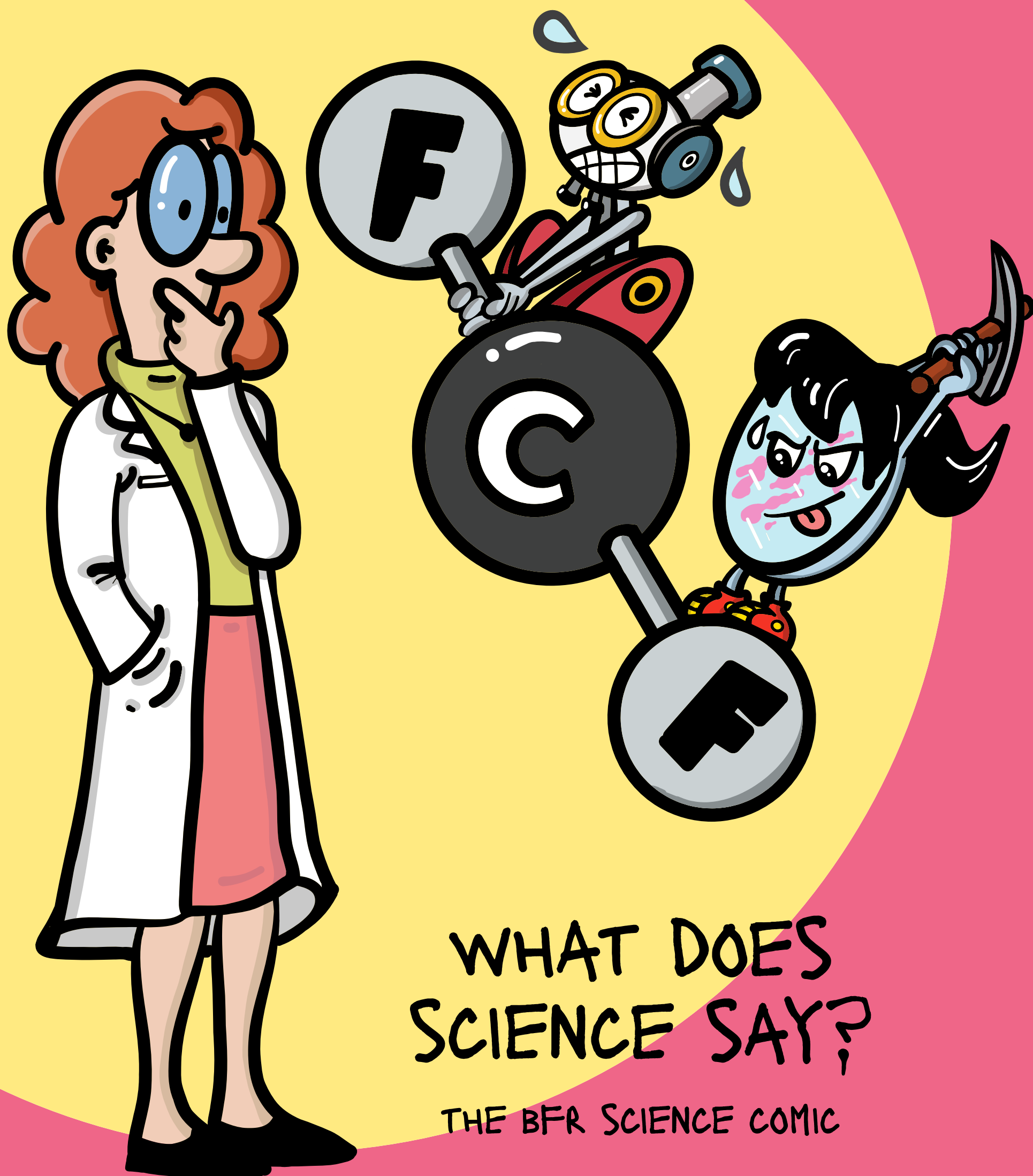


PFAS

PER- AND POLYFLUOROALKYL SUBSTANCES



WHAT DOES SCIENCE SAY?

THE BfR SCIENCE COMIC

IN THE 1980S, THE AMERICAN MEDIA GAVE MOB BOSS JOHN GOTTI THE NICKNAME "TEFLON DON" – DESPITE A MOUNTAIN OF EVIDENCE, HE REPEATEDLY MANAGED TO ESCAPE PROSECUTION.



HE SEEMED LIKE A TEFLON-COATED* FRYING PAN THAT NOTHING STUCK TO – THE JUSTICE SYSTEM DIDN'T MANAGE TO HOLD HIM ACCOUNTABLE.

