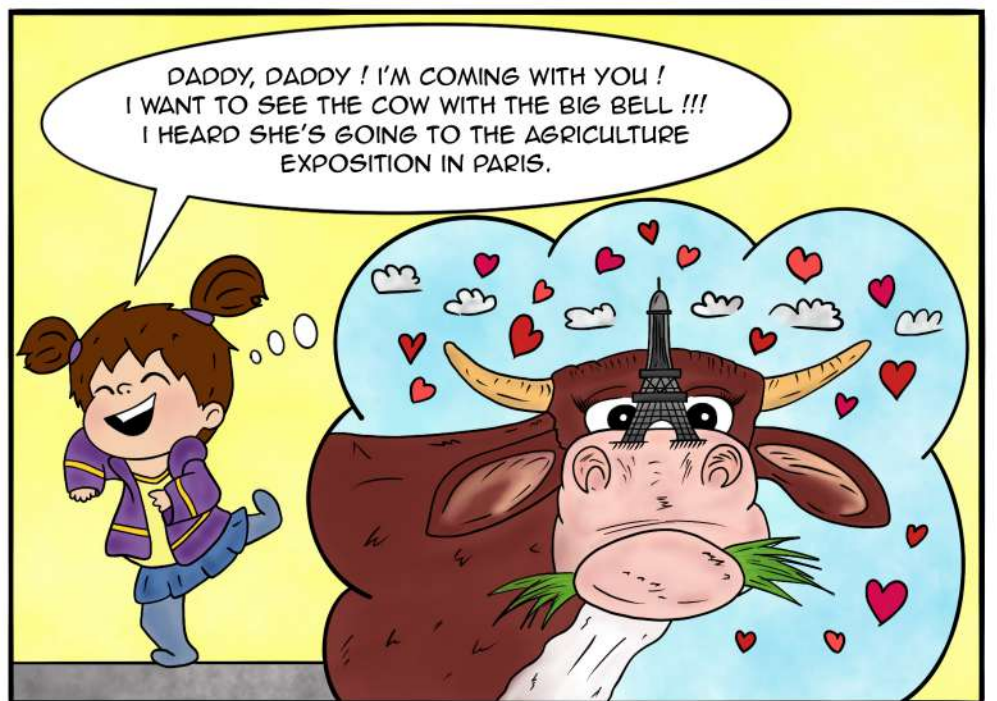


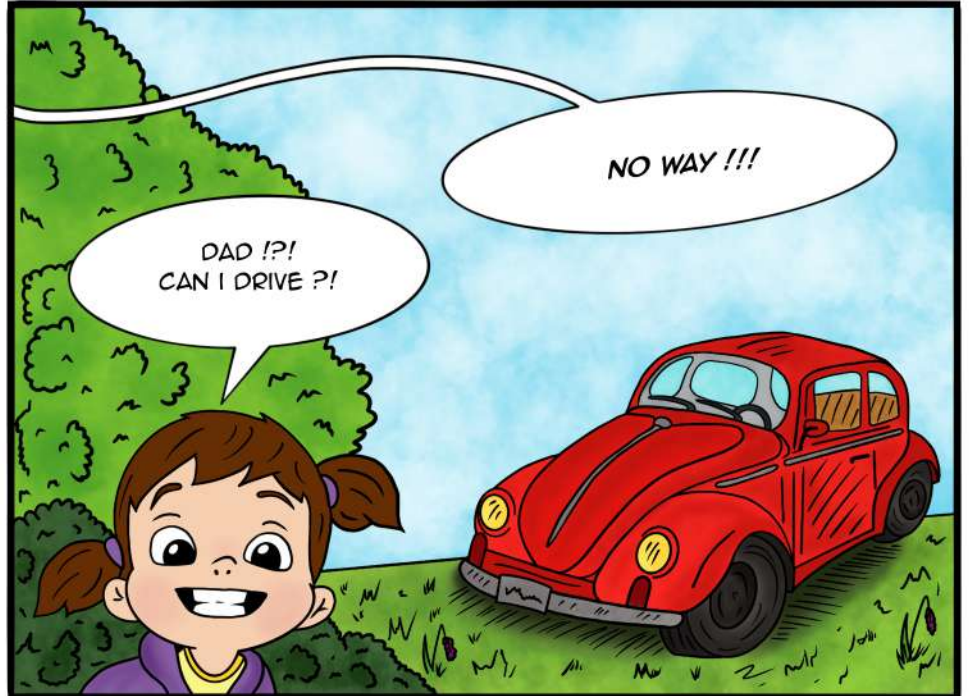
OH YEAH, THEY ARE FUNNY !!! THEY MAKE YELLOW MILK AND ALMOST GOLDEN BUTTER.



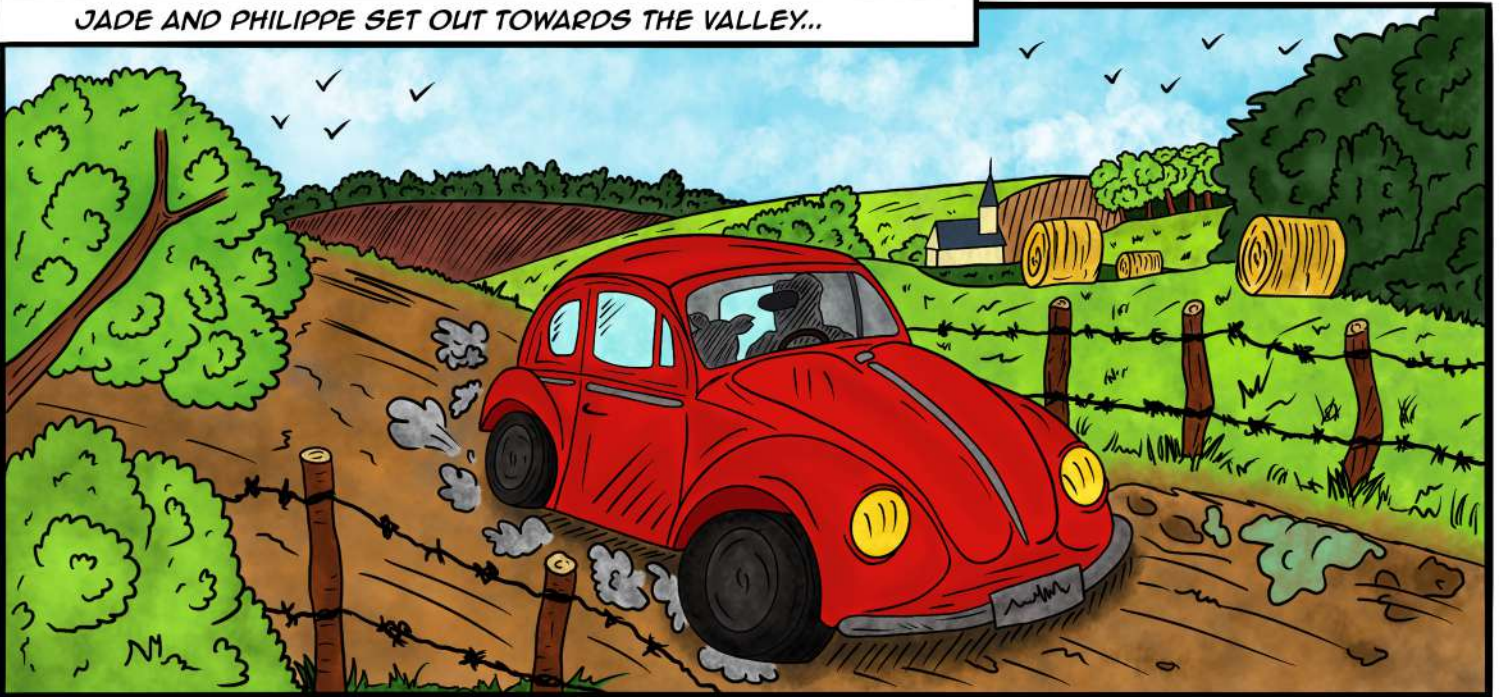
THE ABONDANCE IS ALSO A LOCAL BREED, ORIGINATING FROM OUR REGION, BUT THERE ARE NEARLY 50,000 INDIVIDUALS IN FRANCE.







JADE AND PHILIPPE SET OUT TOWARDS THE VALLEY...

