

PFAS TASK FORCE: HUMAN HEALTH

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PFAS: HUMAN EXPOSURES

HUMAN EXPOSURES TO PFAS



Environmental
Science
Processes & Impacts



PAPER

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An overview of the uses of per- and polyfluoroalkyl substances (PFAS)†

Cite this: *Environ. Sci.: Processes Impacts*, 2020, 22, 2345

Juliane Glüge,^{a*} Martin Scheringer,^a Ian T. Cousins,^b Jamie C. DeWitt,^c Greta Goldenman,^d Dorte Herzke,^{e,f} Rainer Lohmann,^g Carla A. Ng,^h Xenia Trierⁱ and Zhanyun Wang^j

<https://doi.org/10.1039/D0EM00291G>

ROUTES OF EXPOSURE

- **INGESTION**

- Contaminated Food/food wrappers
- Contaminated drinking water
- Ingestion of dust
- Breastfeeding
- Dental floss

- **Inhalation: need to learn more**

- From treated clothing

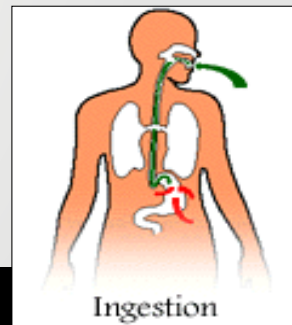
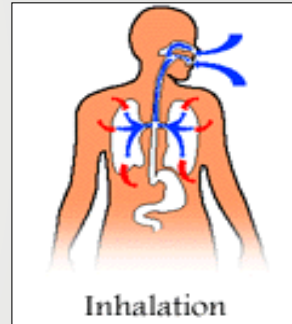
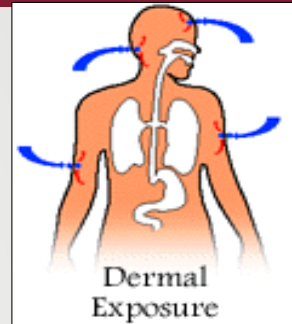
- **Dermal exposure: need to learn more**

- Personal care products

- **Ocular: need to learn more**

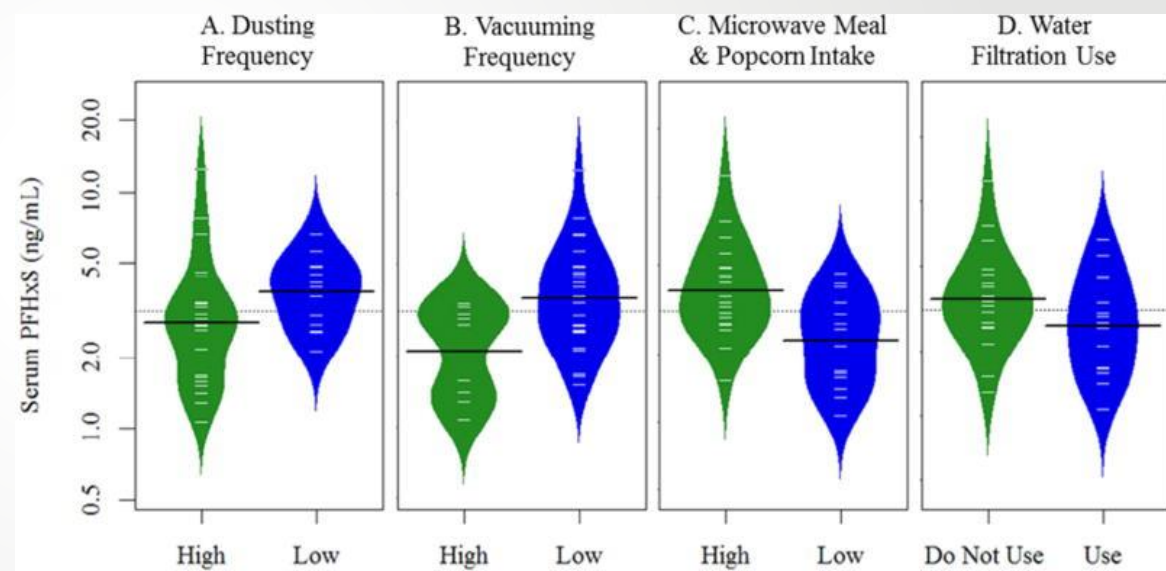
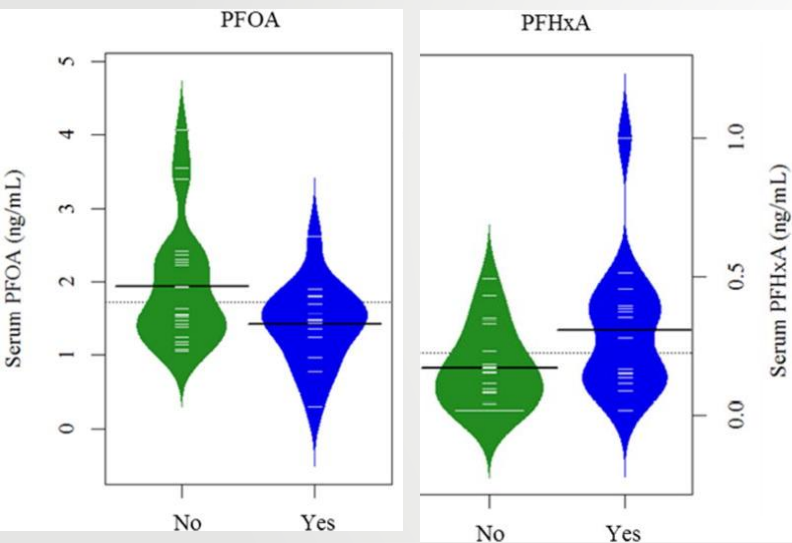
- Personal care products