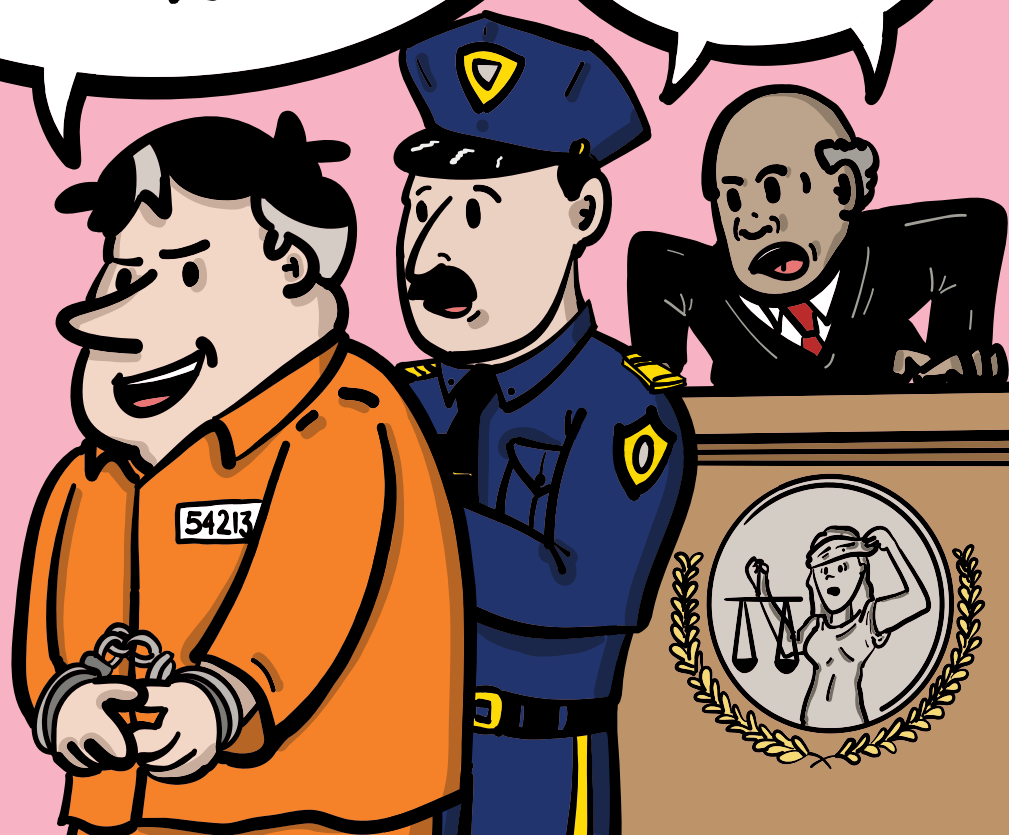


*TEFLON IS A TRADE NAME FOR POLYMER POLYTETRAFLUOROETHYLENE (PTFE), A PLASTIC WHICH BELONGS TO THE PFAS CHEMICAL GROUP.

BUT NOTHING LASTS FOREVER ... GOTTI WAS FINALLY CAUGHT AND SENTENCED TO A LIFETIME IN PRISON.

NOTHING LASTS FOREVER ...
... EXCEPT PERHAPS
THE TYPE OF SUBSTANCE
TEFLON IS;
PFAS.

WHAT?



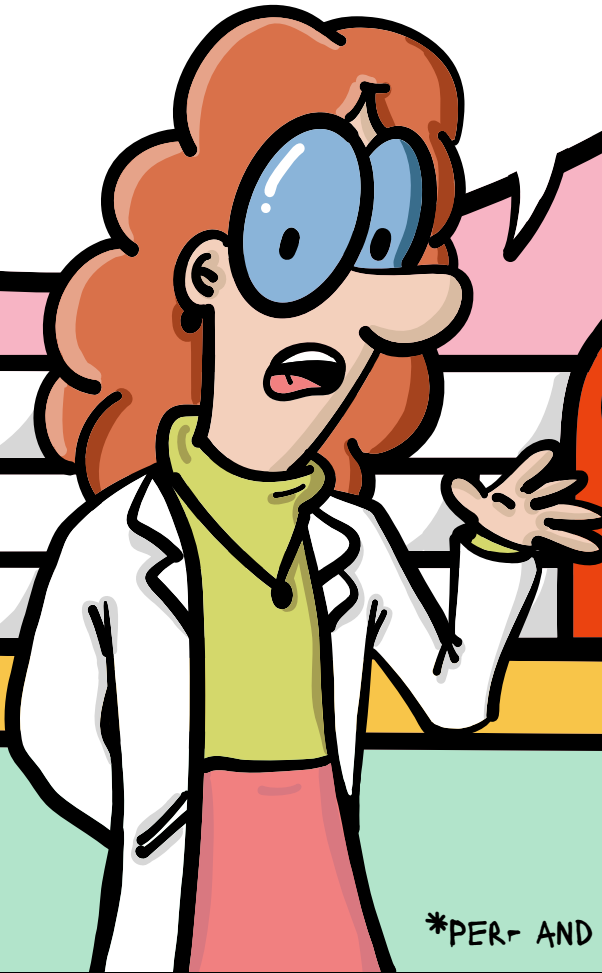
UNFORTUNATELY,
GOTTI'S RIGHT. BUT
++ WHAT ARE PFAS? ++
WHAT RISKS DO THEY POSE?
WHAT DOES
SCIENCE SAY?



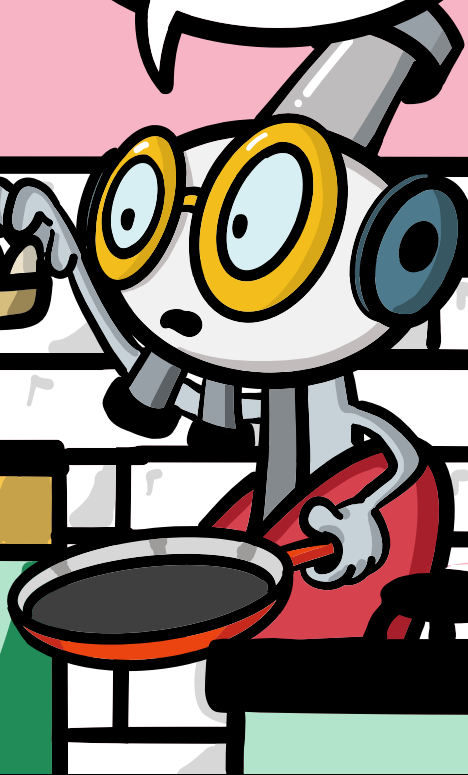
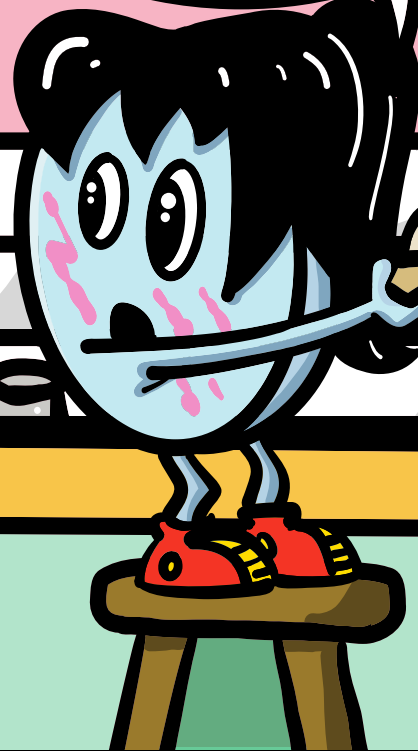
PFAS* ARE A LARGE GROUP OF INDUSTRIAL CHEMICALS THAT, DUE TO THEIR SPECIAL PROPERTIES, ARE USED IN NUMEROUS INDUSTRIAL PROCESSES, TECHNICAL APPLICATIONS, AND CONSUMER PRODUCTS.

