FID Data Reconstruction

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Overview

Brain Development

- Brain development is protract process that begins in the 3rd gestational week, and it continues for an extended period post-natally. (Stiles & Jernigan, 2010)
- MRI studies of structural and functional changes in the developing human brain. (Casey, Giedd, & Thomas, 2000)

Substantia Nigra (SN)

- SN is an anatomically heterogeneous nucleus with regional alternation in striatal projections and distribution of histo-chemical markers. (Fearnley & Lees, 1991)
- Dopamine contributes to the processing of signals in SN. (Geffen, Jessell, Cuello, & Iversen, 1976)
- Dopaminergic neurons have been developed in SN. (Freeman et al., 1991)

Corpus callosum (CC)

- CC is a wid and thick nerve tract, beneath the cerebra cortex in the brain.
- CC plays an major role in inter-hemispheric integration and communication. (Schlaug, Jäncke, Huang, Staiger, & Steinmetz, 1995)
- The size of CC differs upon disease, occupations, genders, and etc.
- Growth of CC was noticed from the 4th fetal month to maturity. (Rakic & Yakovlev, 1968; Pujol, Vendrell, Junqué, Martí-Vilalta, & Capdevila, 1993)

Development in Rats and Humans

- Some papers made approximate one-to-one correspond between development of rats and humans. (Andreollo, Santos, Araújo, & Lopes, 2012)
- The relation between rats and human aging:
  - 6 week in Rat = 4.5 years in Human
  - 4 month in Rat = 12 years in Human
  - 20 month in Rat = 50 years in Human