- **Crosses the placenta**



EFFICACY OF HUMAN ACTIVITIES

Water filtration device use?

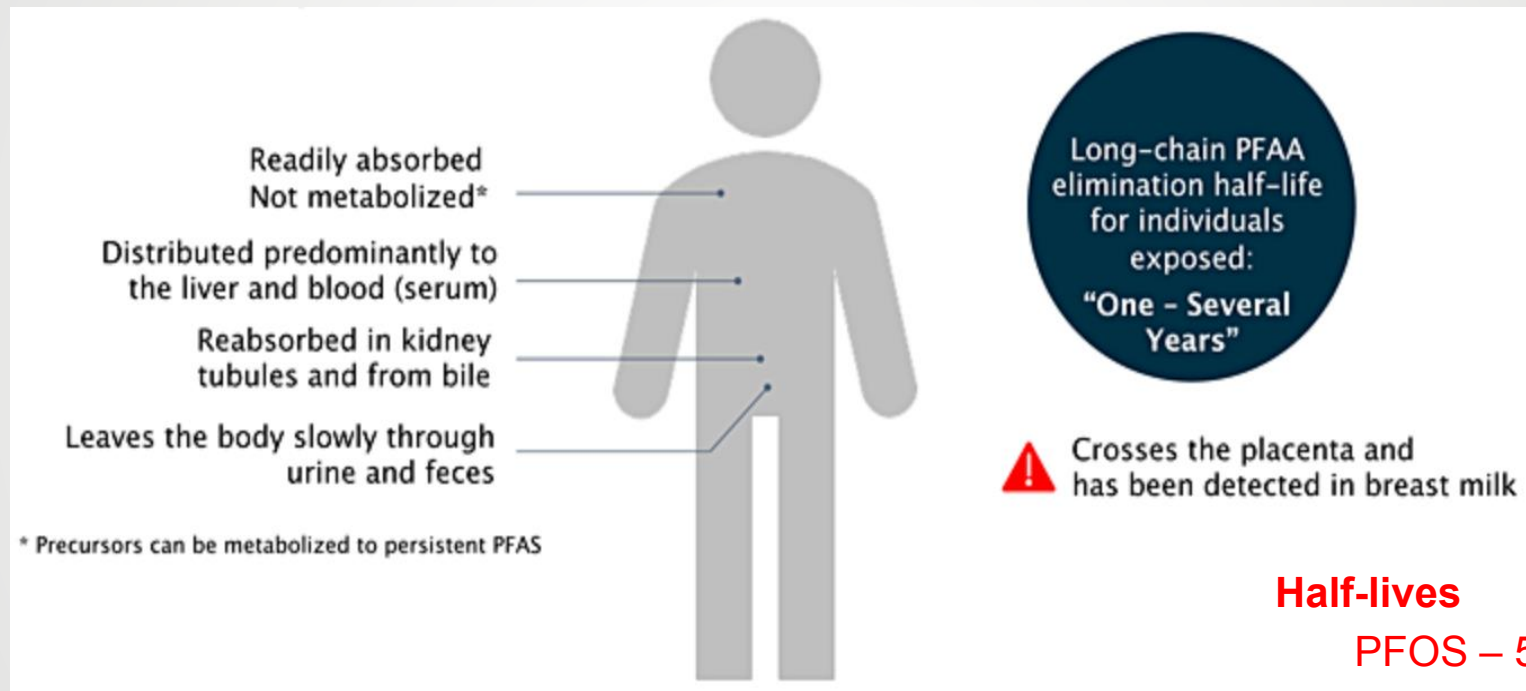


Chemosphere
Volume 184, October 2017, Pages 687-693



PFAS IN THE BODY: WHERE DOES IT GO

BIOLOGICAL FATE OF PFAS



Half-lives

PFOS – 5.4 years

PFOA – 2.3-3.8 years

PFHxS- 7 years