WHAT NOW...

UM...



*PER- AND POLYFLUORALKYL SUBSTANCES



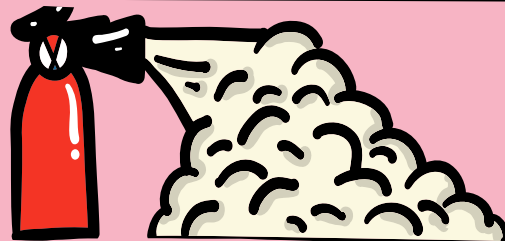
+++ PFAS +++

PROPERTIES

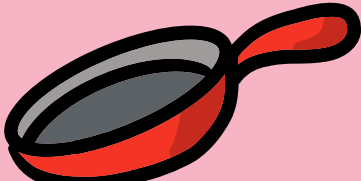
APPLICATIONS

FOAMING
FIRE STABILITY

FIRE-
EXTINGUISHERS



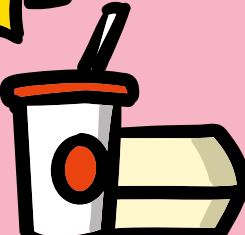
WATER-, GREASE AND
DIRT REPELLENT



NON-STICK
COATED PANS



WATERPROOF
CLOTHING



FAST-FOOD
PACKAGING



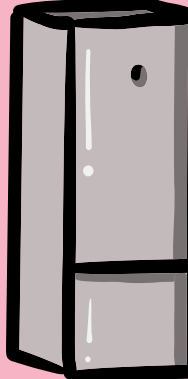
SMARTPHONES



CLEANING
PRODUCTS

NON-FLAMMABLE
(INERT)

AIR CONDITIONING*
COOLING

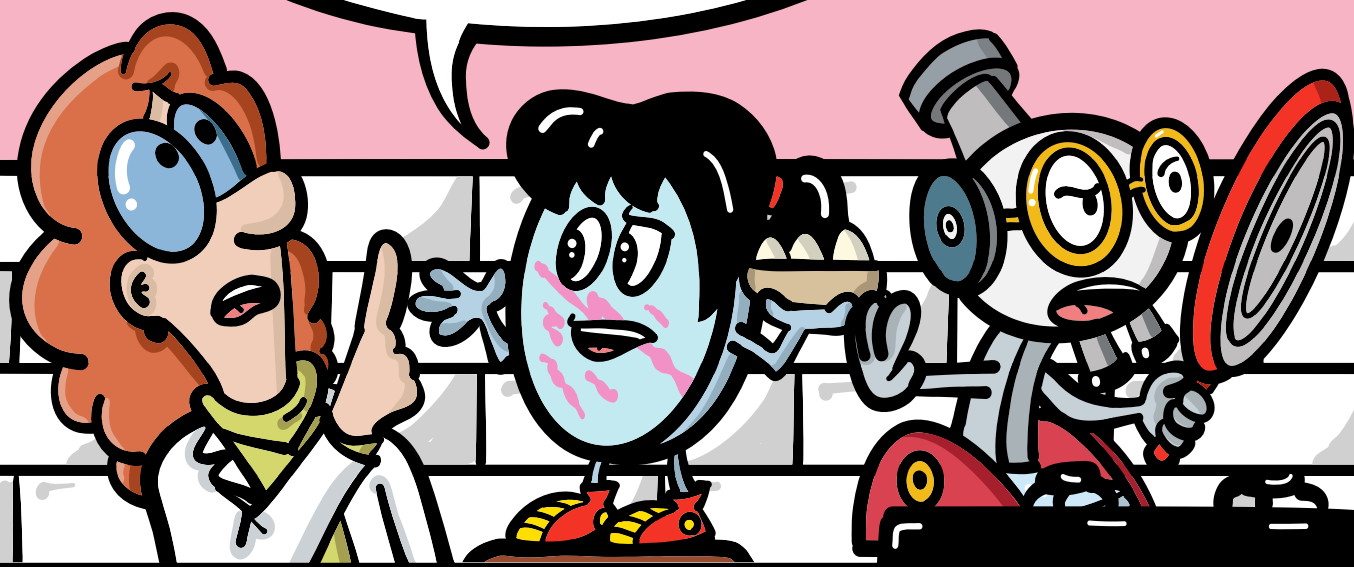


*PFAS USED AS A COOLANT

THESE PROPERTIES
MAKE PFAS
VERY UNIQUE...

LET'S TAKE
A LOOK AT THEIR
STRUCTURE...