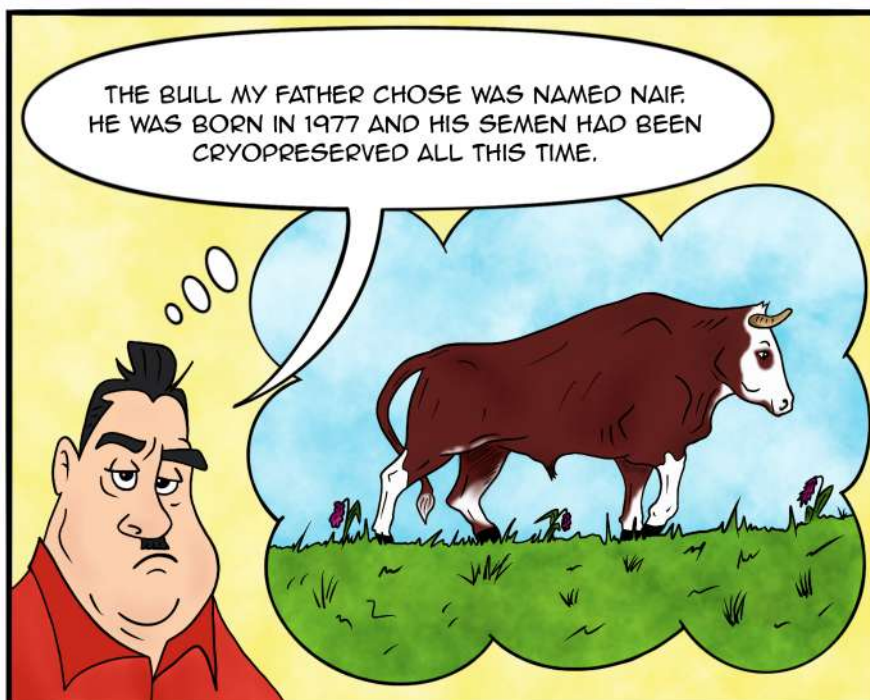
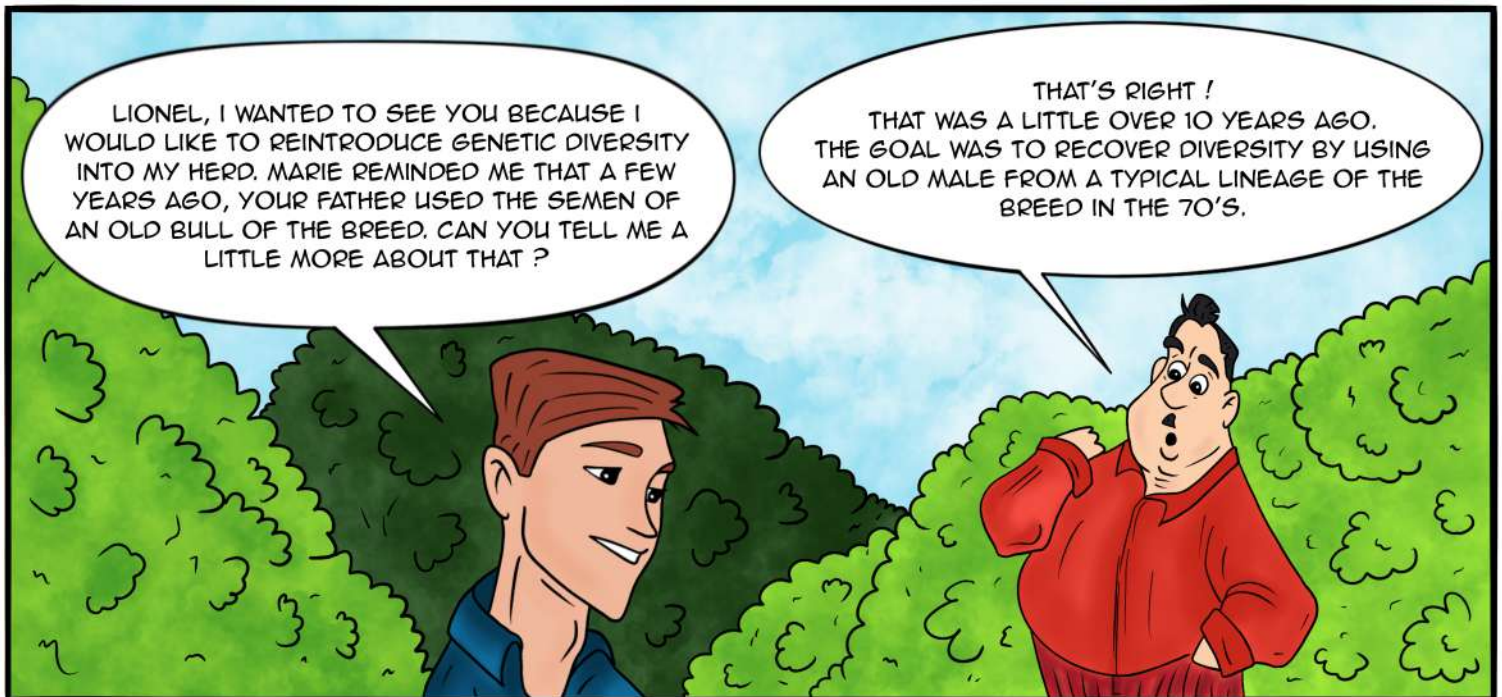


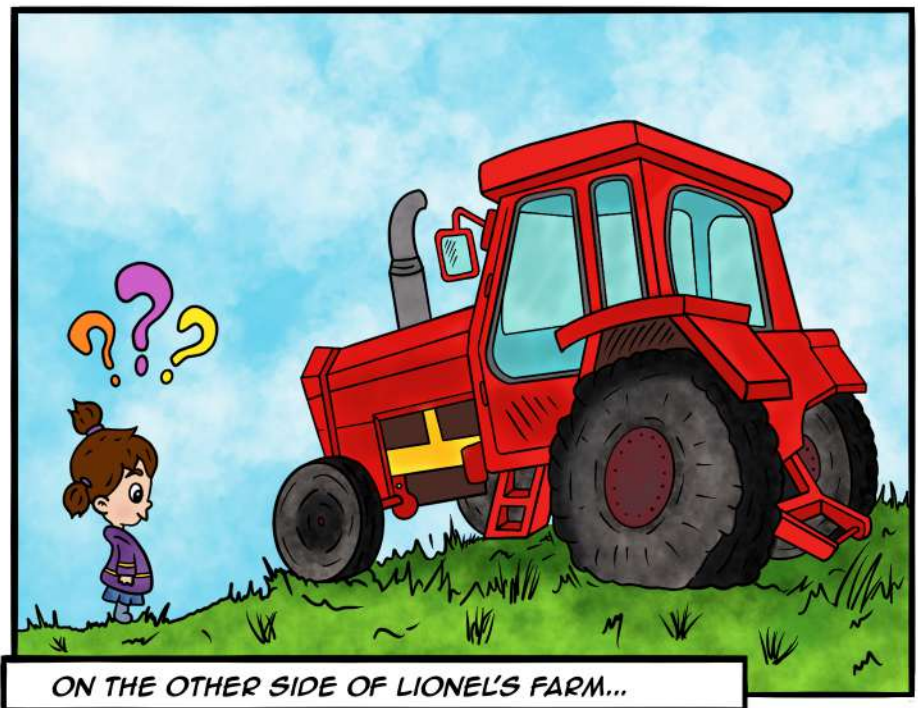
SOMEWHERE IN THE VAL D'ABONDANCE...



JADE AND PHILIPPE ARRIVE AT LIONEL'S FARM.

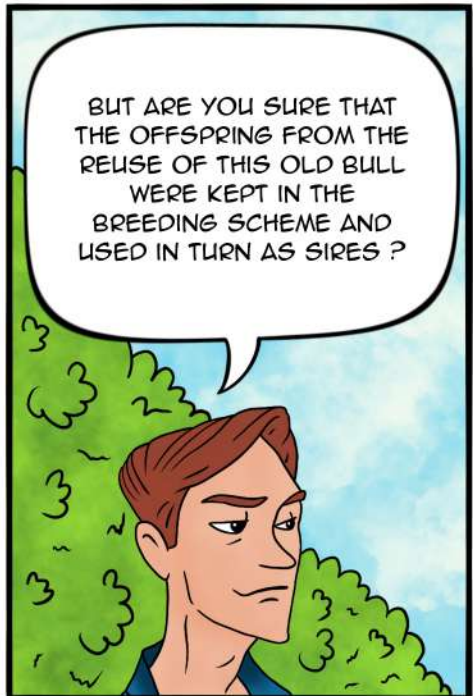
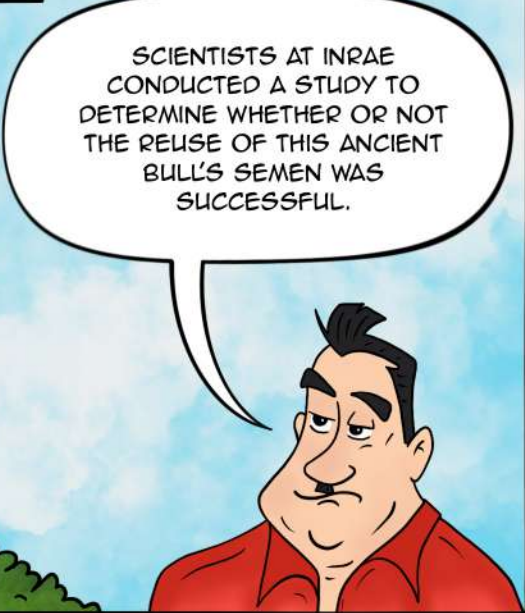








PHILIPPE AND LIONEL CONTINUE THEIR DISCUSSION.