RARE-VTR FID Image

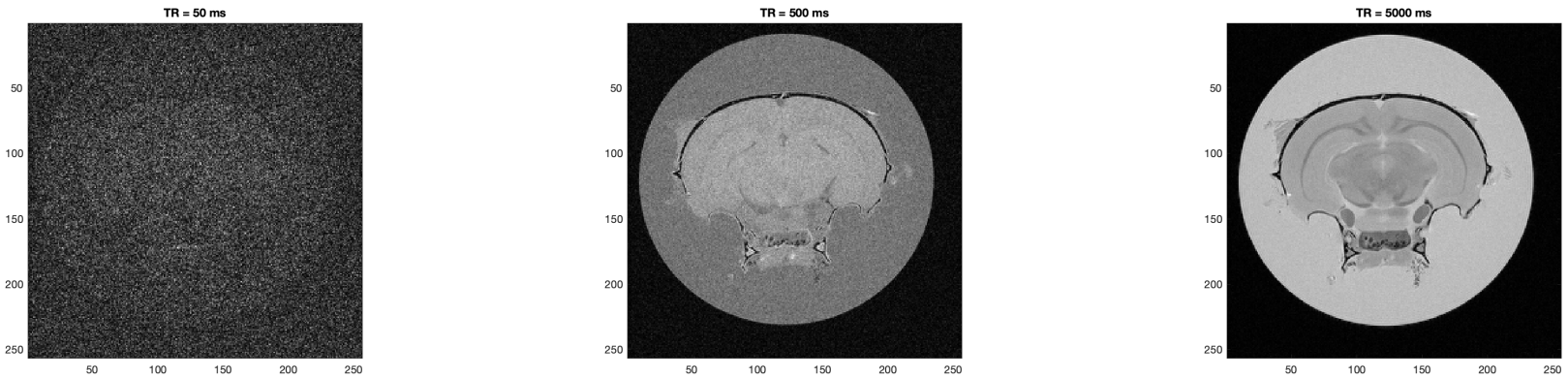


Figure: RARE-VTR FID Images in 6 week

MSME FID Image

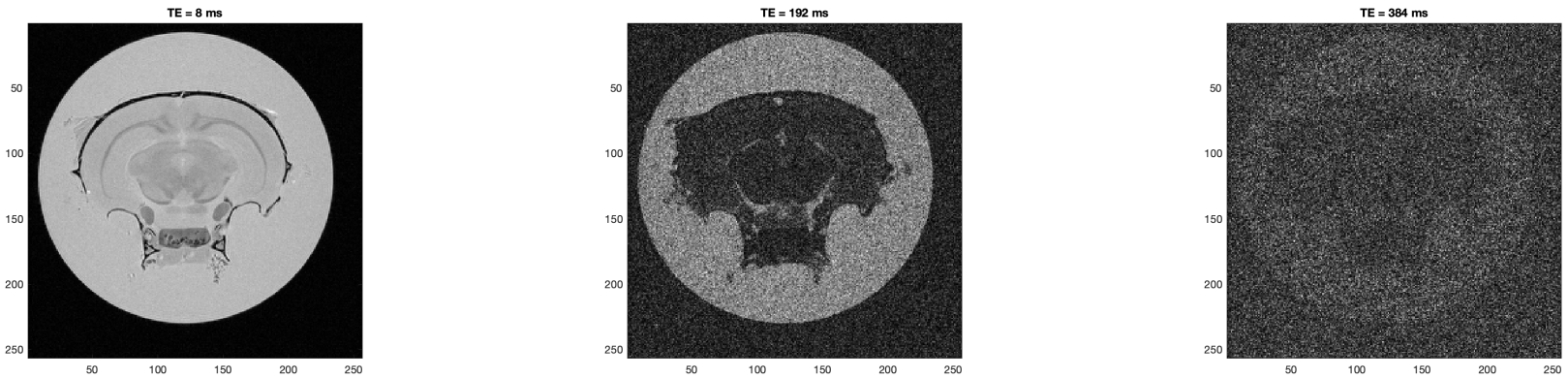


