Purdue Institute for Integrative Neuroscience

Adverse effects of PFAS on the nervous system

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PFAS neurotoxicity – large mammals

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Brain region-specific perfluoroalkylated sulfonate (PFSA) and carboxylic acid (PFCA) accumulation and neurochemical biomarker Responses in east Greenland polar Bears (*Ursus maritimus*)

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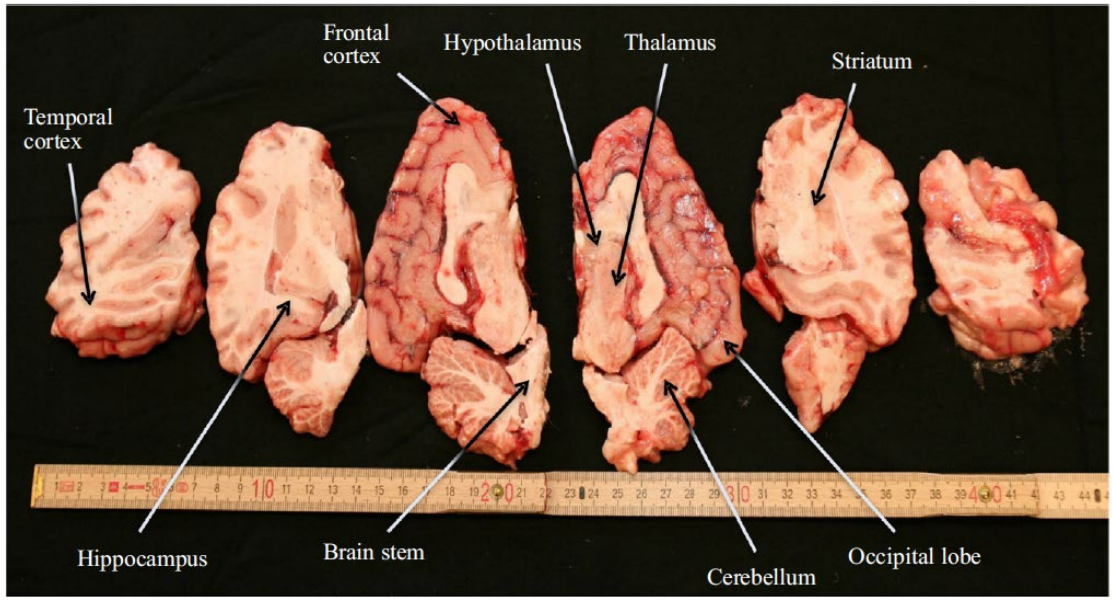


Table 1
Mean ± SE, range (ng/g ww) and detection frequency of PFSA compounds in brain tissue from East Greenland polar bears. nd: not detected.

Brain region	*PFBS*	*PFHxS*	*PFOS*	*PFDS*	*Σ-PFSAs*
Brain average	0.55 ± 0.08 n.d. to 4.48	1.10 ± 0.10 n.d. to 4.77	22.92 ± 0.84 6.55–44.37	0.66 ± 0.06 n.d. to 2.82	28.82 ± 1.19 11.52–72.71