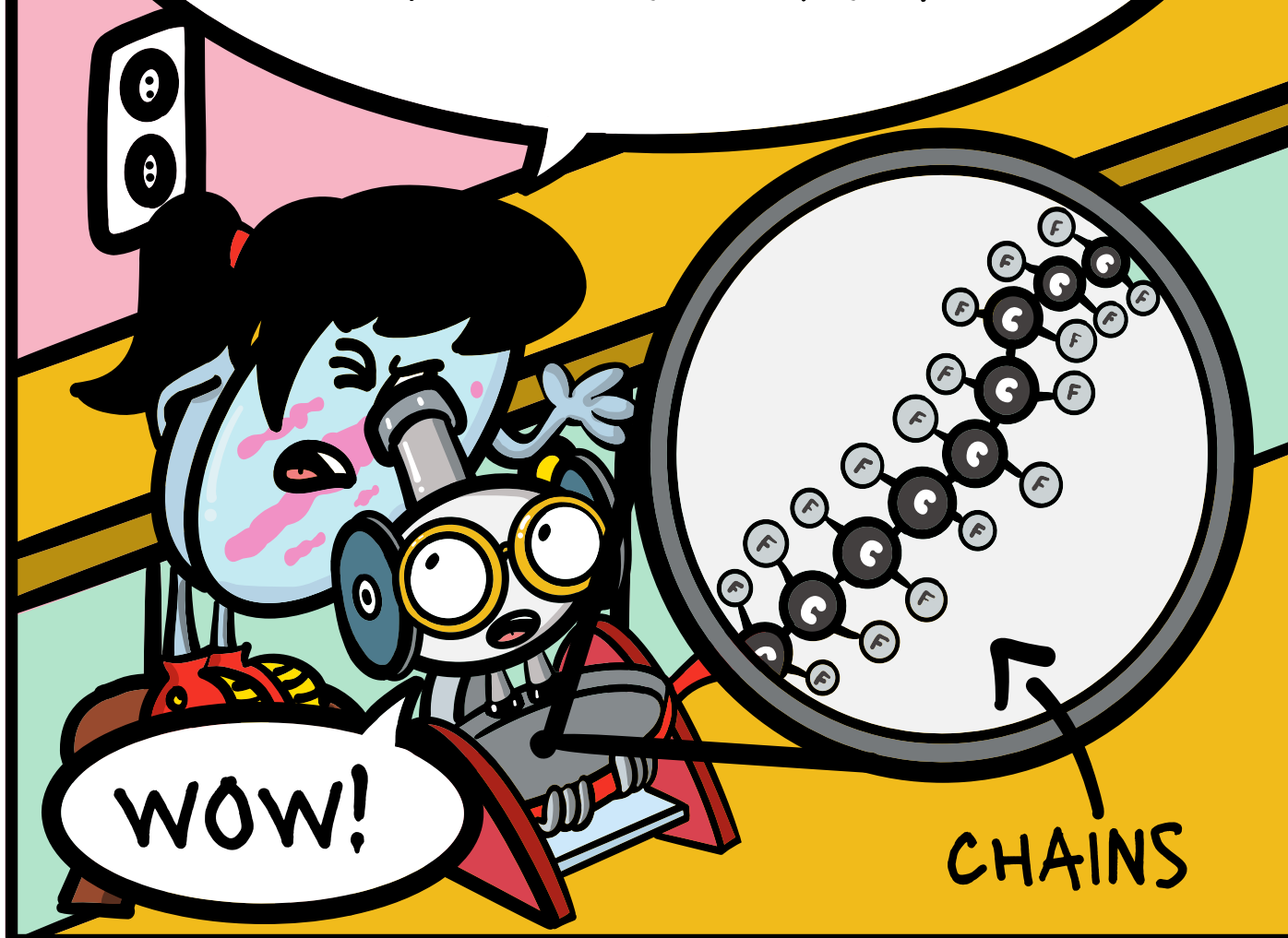
BUT
WHY
CAN PFAS DO
THESE THINGS?



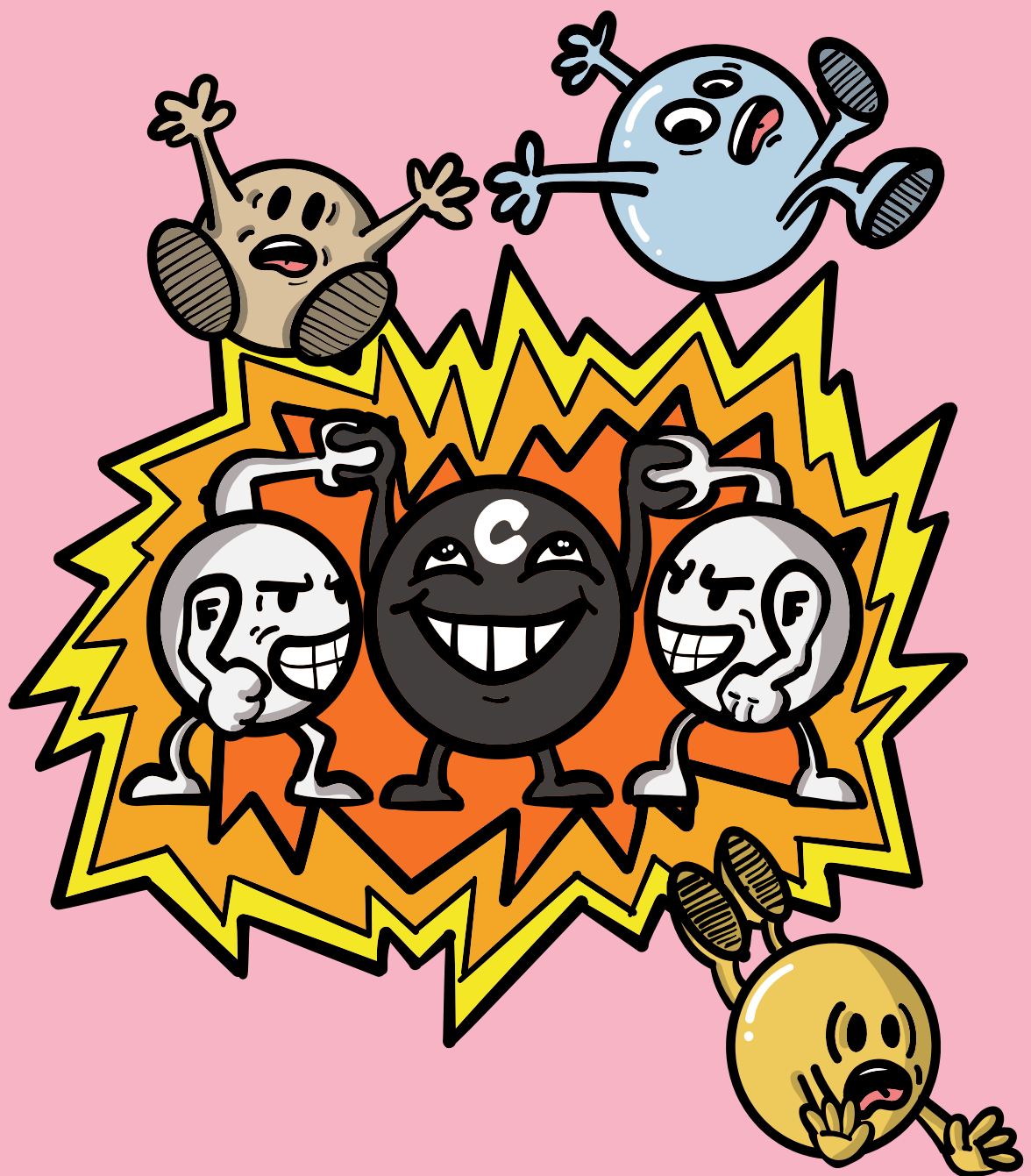
PFAS CONTAIN AT
LEAST ONE CARBON ATOM TO
WHICH FLUORINE ATOMS ARE ATTACHED.
THEY CAN CONSIST OF **SHORT OR
VERY LONG CHAINS**. THE FLUORINE-
CARBON BONDS ARE STRONG, MAKING
THE MOLECULES VERY STABLE.