Figure: MSME FID Images in 6 week

MGE FID Image

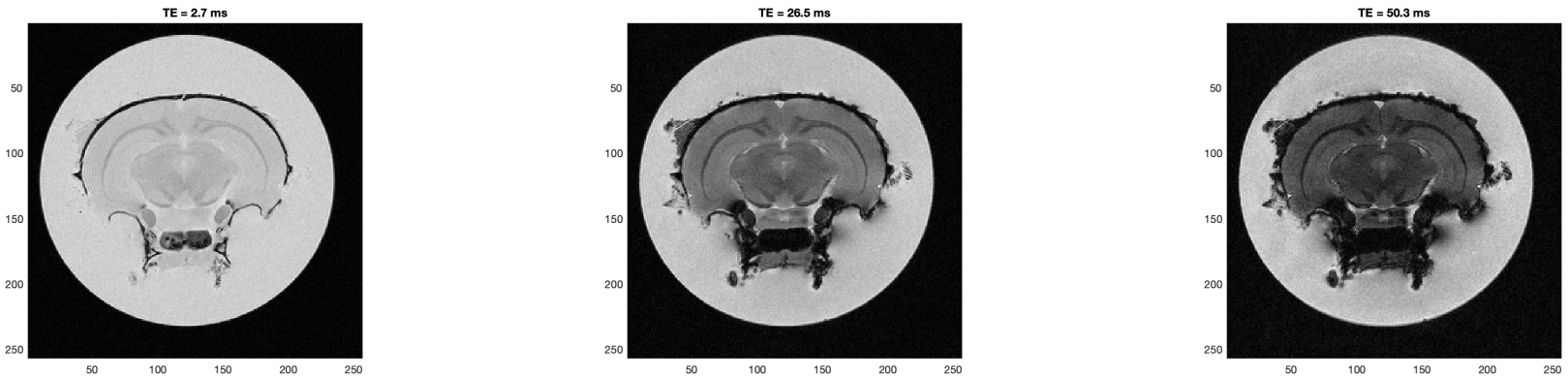
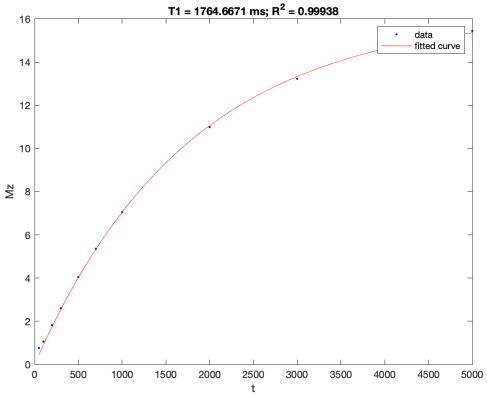
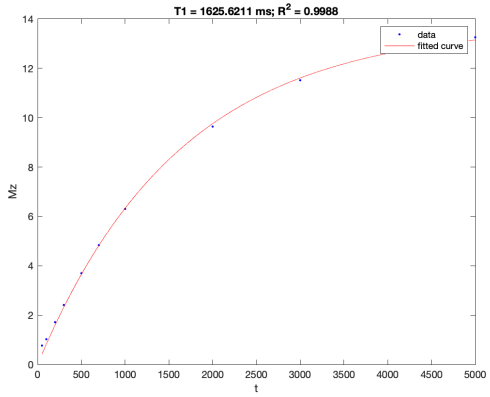