https://pfas-1.itrcweb.org/9-site-risk-assessment/#figure_9_5

HUMAN TISSUE DISTRIBUTION

F. Pérez et al. / Environment International 59 (2013) 354–362

357

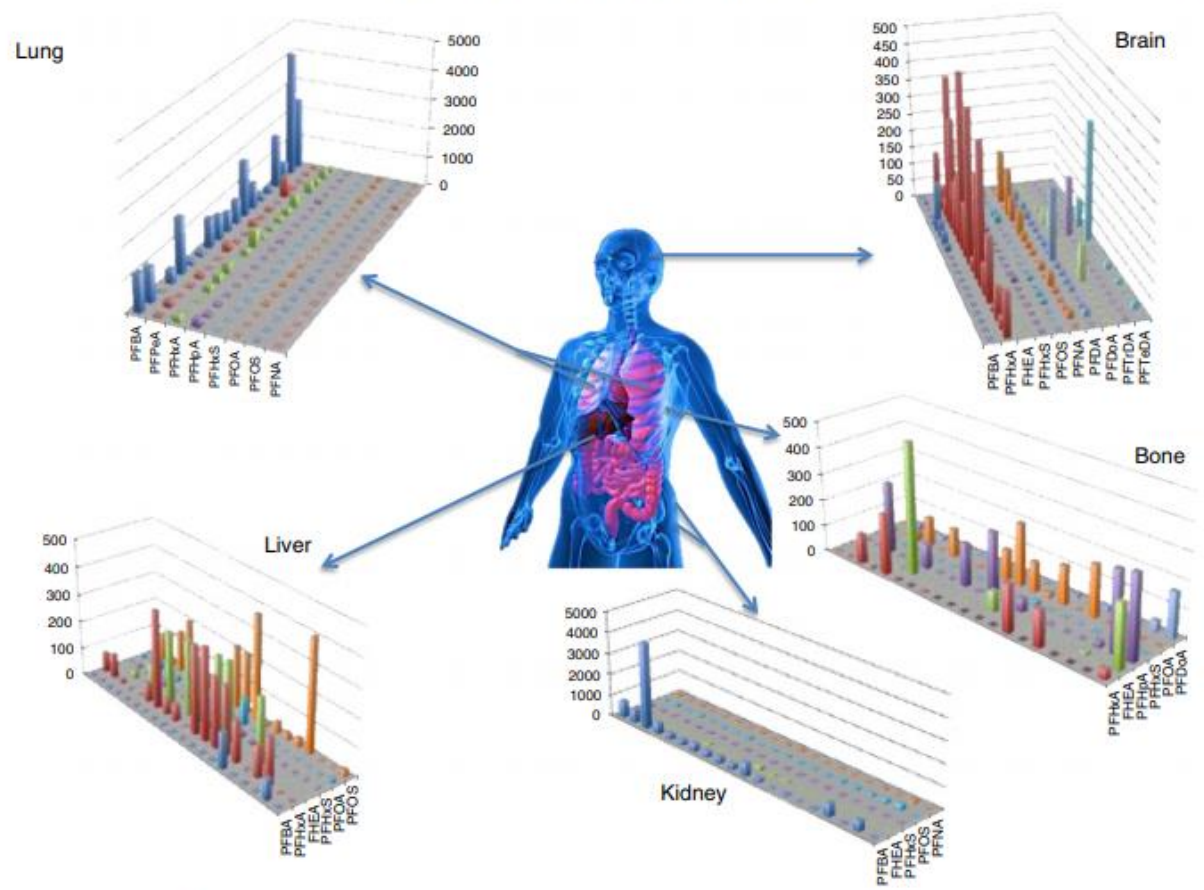


Fig. 1. Concentrations of various PFASs (in ng/g) in 5 human tissues from 20 residents of Tarragona (Catalonia, Spain).