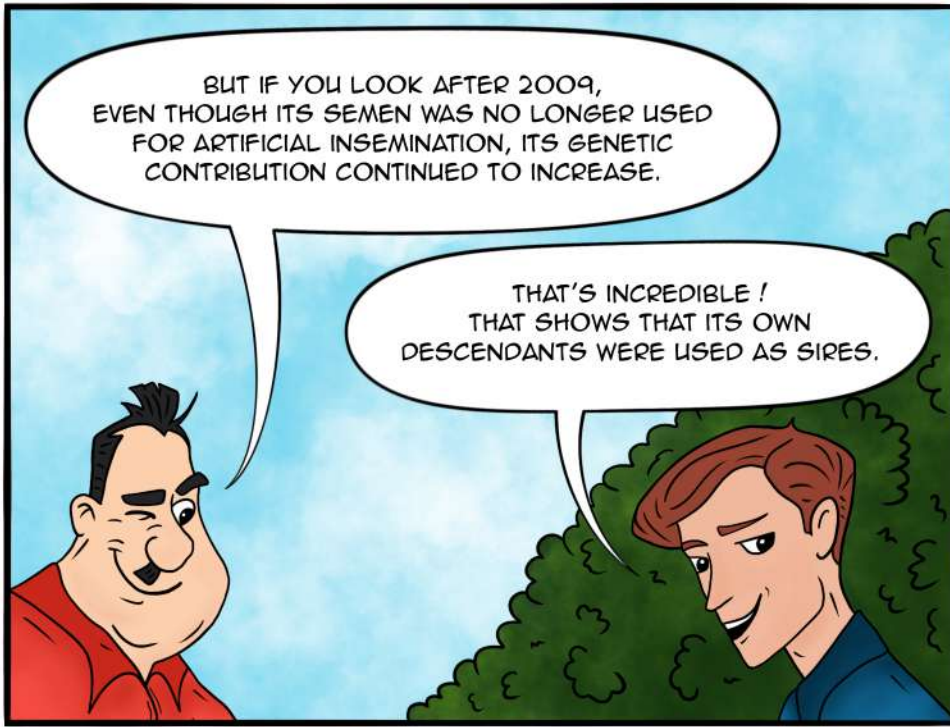
ABSOLUTELY ! TO VERIFY THIS, THE EVOLUTION OF NAIF'S GENETIC CONTRIBUTION WAS TRACED OVER TIME. OVERALL, ITS CONTRIBUTION INCREASED DURING THE TWO PERIODS IT WAS USED, WHICH IS QUITE NORMAL !

NUMBER OF DIRECT OFFSPRING

GENETIC CONTRIBUTION (IN %)

YEARS

Year	Number of Direct Offspring	Genetic Contribution (in %)
1979	2	0.5
1981	4	0.5
1983	2	0.5
1985	10	1.0
1987	5	1.0
1989	8	1.0
1991	7	1.0
1993	2	1.0
1995	4	1.0
1997	4	1.0
1999	4	1.0
2001	4	1.0
2003	6	1.0
2005	9	1.0
2007	2	1.0
2009	7	2.0
2011	6	2.0
2013	8	2.0
2015	9	2.0



BUT IF YOU LOOK AFTER 2009, EVEN THOUGH ITS SEMEN WAS NO LONGER USED FOR ARTIFICIAL INSEMINATION, ITS GENETIC CONTRIBUTION CONTINUED TO INCREASE.

THAT'S INCREDIBLE ! THAT SHOWS THAT ITS OWN DESCENDANTS WERE USED AS SIRS.



JADE COMES IN WHISTLING.



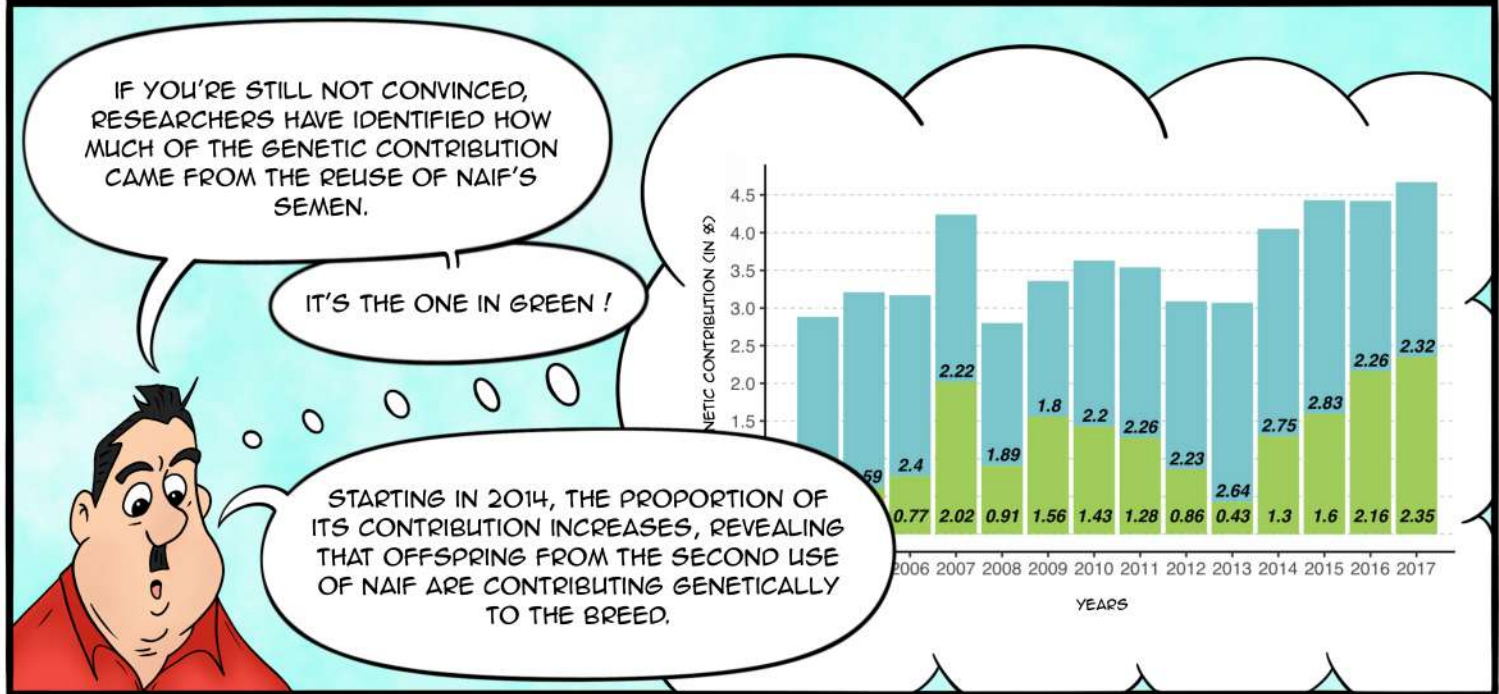
DADDY, DADDY ! LOOK, I MADE A FLOWER CROWN FOR ORANGE !