WOW!

CHAINS

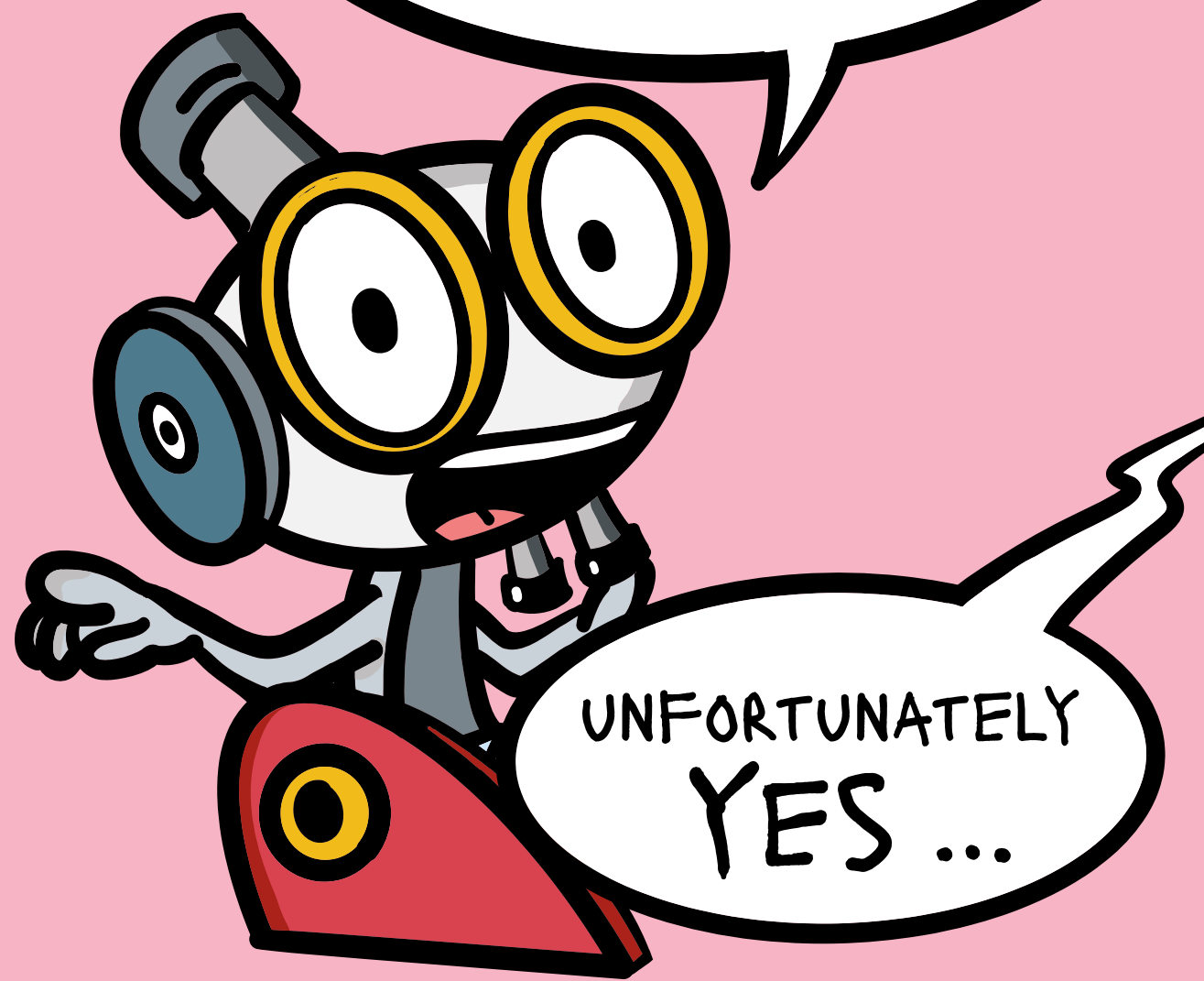


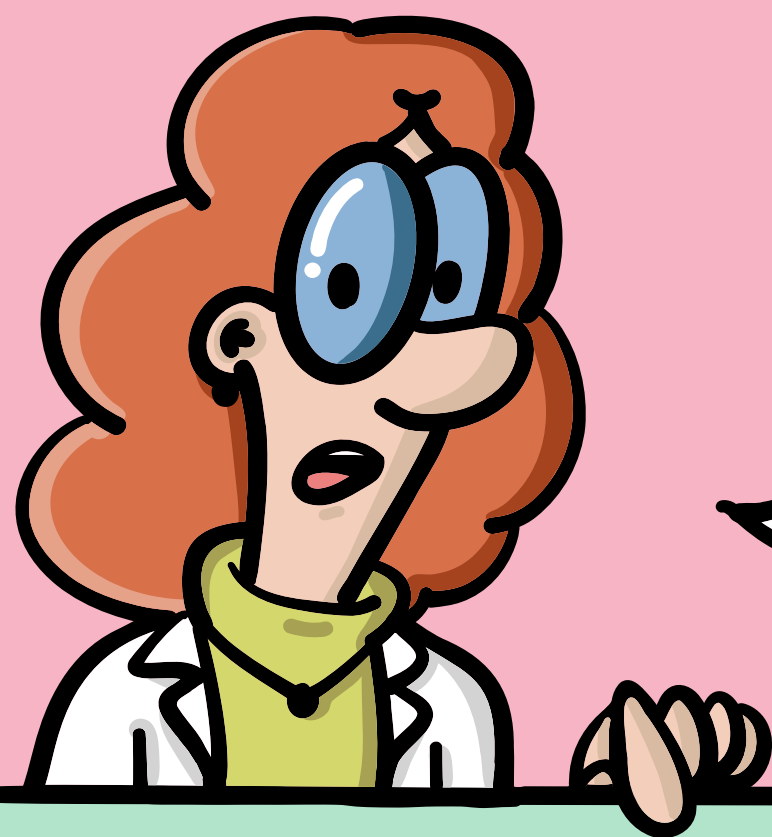
THE FLUORINE ATOMS ESSENTIALLY ENCLOSE
AND SHIELD THE CARBON-CHAIN INSIDE, AND
REPEL EVERYTHING COMING FROM THE OUT-