Environment International
Volume 59, September 2013, Pages 354–362



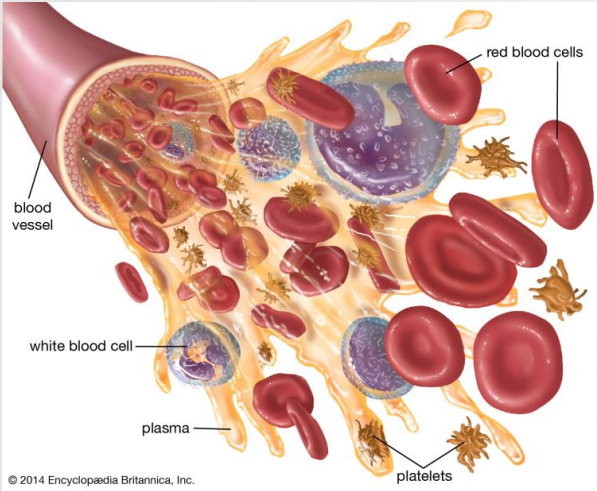
Accumulation of perfluoroalkyl substances in human tissues

Francisca Pérez ^a, Martí Nadal ^b, Alicia Navarro-Ortega ^a, Francesc Fàbrega ^b, José L. Domingo ^b, Damià Barceló ^{a, c}, Marinella Farré ^a

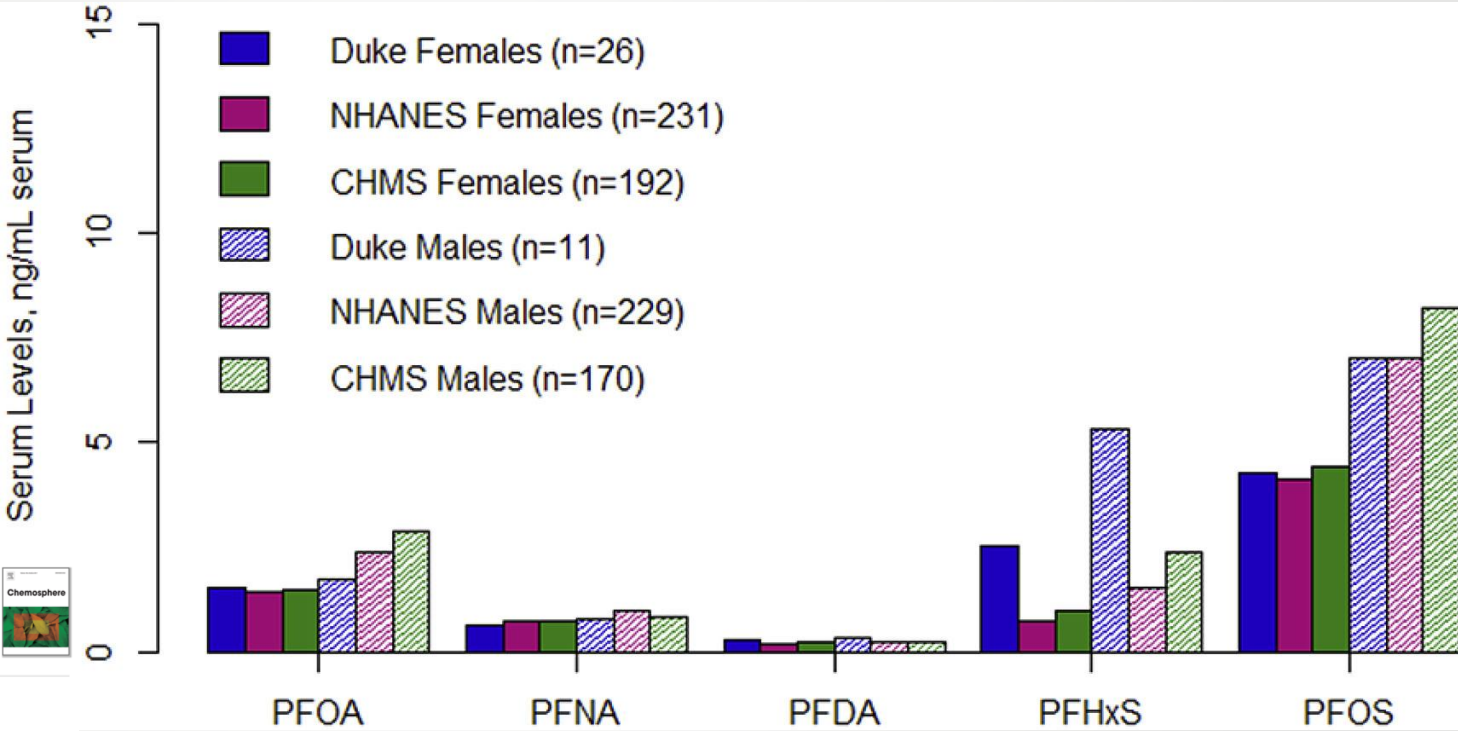
- Tissue-specific accumulation profiles
- PFBA highest in the lungs (dust)
 - Liver high in several different PFAS

