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Re-analyses of data on rat brain morphometry and motor activity

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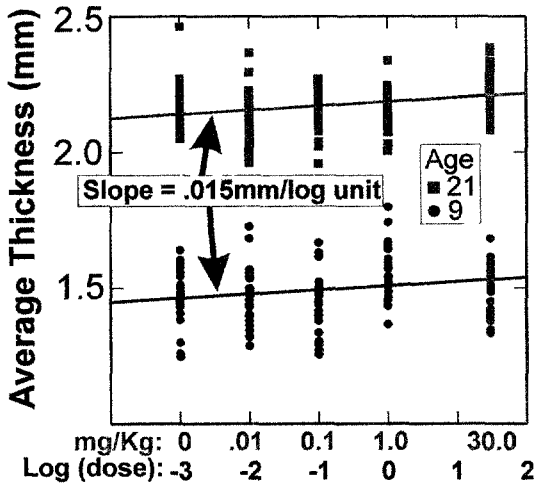
Brain morphometry

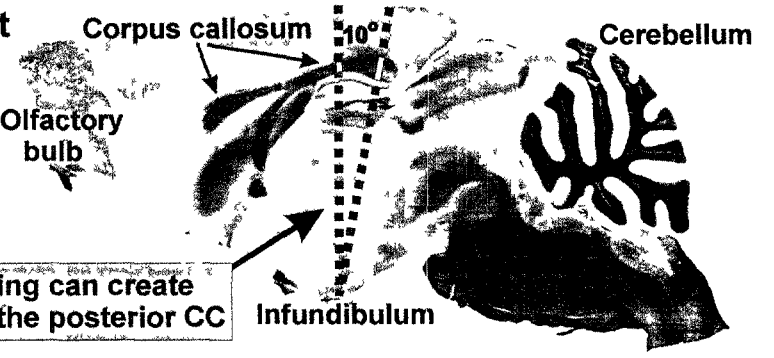
Argus (1998): No perchlorate effects significant at P < .01

Argus/Primedica (2001):
Original methods & analysis **do not meet standards of neuroscience journals.**
(1) One or two measures of thickness, rather than area or volume of structure
(2) Thickness not measured in equivalent location in different brains.
(3) Separate analyses for left & right sides, 9 & 21 days, male & female, and each dose versus control, all done with P < .05 criterion - **high risk of false positives**
I re-assessed the original data with analysis of variance and multiple regression.
Higher perchlorate doses increased thickness of frontal & parietal cortex, and striatum.
Size of the effect was very small by accepted standards in neuroscience.



Cortex grows 0.7 mm thicker in about 12 days or 288 hours in normal rats.
Perchlorate effect of .015 mm is equivalent of about 6 hours of normal growth after more than 40 days of treatment, an increase of about 0.06% in thickness of cerebral cortex.
Across entire range of doses, the perchlorate effect can account for only 0.4% of total variation in thickness.

EPA report emphasized an apparent effect of perchlorate on thickness of the posterior corpus callosum.
This "effect" was an artifact of group differences in the plane of sectioning the brain.



Small difference in angle of sectioning can create large difference in apparent size of the posterior CC

Behavior

Argus (1998) study reported no significant perchlorate effects on passive avoidance learning, water maze learning, auditory startle habituation, or motor activity.
A post hoc exploration of these data later glimpsed an effect of perchlorate on 1 of 4 tests only late in a long session in 1 of 8 groups. That is, an "effect" was seen in 1 of 4x3x8 = 96 situations, which is **close to the chance level when α = .01.**

Bekkedal et al. (2000) study of open field activity:
In my re-analysis with repeated measures ANOVA, there were large changes in all measures of open field behavior with age and period within a trial, but **there were no statistically significant effects of perchlorate dose.**