SIDE. THIS IS WHAT CREATES THE STABILITY.



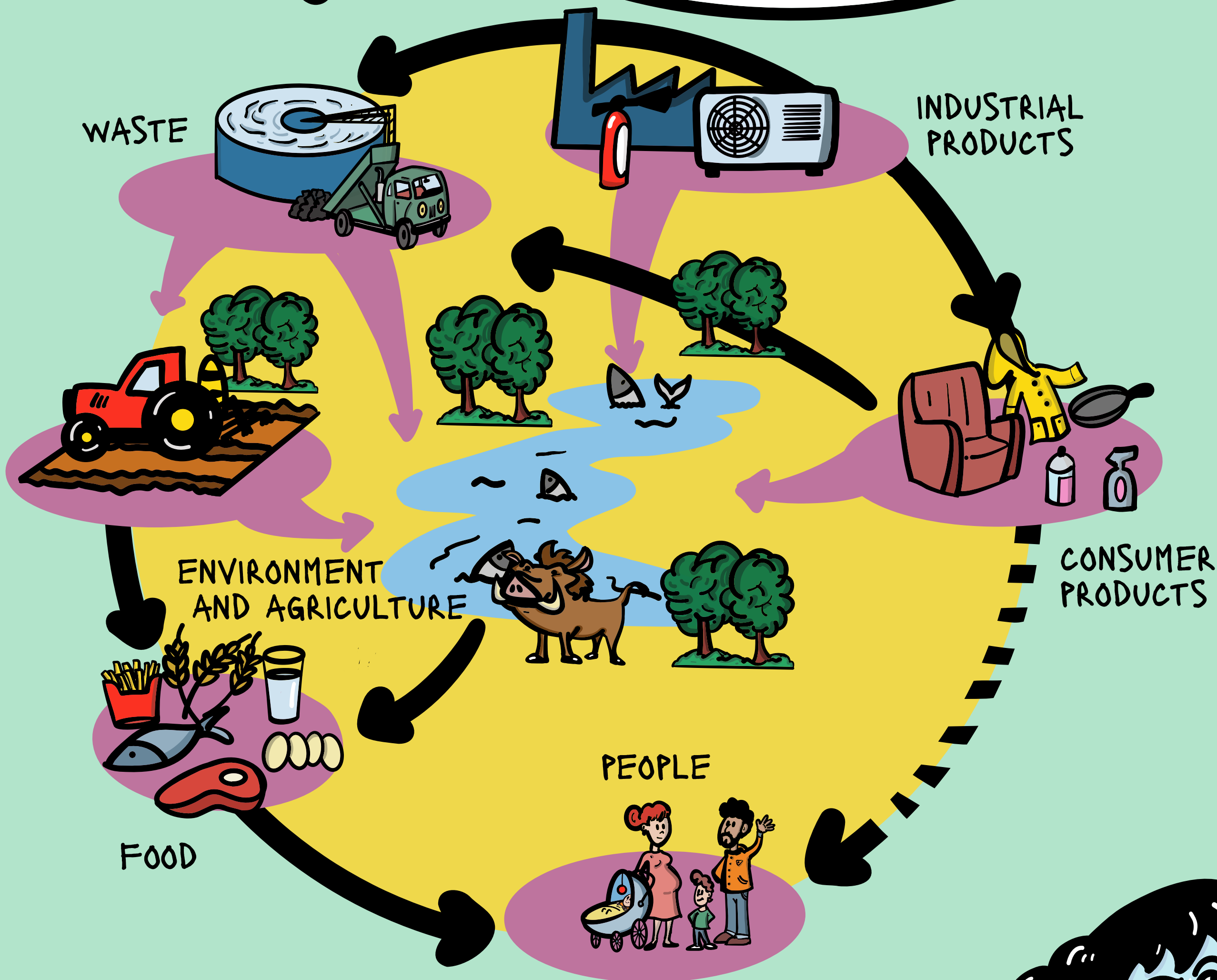
NOW
I UNDERSTAND WHY
IT IS A SUBSTANCE WITH
SO MANY APPLICATIONS,
BUT IT HAS SOME
DRAWBACKS?