HUMAN SERUM LEVELS

(Siebenaler et al. 10.1016/j.chemosphere.2017.06.023)




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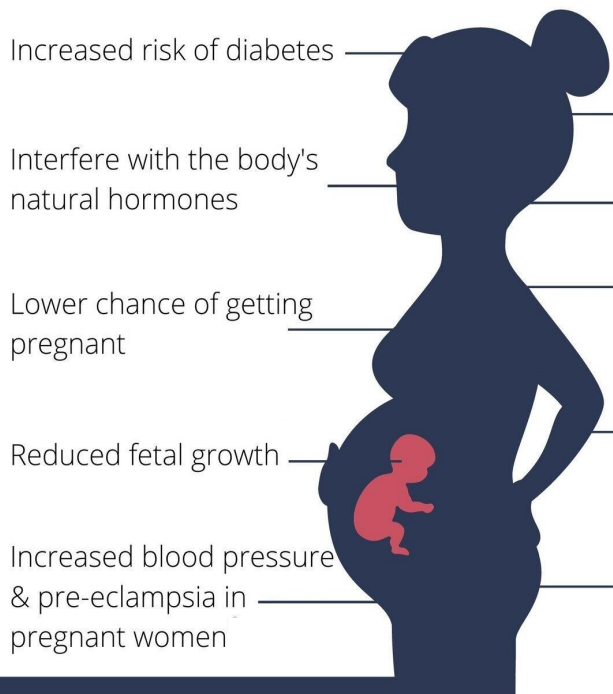



Chemosphere
Volume 184, October 2017, Pages 687-693


Serum perfluoroalkyl acids (PFAAs) and associations with behavioral attributes

Rebecca Siebenaler ¹, Rochelle Cameron ², Craig M. Butt ³, Kate Hoffman ⁴, Christopher P. Higgins ⁵, Heather M. Stapleton ⁶ 