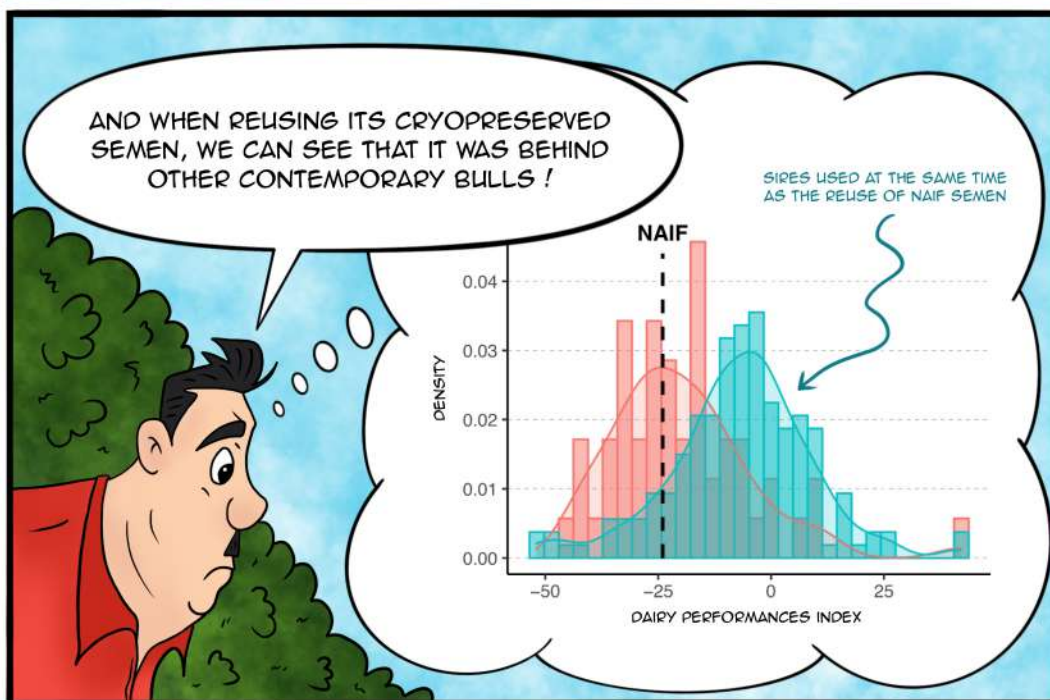
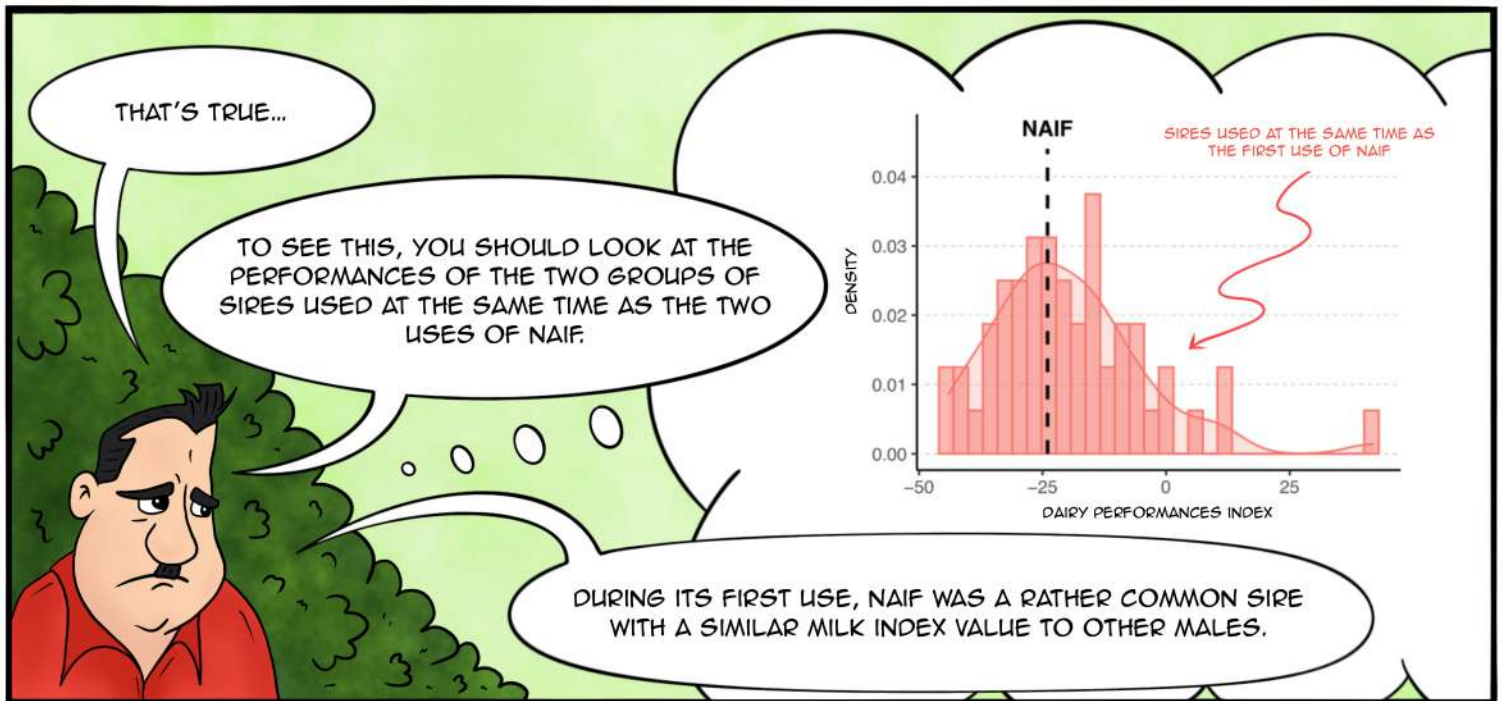


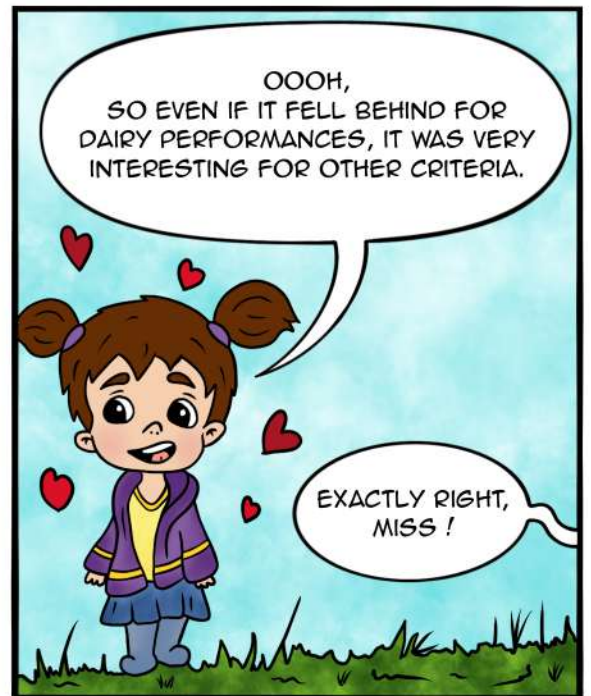
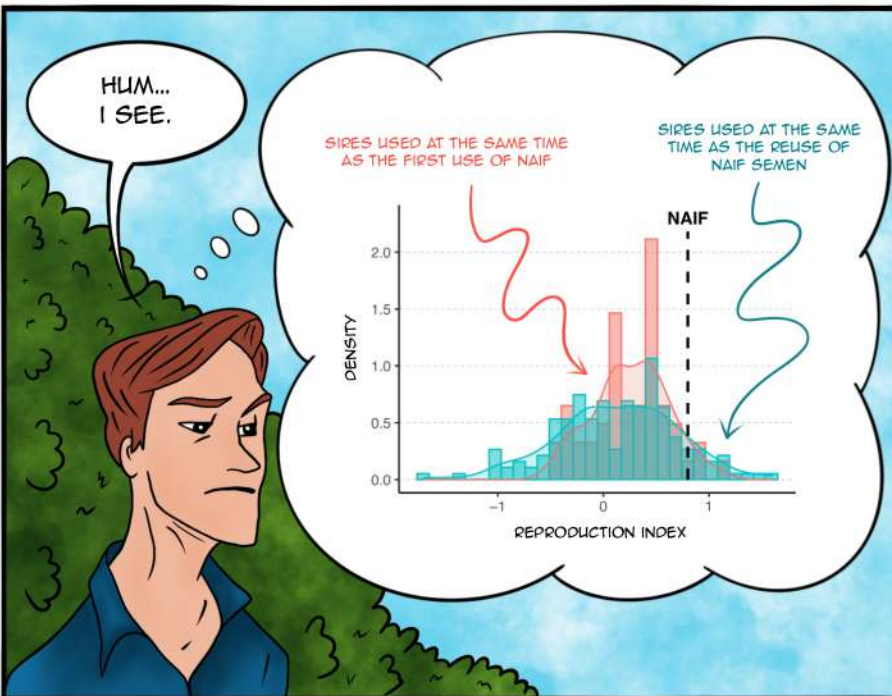
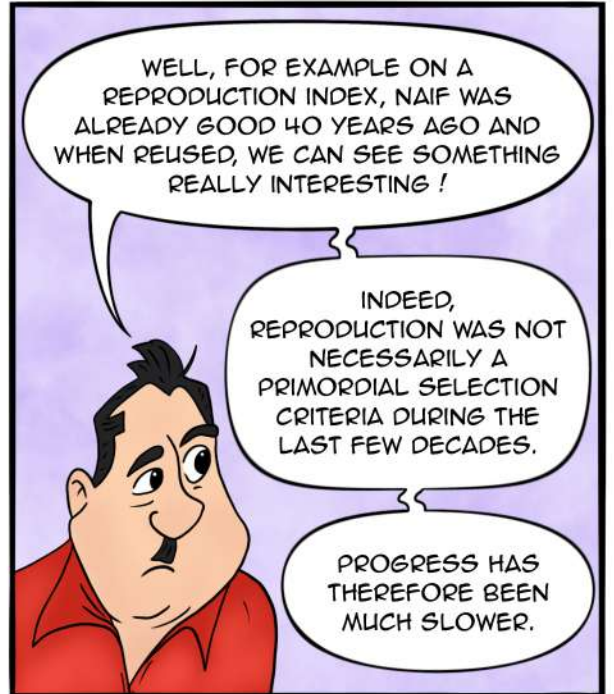
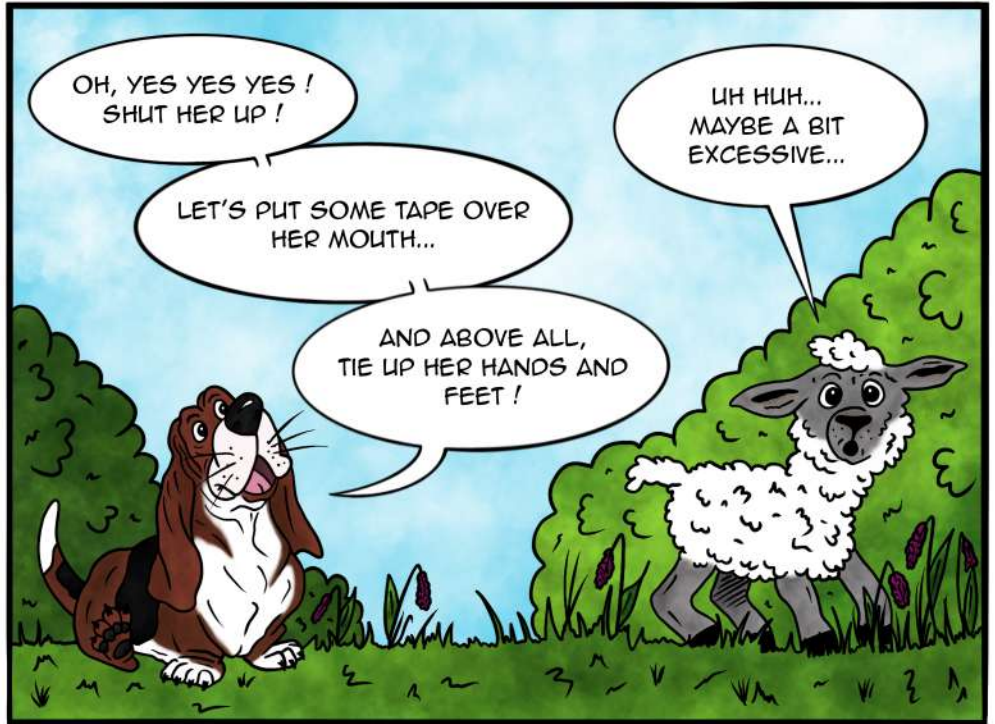
MMHMM, THAT'S NICE...