UNFORTUNATELY
YES ...





DUE TO
THEIR HIGH STABILITY, PFAS
HARDLY DEGRADE AT ALL. THEY ARE
KNOWN AS "FOREVER CHEMICALS" AND
ACCUMULATE IN WATER BODIES,
SOIL, PLANTS AND ANIMALS
AND CAN ENTER THE
FOOD CHAIN ...



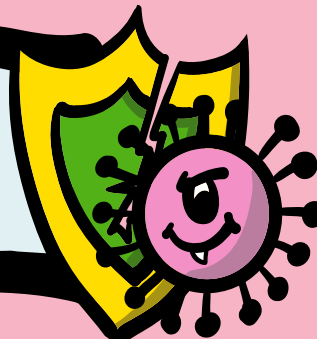
I SEE ... AND IF PFAS
END UP IN FOOD, DO WE KNOW WHAT
EFFECTS THIS CAN HAVE ON
HUMAN HEALTH?



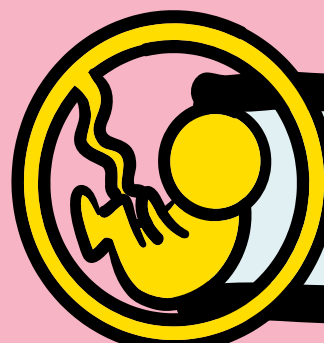
THESE FOUR
LONG-CHAIN
COMPOUNDS OF PFAS
HAVE BEEN WELL STUDIED;
PFOA, PFOS,
PFHXS
AND PFNA.

STUDIES HAVE SHOWN
NEGATIVE EFFECTS
ON ...

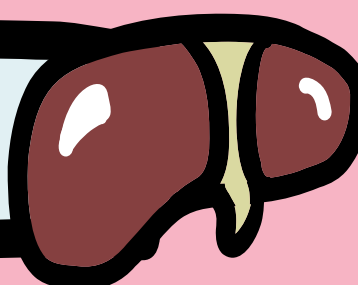
... ANTIBODIES
AFTER VACCINATION



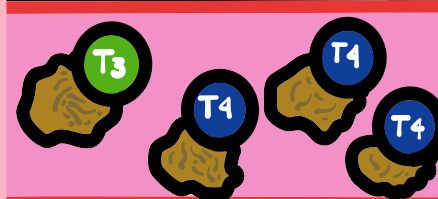
... EMBRYO
DEVELOPMENT



... THE LIVER,



... THYROID HORMONE
TRANSPORT.



EFSA* HAS
ESTABLISHED A TWI**
FOR THESE FOUR
PFAS BASED ON EPIDEMIOLOGICAL
STUDIES THAT HAVE FOUND A
CONNECTION BETWEEN PFAS
CONCENTRATIONS IN BLOOD
AND LOWER LEVELS
OF VACCINE
ANTIBODIES
IN CHILDREN.

CHEMICAL
COMPOSITION

ACCUMULATE
IN THE BODY

ACCUMULATE
IN THE
ENVIRONMENT

PFAS
EXAMPLES

LONG CHAIN
8 OR MORE
CARBON ATOMS

YES

YES

PFOA
PFOS
PFHXS
PFNA

SHORT-CHAIN
LESS THAN 8
CARBON ATOMS

NO

YES

PFBA
PFHXA
PFBS

THE BFR HAS INVESTIGATED PFAS LEVELS IN
GERMANY AND REACHED THE CONCLUSION THAT
SOME POPULATION GROUPS EXCEED THE TWI.

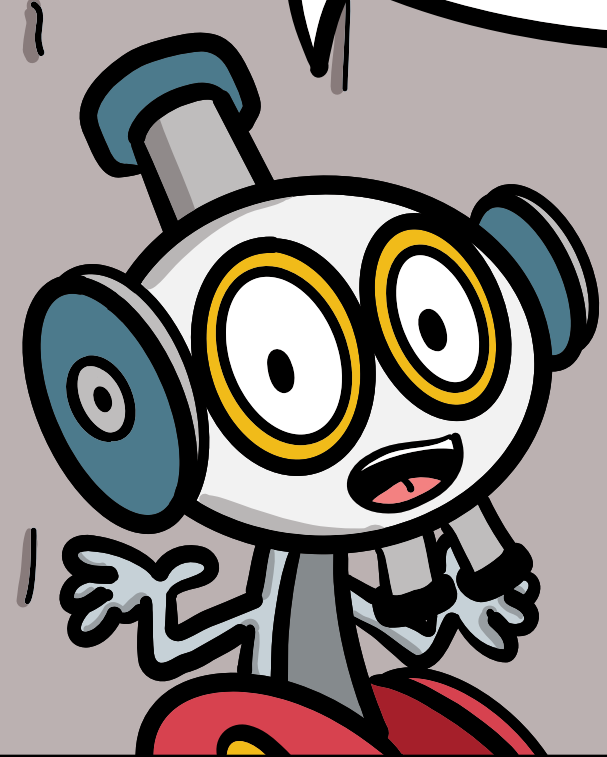
HOWEVER, THANKS TO RESTRICTIONS AND
SUBSTITUTES, THE INTAKE OF LONG-CHAIN
PFAS HAS DECREASED.

*EFSA; EUROPEAN FOOD SAFETY AUTHORITY

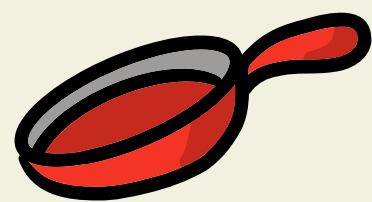
**TWI; TOLERABLE WEEKLY INTAKE
(4.4 NANOGRAM PER KILOGRAM BODYWEIGHT PER WEEK)



THE FEWER
PRODUCTS CONTAINING
PFAS ARE USED, THE
LOWER THE AMOUNT
RELEASED INTO THE
ENVIRONMENT.