PFAS & PUBLIC HEALTH: HEALTH RISKS



Increased risk of diabetes

Interfere with the body's natural hormones

Lower chance of getting pregnant

Reduced fetal growth

Increased blood pressure & pre-eclampsia in pregnant women

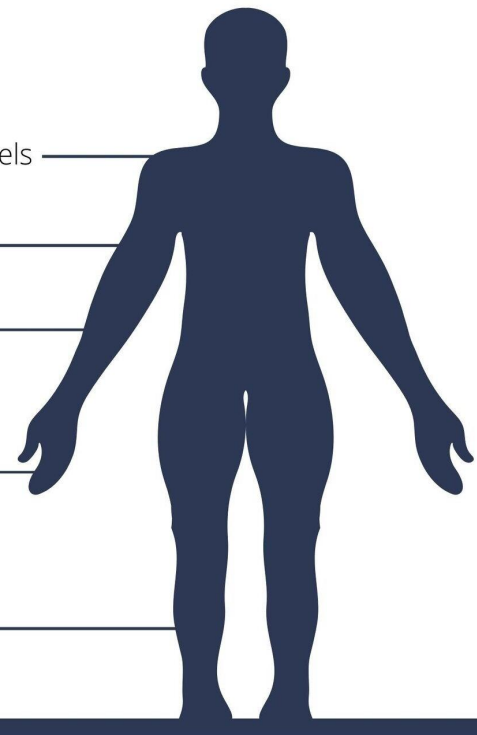
Increase cholesterol levels

Increased cancer risk

Altered metabolism

Reduced immune system function & vaccine response

Increase in thyroid disease



Increased risk of childhood obesity

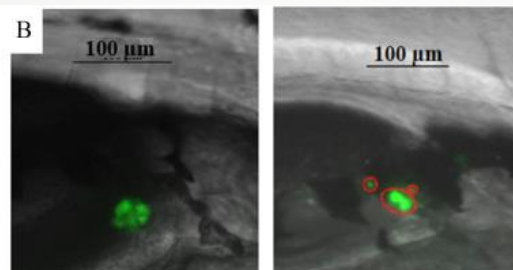
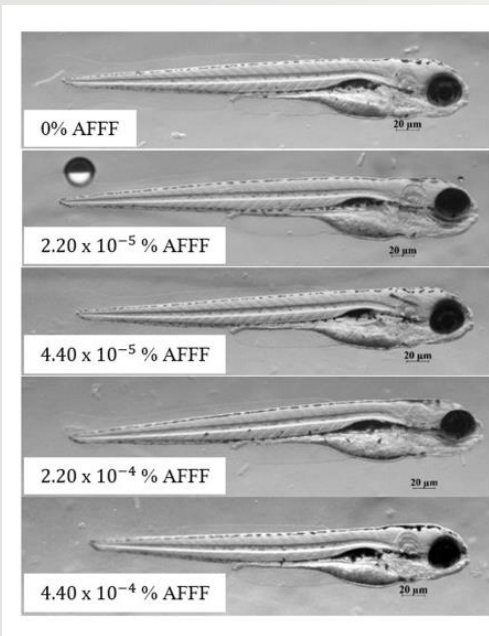
Growing, learning, & behavioral issues



While the knowledge of potential PFAS health effects has grown, many questions remain unanswered. Continued research is needed to better understand the effects of PFAS exposure.²

<https://www.wehnonline.org/pfas>

AFFF MIXTURE VS. PFOS ALONE



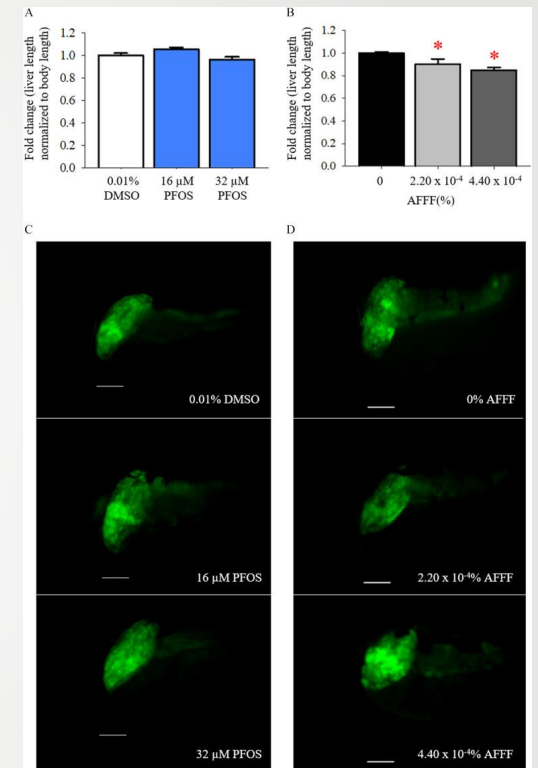
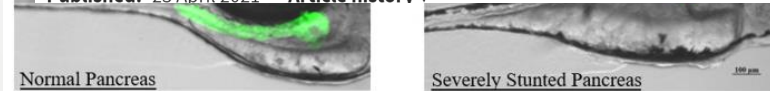
Life-course exposure to perfluoroalkyl substances in relation to markers of glucose homeostasis in early adulthood

Damaskini Valvi, MD, PhD ✉, Kurt Højlund, MD, PhD, Brent A Coull, PhD, Flemming Nielsen, PhD, Pal Weihe, MD, Philippe Grandjean, MD PhD