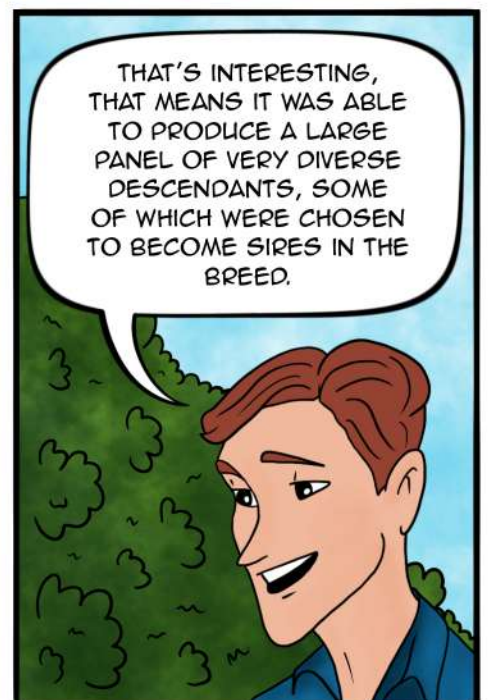
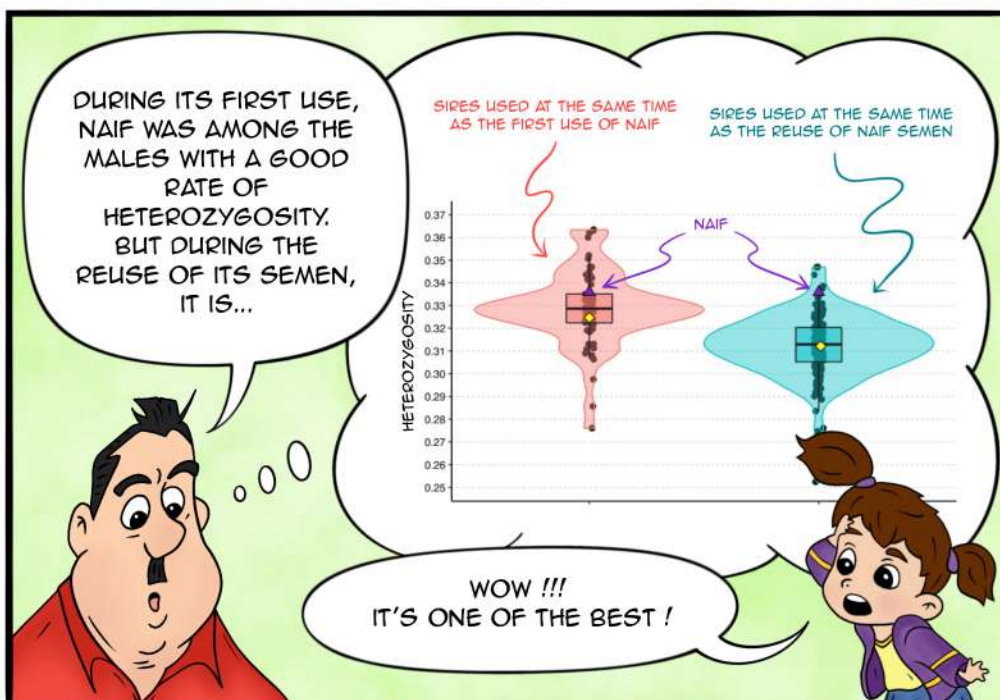
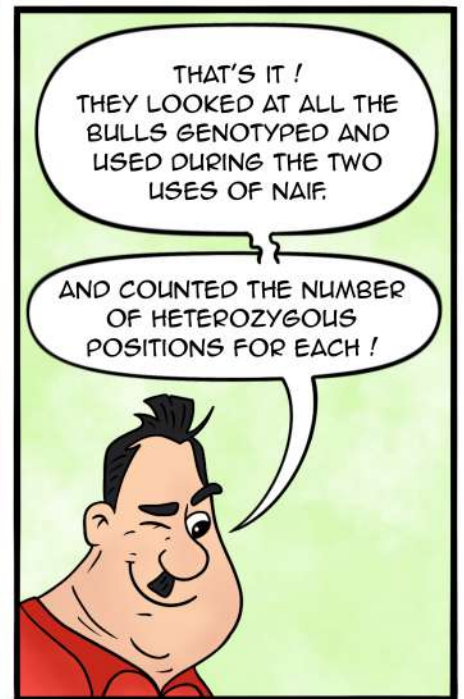
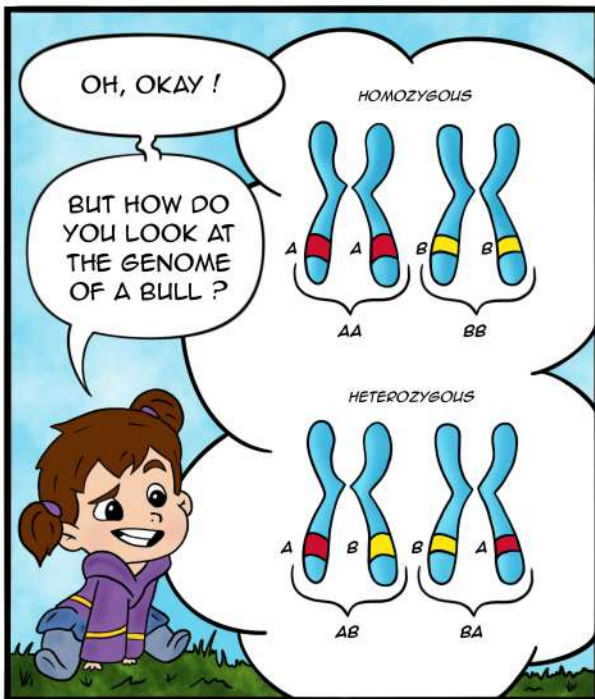
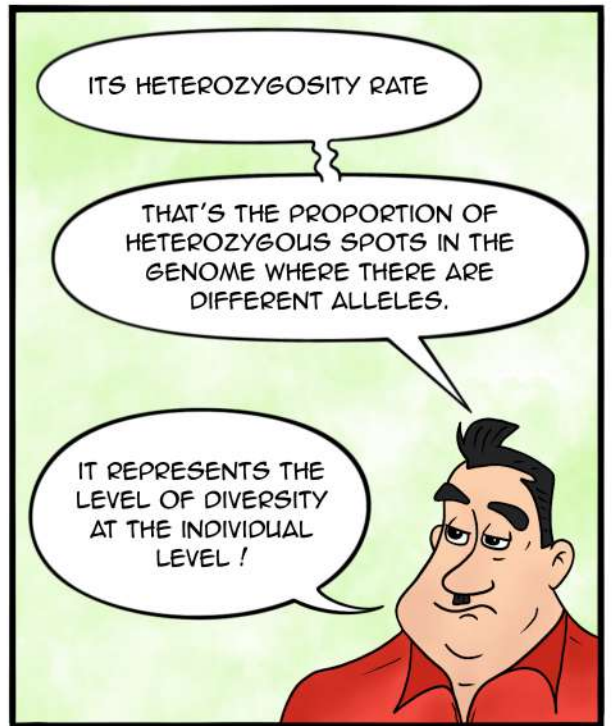
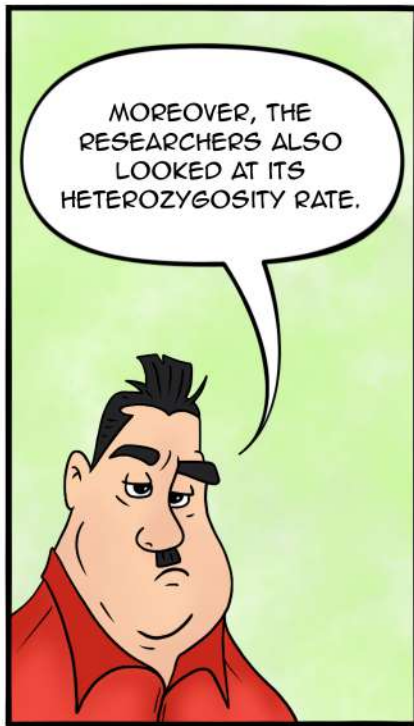