Figure: MGE FID Images in 6 week

T_1 Fitting





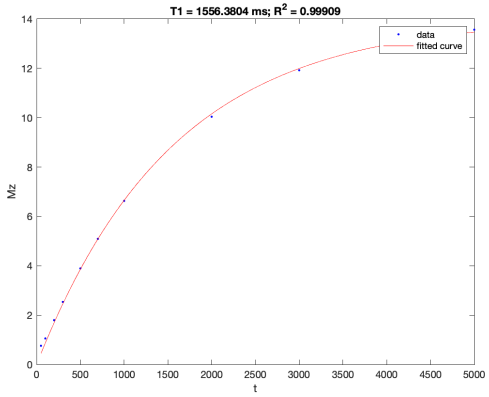
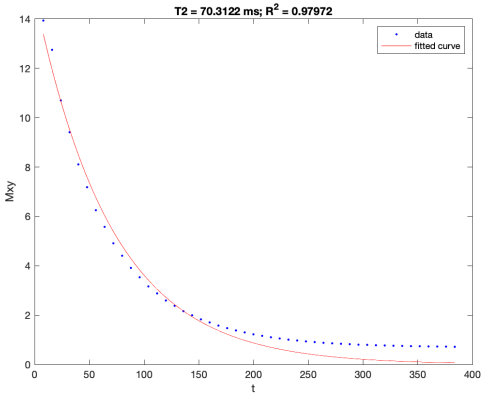
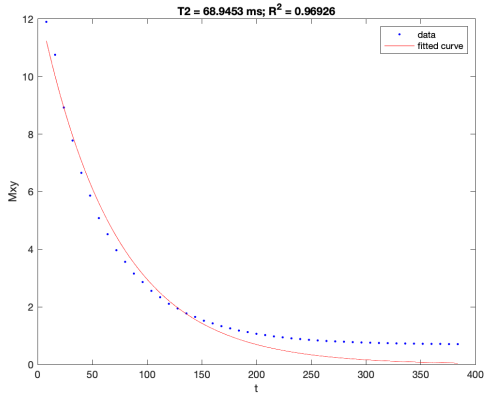


Figure: T_1 Fitting

T_2 Fitting





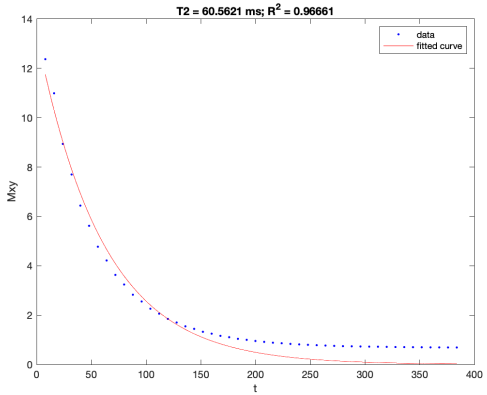
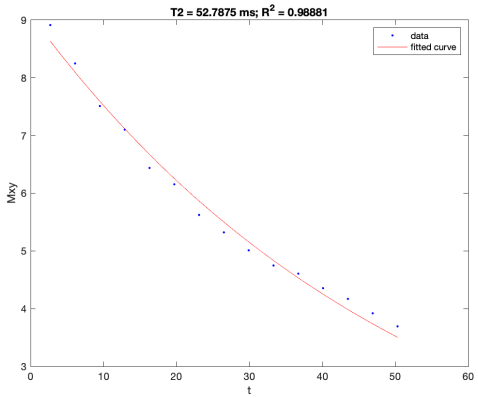
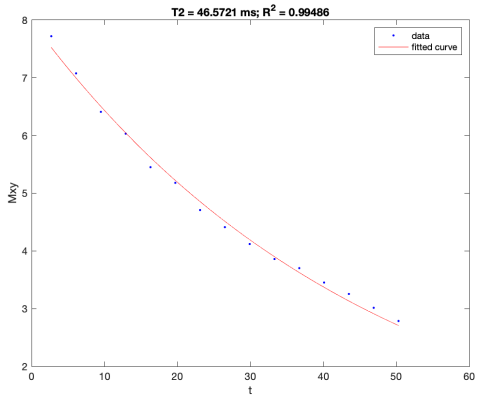