The Journal of Clinical Endocrinology & Metabolism, dgab267,

<https://doi.org/10.1210/clinem/dgab267>

Published: 23 April 2021 Article history ▼



Research

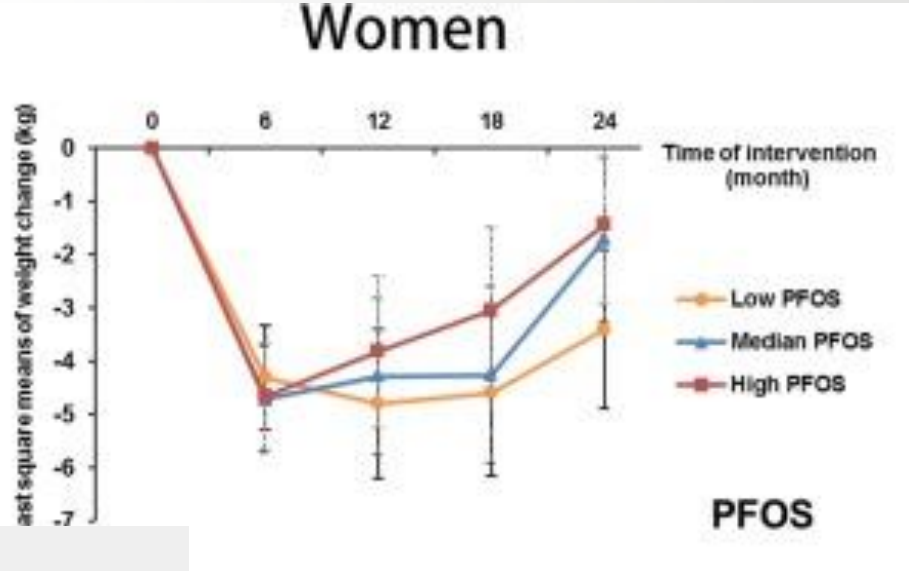
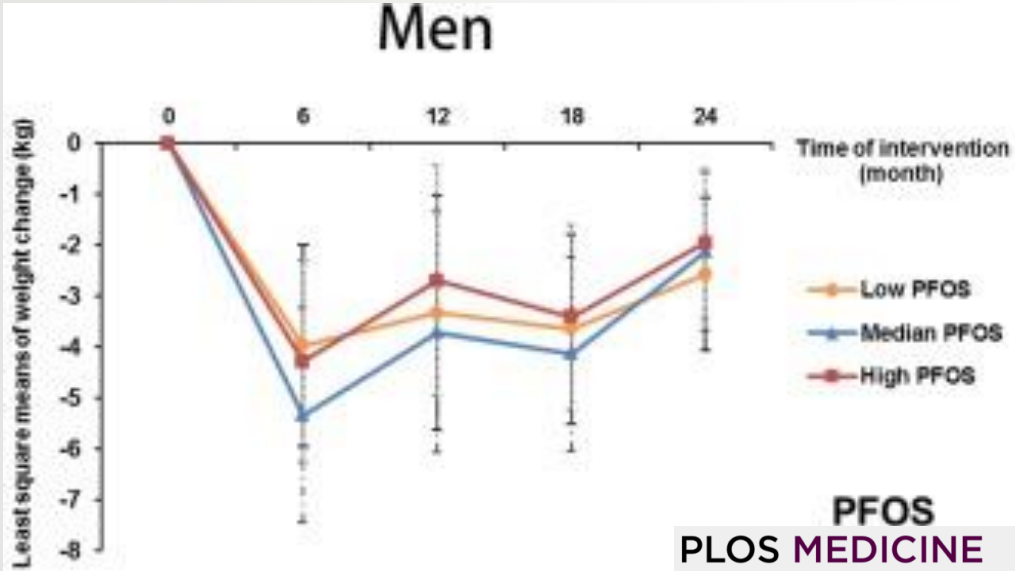
A Section 508–conformant HTML version of this article is available at <https://doi.org/10.1289/EHP6470>.

Chemical Characterization of a Legacy Aqueous Film-Forming Foam Sample and Developmental Toxicity in Zebrafish (*Danio rerio*)

Kate M. Annunziato,¹ Jeffery Doherty,² Jonghwa Lee,² John M. Clark,² Wenle Liang,¹ Christopher W. Clark,¹ Malina Nguyen,¹ Monika A. Roy,^{1,3} and Alicia R. Timme-Laragy¹

OBESITY & WEIGHT LOSS

- 2 year randomized clinical trial, 620 overweight and obese men and women
- Higher levels of PFAS associated with a greater weight regain, primarily in women.
- Higher levels of PFAS, (PFOS and PFNA) associated with greater decline in resting metabolic rate



PFOS
PLOS MEDICINE

OPEN ACCESS PEER-REVIEWED
RESEARCH ARTICLE

Perfluoroalkyl substances and changes in body weight and resting metabolic rate in response to weight-loss diets: A prospective study