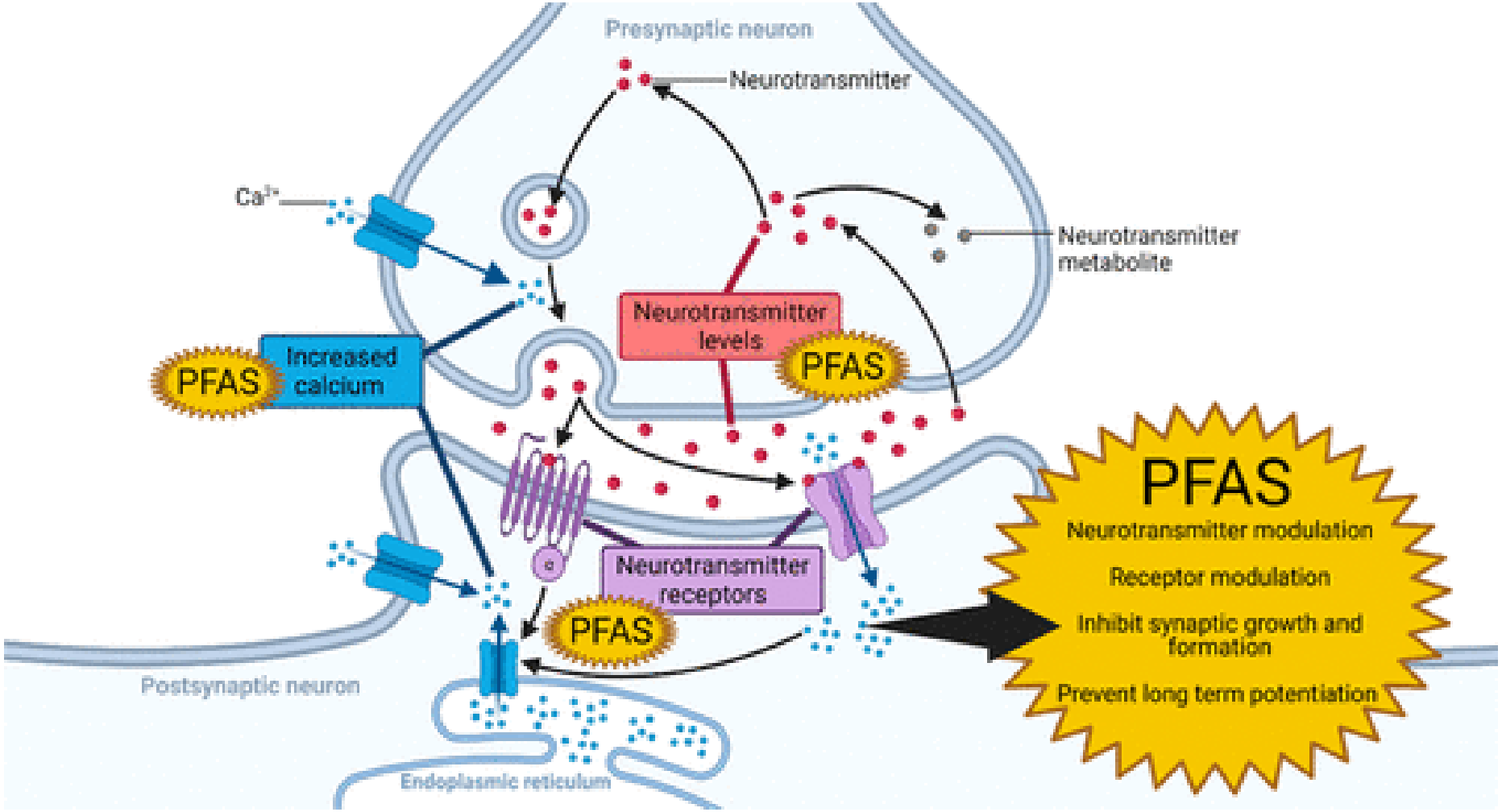
Table 2
Mean ± SE, range (ng/g ww) and detection frequency of PFCA compounds in brain tissue from East Greenland polar bears. nd: not detected.

Brain region	*PFHxA*	*PFHpA*	*PFOA*	*PFNA*	*PFDA*	*PFUnDA*	*PFDoDA*	*PFTrDA*	*PFTeDA*	*PFPeDA*	*Σ-PFCAs*
Brain average	0.13 ± 0.03 n.d. to 1.24	n.d. n.d.	1.09 ± 0.13 n.d. to 5.58	2.59 ± 0.13 0.79–6.89	2.63 ± 0.15 n.d. to 6.69	22.30 ± 1.14 6.83–53.27	8.19 ± 0.46 1.96–20.91	37.87 ± 2.29 9.16–105.24	6.81 ± 0.40 1.34–18.68	4.71 ± 0.42 n.d. to 21.37	99.40 ± 5.95 34.67–327.13

PFAS enter and bioaccumulate in human brain

- PFAS toxicity has been studied in the context of many adverse health outcomes. Neurological effects are an emergent concern.
- Total brain PFAS burdens vary (i.e., ~1.8, 2.9, 98, 180 ppb) from 4 studies. Lab studies support bioaccumulation, relative to plasma.
- Significant possible risk relationships were detected for all causes mortality, diabetes, cerebrovascular diseases, myocardial infarction and Alzheimer's disease (PMID: 28541558).
- Overall gap – PFAS accumulate in the brain (half lives unknown), with unclear neurological effects.

PFAS affecter neurotransmitters (primary means by which neurons communicate with each other)



Summary

- PFAS are a common exposure
- Many adverse health effects have been reported
- Similarities and differences across individual PFAS – we still need rodents
- There are neurochemical targets with likely adverse diverse neurological effects – multiple relevant diseases
- Preliminary links to multiple neurological diseases/disorders across lifespan. Cellular, animal and human studies in progress