THE USE OF
PFOS HAS BEEN LARGELY
BANNED SINCE 2009,
AND PFOA SINCE JULY 2020.
OTHER LONG-CHAIN PFAS HAVE
BEEN RESTRICTED IN THE
EU SINCE 2023.



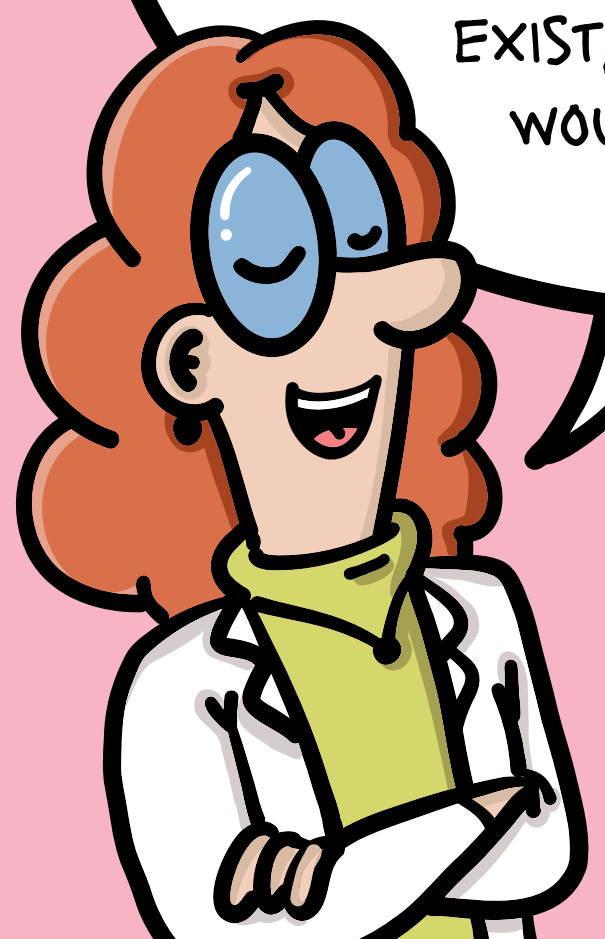
KITCHEN-
UTENSILS



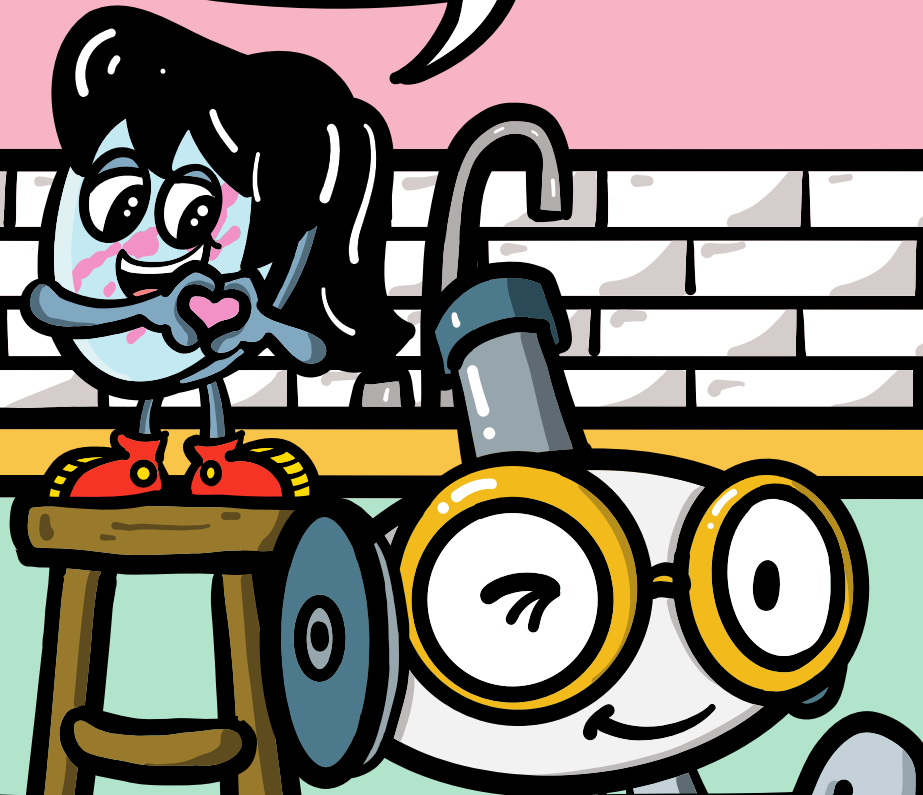
TEXTILES



COSMETICS



A PROPOSAL
BY FIVE EUROPEAN
COUNTRIES (INCLUDING GERMANY)
IS CURRENTLY BEING DISCUSSED,
WHICH WOULD SEVERELY
RESTRICT THE USE OF THE
ENTIRE GROUP OF PFAS.
WHERE VIABLE ALTERNATIVES
EXIST, THE USE OF PFAS
WOULD BE BANNED.



THE ONLY
THING THAT SHOULD
LAST FOREVER
IS SCIENCE ...
... AND LOVE!

MORE INFO: WWW.BFR.BUND.DE/EN

This text version is a translation of the original German text which is the only legally binding version.



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The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the German Federal Ministry of Agriculture, Food and Regional Identity (BMLEH). It protects people's health preventively in the fields of public health and veterinary public health. The BfR provides advice to the Federal Government as well as the Federal States ('Laender') on questions related to food, feed, chemical and product safety. The BfR conducts its own research on topics closely related to its assessment tasks.



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Protecting Health**