IT'S GOING TO LOOK GREAT ! BETTER THAN A BIG OLD BELL...



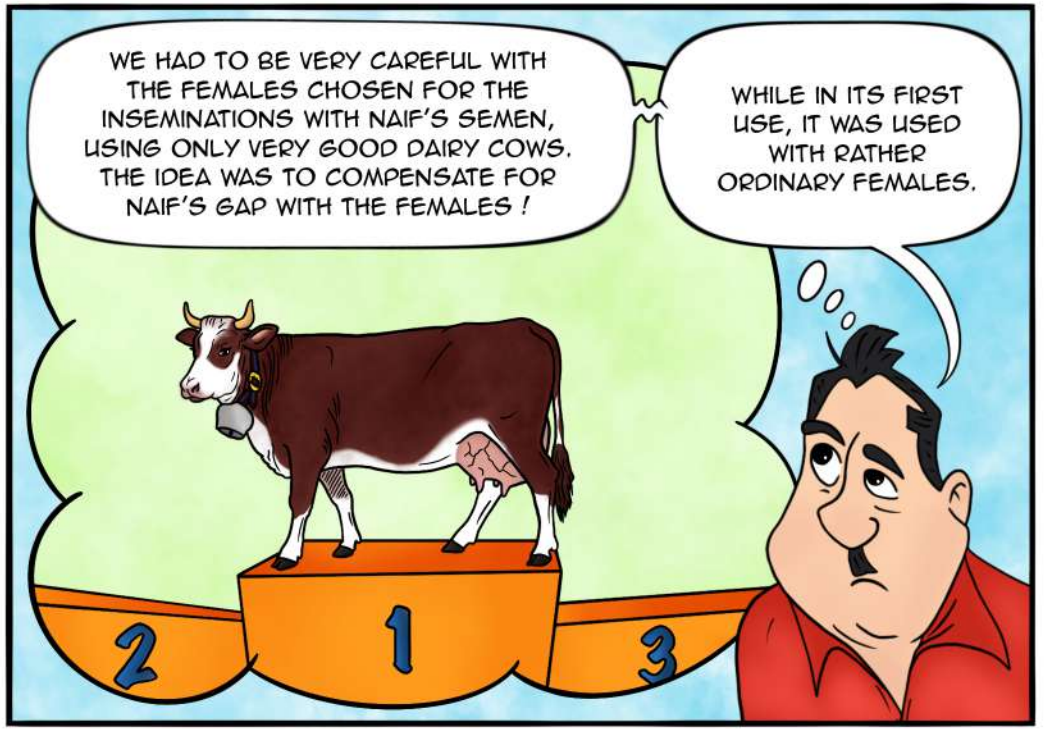








LIONEL,
I WAS WONDERING,
HOW DID YOU MANAGE
TO COMPENSATE FOR
NAIF'S WEAK MILK
PERFORMANCE ?



WE HAD TO BE VERY CAREFUL WITH
THE FEMALES CHOSEN FOR THE
INSEMINATIONS WITH NAIF'S SEMEN,
USING ONLY VERY GOOD DAIRY COWS.
THE IDEA WAS TO COMPENSATE FOR
NAIF'S GAP WITH THE FEMALES !

WHILE IN ITS FIRST
USE, IT WAS USED
WITH RATHER
ORDINARY FEMALES.

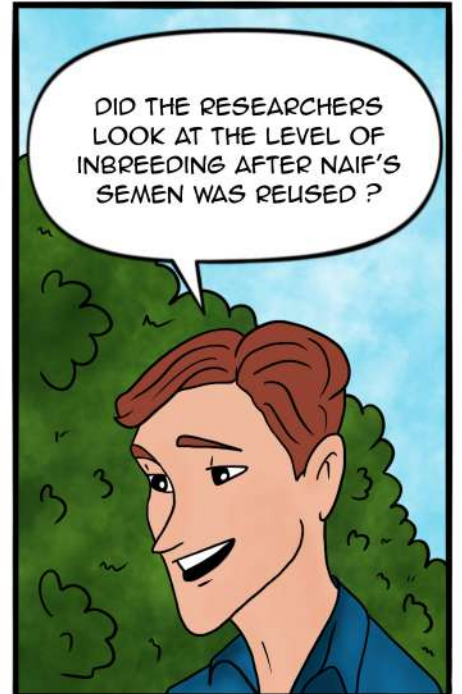


HEY, BUT HOW DID YOU
KNOW THAT THE FEMALES WERE
NOT NAIF'S DAUGHTERS OR
GRANDDAUGHTERS ?

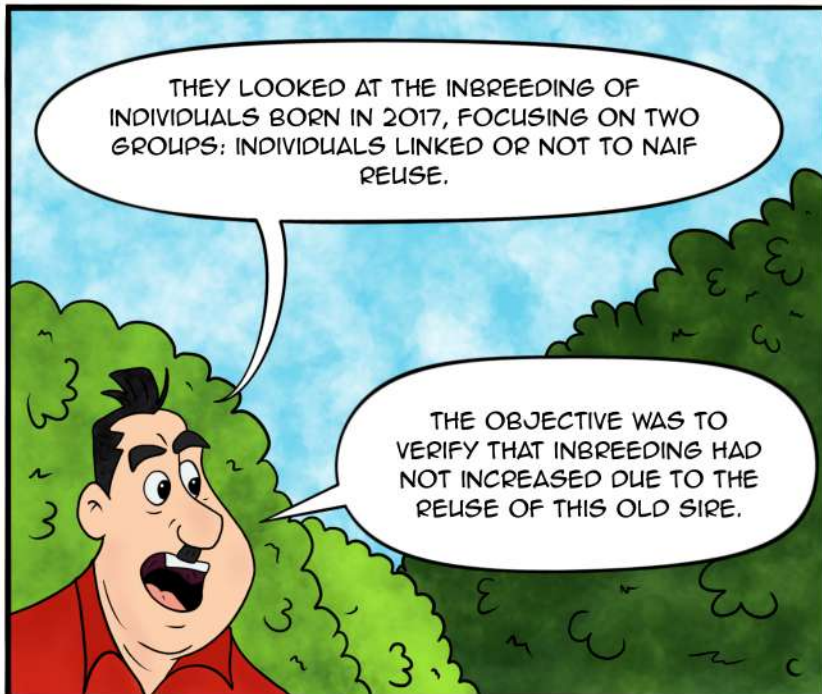
YESTERDAY,
MOM AND DAD TOLD ME THAT IF
YOU HAVE INBREEDING, THEN
DIVERSITY DECREASES... WOULDN'T
THAT HAVE DONE THE OPPOSITE OF
WHAT YOU WANTED ?



YES, YOU ARE RIGHT.
THAT'S WHY, IN ADDITION TO
BEING CAREFUL ABOUT THE
PERFORMANCE OF THE
FEMALES, MY FATHER
LOOKED AT THE PEDIGREES
TO AVOID CHOOSING
FEMALES TOO CLOSELY
RELATED TO NAIF.



DID THE RESEARCHERS
LOOK AT THE LEVEL OF
INBREEDING AFTER NAIF'S
SEMEN WAS REUSED ?