Figure: T_2 Fitting

T_2^* Fitting





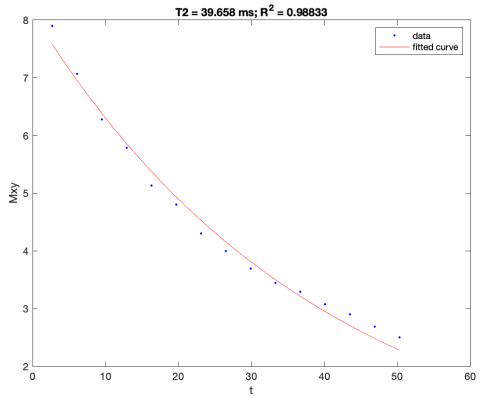


Figure: T_2^* Fitting

T_1 Mapping

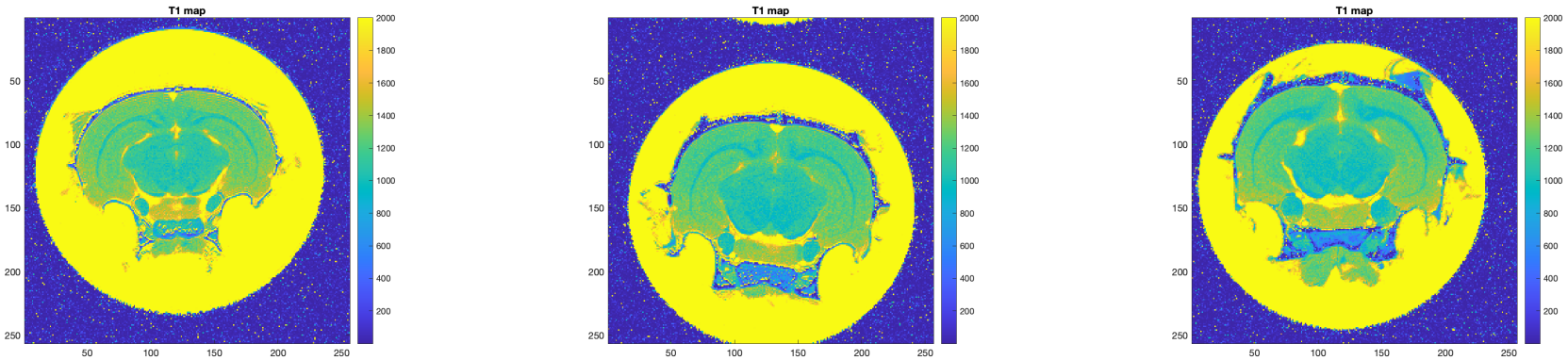


Figure: T_1 Mapping

T_2 Mapping

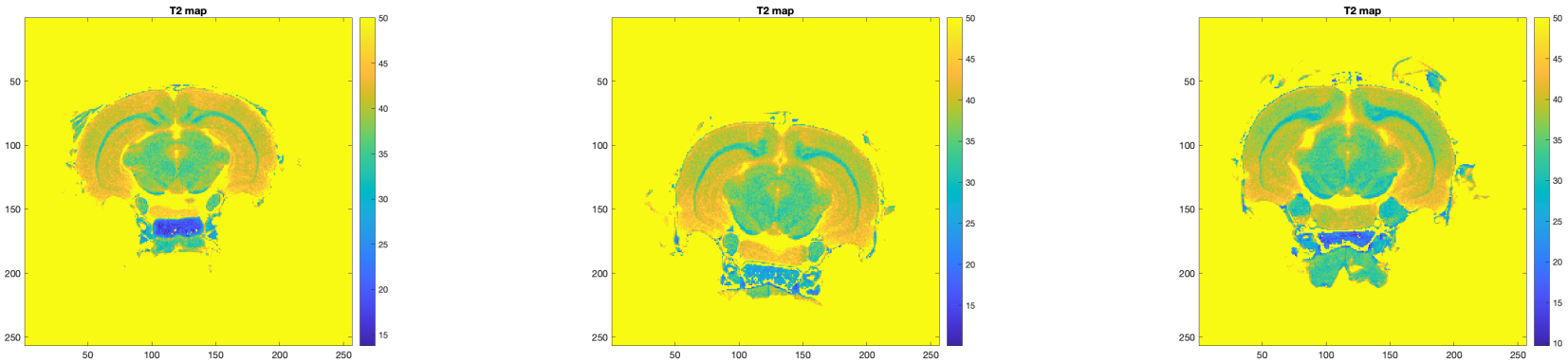


Figure: T_2 Mapping

T_2^* Mapping

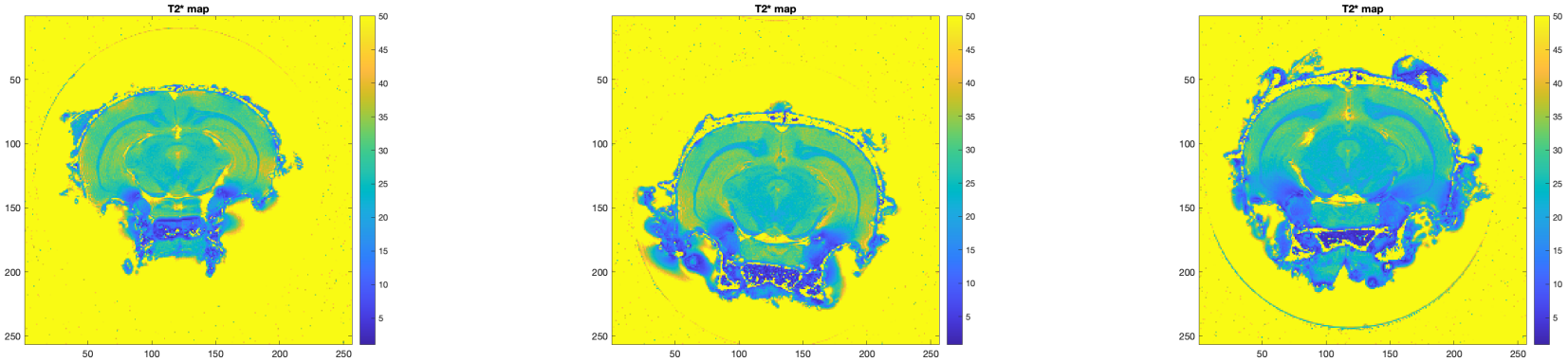
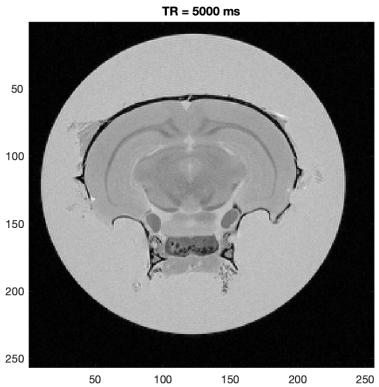
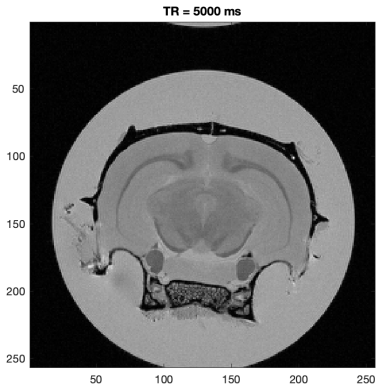