Gang Liu, Klodian Dhana, Jeremy D. Furtado, Jennifer Rood, Geng Zong, Liming Liang, Lu Qi, George A. Bray, Lillian DeJonge, Brent Coull, Philippe Grandjean, Qi Sun

Published: February 13, 2018 • <https://doi.org/10.1371/journal.pmed.1002502>

IMMUNE SYSTEM SUPPRESSION



Journal of Immunotoxicology



ISSN: 1547-691X (Print) 1547-69

Estimated exposure to perfluorinated compounds in infant antibody concentrations

Philippe Grandjean, Carsten Heilmann, B. Mogensen, Amalie Timmermann

To cite this article: Philippe Grandjean, Carsten Heilmann, B. Mogensen, Amalie Timmermann. Estimated exposure to perfluorinated compounds in infant antibody concentrations. Journal of Immunotoxicology.

To link to this article: <https://doi.org/10.1080/1547691X.2020.1844444>

MASS PFAS-COV STUDY

<https://www.masspfas-covstudy.org/>

perfluorinated

Philippe Grandjean, Clara Amalie Gade Timmermann, Marie Kruse, Flemming Nielsen, Pernille Just Vinholt, Lasse Boding, Carsten Heilmann, Kåre Mølbak

Published: December 31, 2020 • <https://doi.org/10.1371/journal.pone.0244815>

PFAS HEALTH EFFECTS DATABASE

- <https://pfastoxdatabase.org/>

How to Use

Database Chemicals Health Outcomes About

The numbers in the heat map indicate the number of studies, not the number of significant effects. Click to select studies, click again to deselect.

Colors correspond to the study type: human in green, animal in blue, in vitro in orange.

PFAS	Total	Metabolic & Digestive System	Body Weight, Size & Growth	Endocrine System	Systemic/ Nonspecific/ Other	Reproductive System	Cell Toxicity / Mortality	Circulatory System	Nervous System & Behavior	Immune System	Urinary System	Respiratory System	Genotoxicity	Sensory System	Skeletal System	Cancers
PFAS	434	75	51	26	107	46	1	83	38	30	14	23	32	93	13	6
PFNA	434	75	51	26	107	46	1	83	38	30	14	23	32	93	13	6
PFDA	364	39	90	30	55	61	41	28	27	3	51	41	59	10	3	15
PFHxS	360	72	13	15	109	19	1	77	13	28	12	6	21	92	5	1
PFUnA	197	33	15	14	44	19	37	9	21	5	3	14	36	5	1	6
PFDoA	143	12	20	12	18	22	13	14	20	3	9	22	19	11	3	7
PFAS mix	121	18	24	7	20	19	27	19	10	1	17	6	18	12	1	2
PFHpA	95	16	10	13	13	7	12	6	16	2	2	12	18	1	1	2
PFBS	94	5	6	13	7	12	5	6	20	2	3	13	9	9	11	16
PFHxA	84	10	12	17	6	12	7	5	20	7	18	3	6	2	10	21
PFBA	68	4	11	16	4	15	3	4	21	11	12	4	4	1	11	19
PFTTrDA	51	5	7	2	11	9	7	7	4	1	2	3	8	3	1	2
PFTeA	47	7	3	7	5	9	4	4	8	1	1	8	2	1	1	1
PFPeA	40	4	4	11	4	5	4	1	9		14	4	1		2	8
PFHpS	38	5	1	13	2	10	2	2			1	13			2	2
PFAS + other	37	1	16	1	1	10	3	12	4	11	2	3	8	1	6	4
NMeFOSAA	36	5		1	8		7	1			1	12				2
NEtFOSAA	30	4		1	5	1	4				2	9				2

Filters

Refresh page to reset all filters

Study Type
Click for study type specific histograms, hover for study counts

human
 animal
 in vitro


Early Life Effects

Financial Conflict of Interest

Selected Studies

Hover to see details, click for PubMed.

- Abe et al. 2017
- Abe et al. 2017
- Adinehzadeh and Reo 1998
- Adinehzadeh et al. 1999
- Ahmed et al. 2019
- Akerblom et al. 2017
- Alderete et al. 2019
- Alkhalawi et al. 2016
- Alves et al. 2016

An aerial photograph of a large crowd of people, mostly wearing red shirts, gathered on a green football field. The crowd is arranged in a large, irregular shape that resembles a stylized letter or logo. In the background, there are several university buildings, including a prominent tall brick tower, and a large stadium with a green roof. The sky is overcast with grey clouds.

QUESTIONS?
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