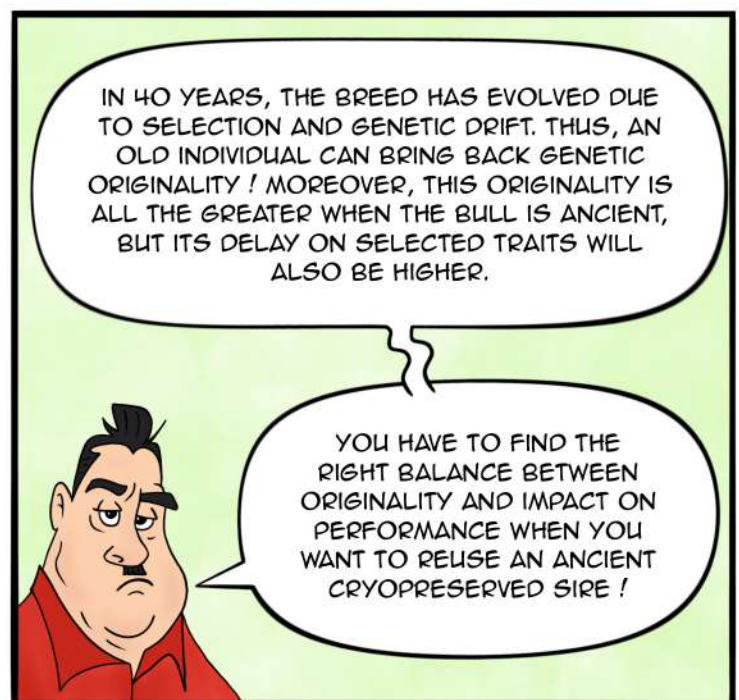
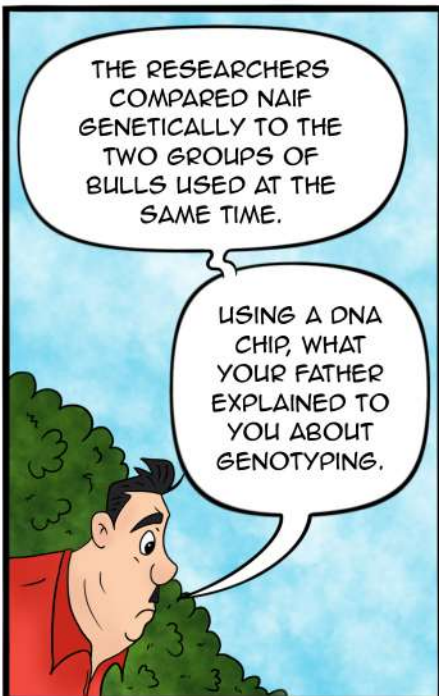
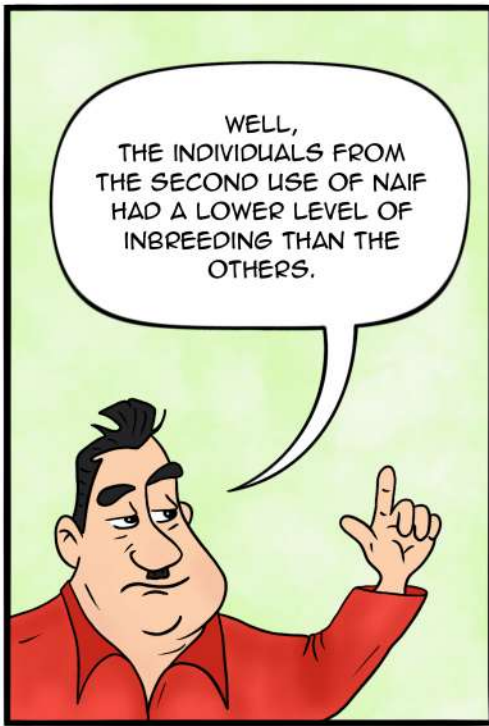
THEY LOOKED AT THE INBREEDING OF
INDIVIDUALS BORN IN 2017, FOCUSING ON TWO
GROUPS: INDIVIDUALS LINKED OR NOT TO NAIF
REUSE.

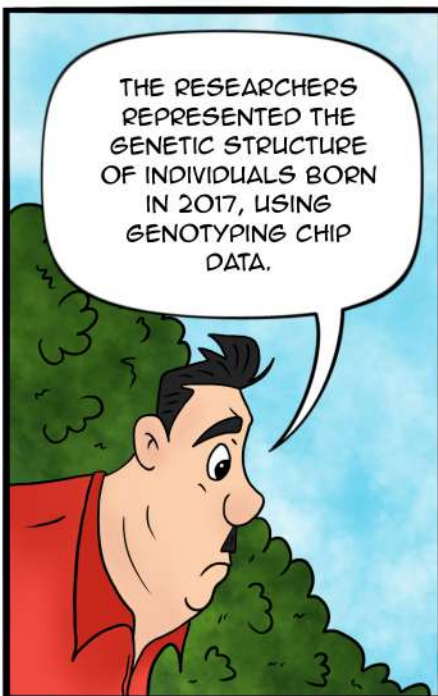
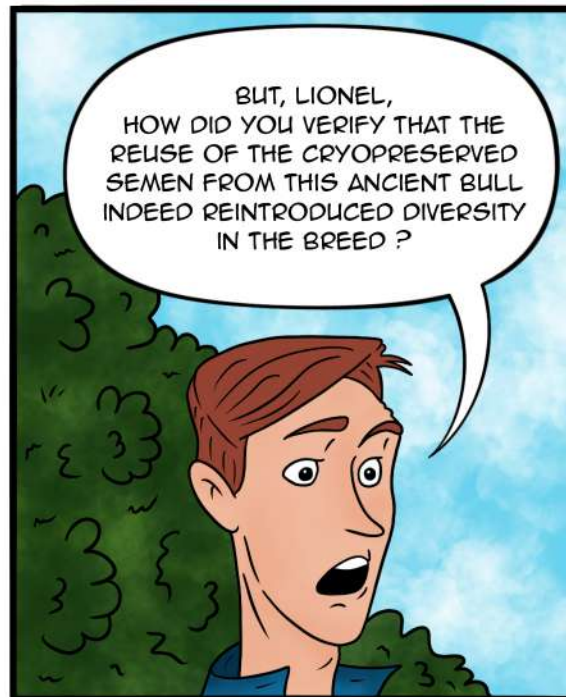
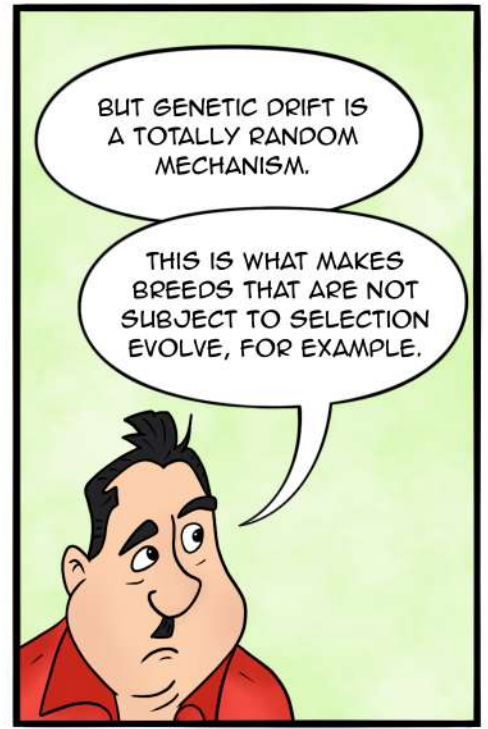
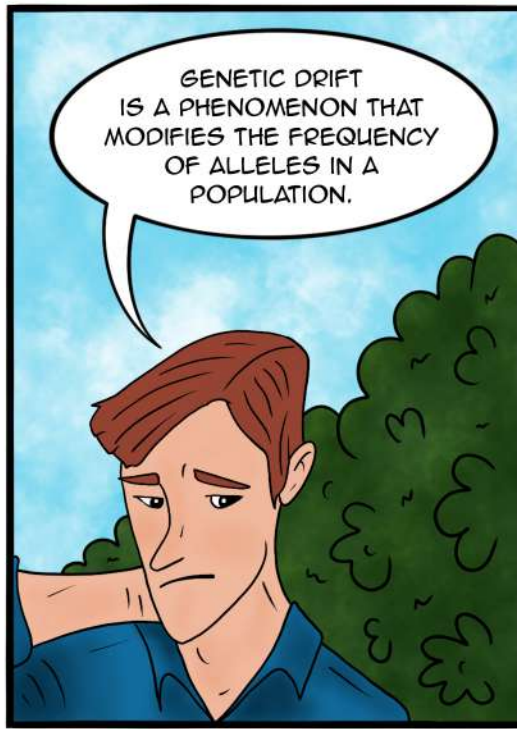
THE OBJECTIVE WAS TO
VERIFY THAT INBREEDING HAD
NOT INCREASED DUE TO THE
REUSE OF THIS OLD SIRE.