Figure: T_2^* Mapping

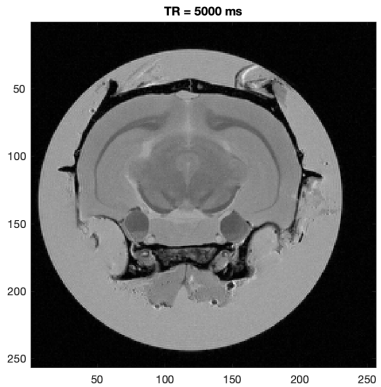
Analysis by Age I



(a) 6 Week



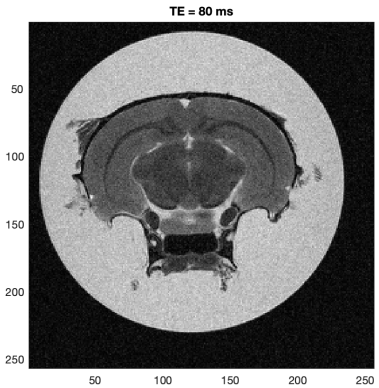
(b) 4 Month



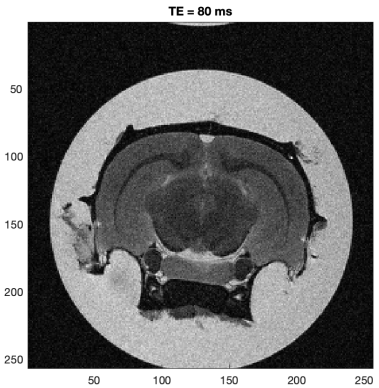
(c) 20 Month

Figure: RARE-VTR FID Images by Age

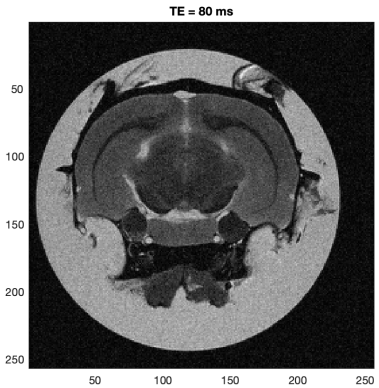
Analysis by Age II



(a) 6 Week



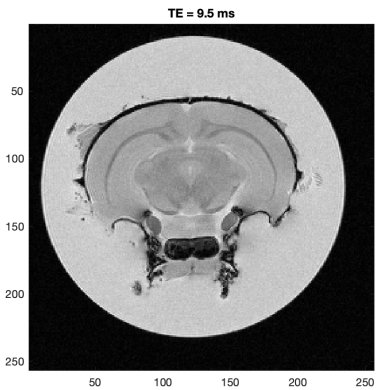
(b) 4 Month



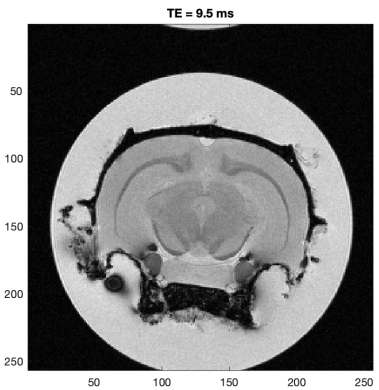
(c) 20 Month

Figure: MSME FID Images by Age

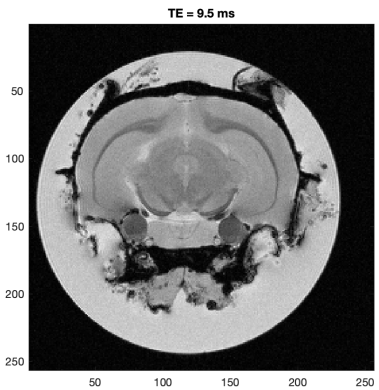
Analysis by Age III



(a) 6 Week



(b) 4 Month



(c) 20 Month

Figure: MGE FID Images by Age

SN

- There is dark area on 4 Month both in T_1 and T_2 weighted images.
- $\therefore$ The dark area in SN is not fat or CSF.
- 4 month in rats is equivalent to 12 years in human; the rat is on adolescence.
- It is believed that the dark area is empty area; is an intermediate part for pruning between neuron synapses on adolescence. (Blakemore, den Ouden, Choudhury, & Frith, 2007)
- SN plays a major role both in dopamine distribution and the development in adolescence.
  - The activity of dopamine system in adolescence. (Teicher, Andersen, & Hostetter Jr, 1995)
  - SN has a major role in dopamine distribution. (Cheramy, Leviel, & Glowinski, 1981)

CC

- CC has been darker along the aging both in T_1 and T_2 weighted images.
- Thus, CC is making more sophisticated neuron synapses.
- The size or shape of CC have been changed by many factors, such as aging. (Reuter-Lorenz & Stanczak, 2000)
- CC is exponentially grown in adolescence. (Giedd et al., 1996; Gbedd et al., 1999)

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