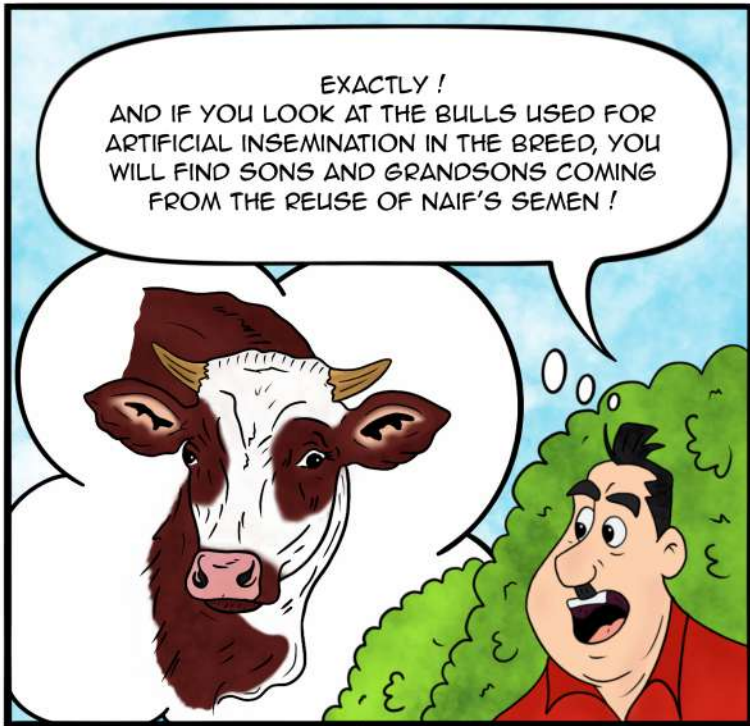


AND SO WHAT ?!?

WHAT WAS THE
RESULT ?







OVER BY THE HENHOUSE...





IT'S THE LITTLE CAP FROM YOUR TRACTOR WHEEL !



WHAT ?!?

WHAT HAS SHE BEEN UP TO ?



OH NO... PLEASE TELL ME SHE DIDN'T DO THAT...



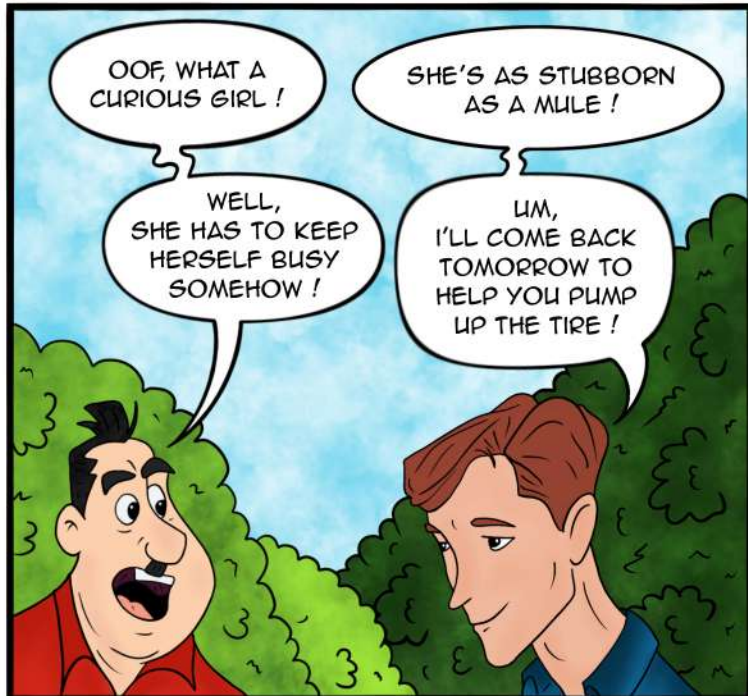
I WANTED TO KNOW WHAT IT IS FOR... WELL, I GUESS IT HOLDS IN THE AIR !



I CAN'T BELIEVE IT ! JADE GET IN THE CAR ! NOW !



I DON'T GET WHY HE'S SO UPSET... I MEAN AT LEAST I DIDN'T DO IT ON HIS TRACTOR !



OOF, WHAT A CURIOUS GIRL !

SHE'S AS STUBBORN AS A MULE !

WELL, SHE HAS TO KEEP HERSELF BUSY SOMEHOW !

UM, I'LL COME BACK TOMORROW TO HELP YOU PUMP UP THE TIRE !



IT'S A DEAL. HAVE A GOOD TRIP BACK !

JADE AND PHILIPPE TAKE THE ROAD TOWARDS THE HOUSE.



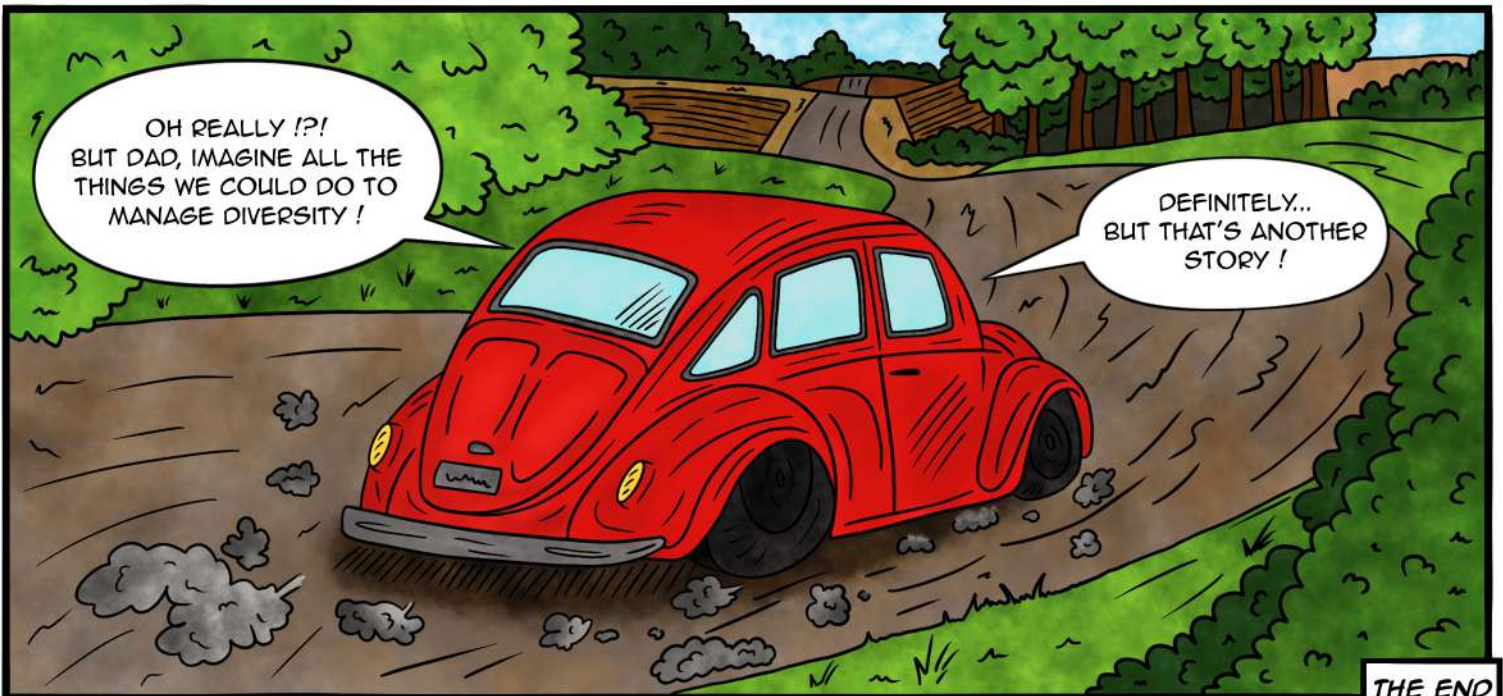
IT'S AMAZING WHAT LIONEL AND HIS FATHER WERE ABLE TO DO WITH THE CRYOPRESERVED SEMEN FROM THAT ANCIENT BULL, NAIF !

YES, IT'S TRUE ! AND YOU KNOW, THERE ARE ACTUALLY MANY CRYOPRESERVED INDIVIDUALS OF DIFFERENT SPECIES AND BREEDS ! FOR EXAMPLE, IN THE FRENCH NATIONAL CRYOBANK.



OH REALLY !?! BUT DAD, IMAGINE ALL THE THINGS WE COULD DO TO MANAGE DIVERSITY !

DEFINITELY... BUT THAT'S ANOTHER STORY !



THE END

IF YOU WOULD LIKE MORE INFORMATION ON THE REUSE OF NAIF, PLEASE GO HERE:

[HTTPS://DOI.ORG/10.1186/S12711-023-00801-6](https://doi.org/10.1186/S12711-023-00801-6)

THANKS TO ANDREA RAI FOR THE LINGUISTIC REVISION !

