The early development as a predictor of the further health

E.I. Nikolaeva, professor

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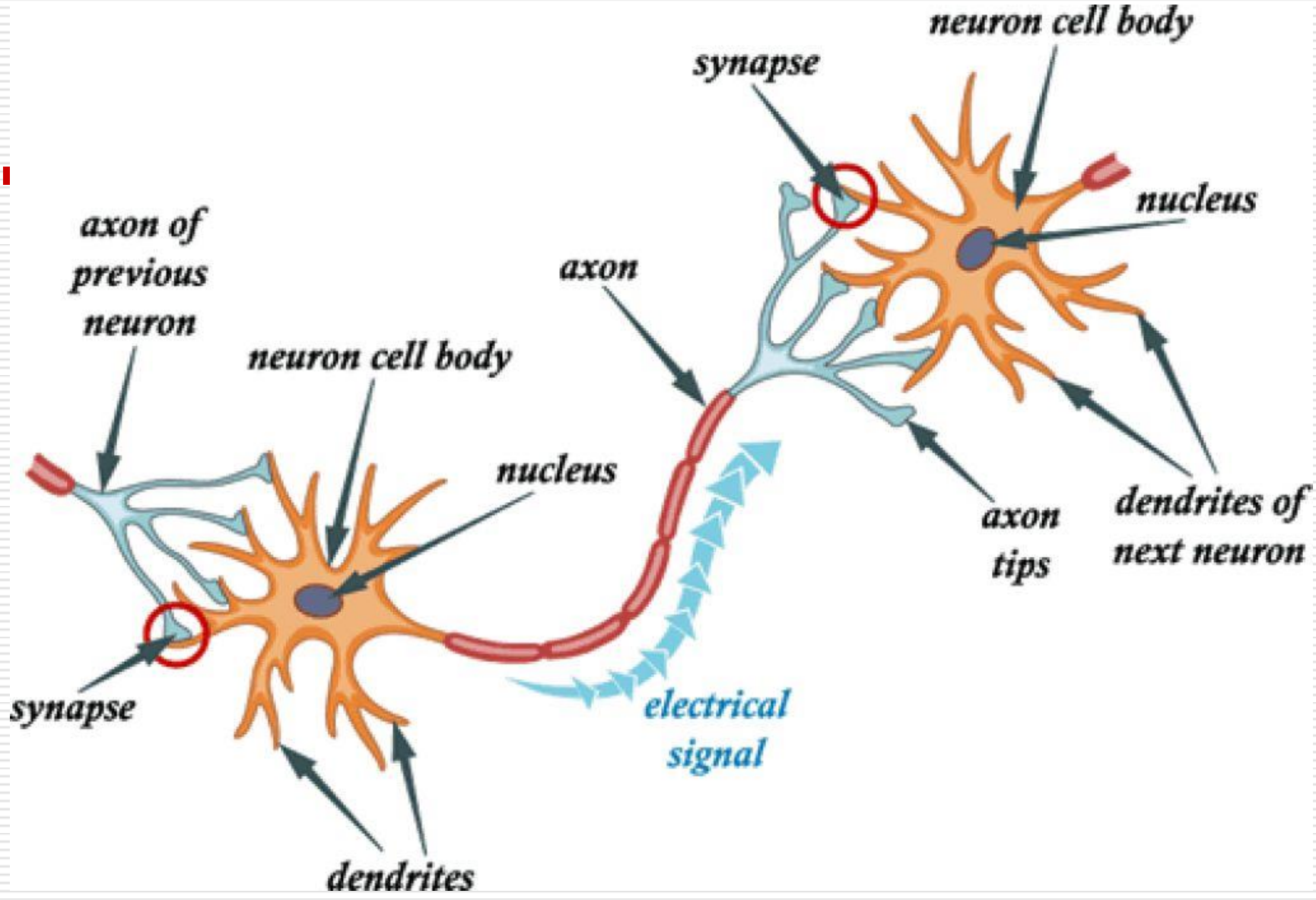
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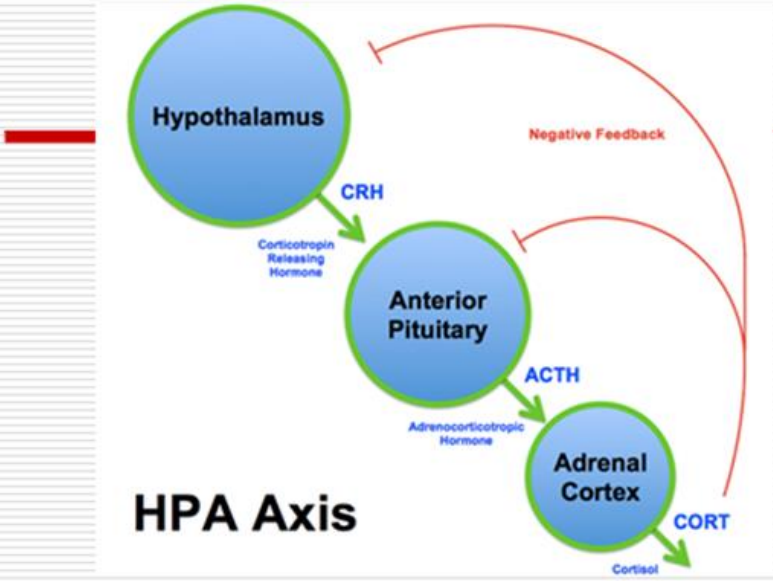
As the baby grows into the child, and the child eventually into the adult, exploring and explaining what transforms as the individual develops from infancy to maturity, and what remains stable and predicts the future person, have constituted challenging tasks to philosophy, biology, and psychology.

- Sensitive periods of development: periods during which an experience (or its absence) has a more marked impact on the neural organization underlying a particular skill or competence.
- The most well-known one is attachment: psychosocial process resulting in strong emotional bond with a particular person and deriving security from physical and psychological contact with that attachment figure chronic, rather than acute, stressors later in life is not yet known.

But today we will speak about new opened period- sensitive period for the stress reaction of adults. You remember that stress reaction is provided with HPA axis – that is hypothalamus, pituitary glands and adrenal cortex.



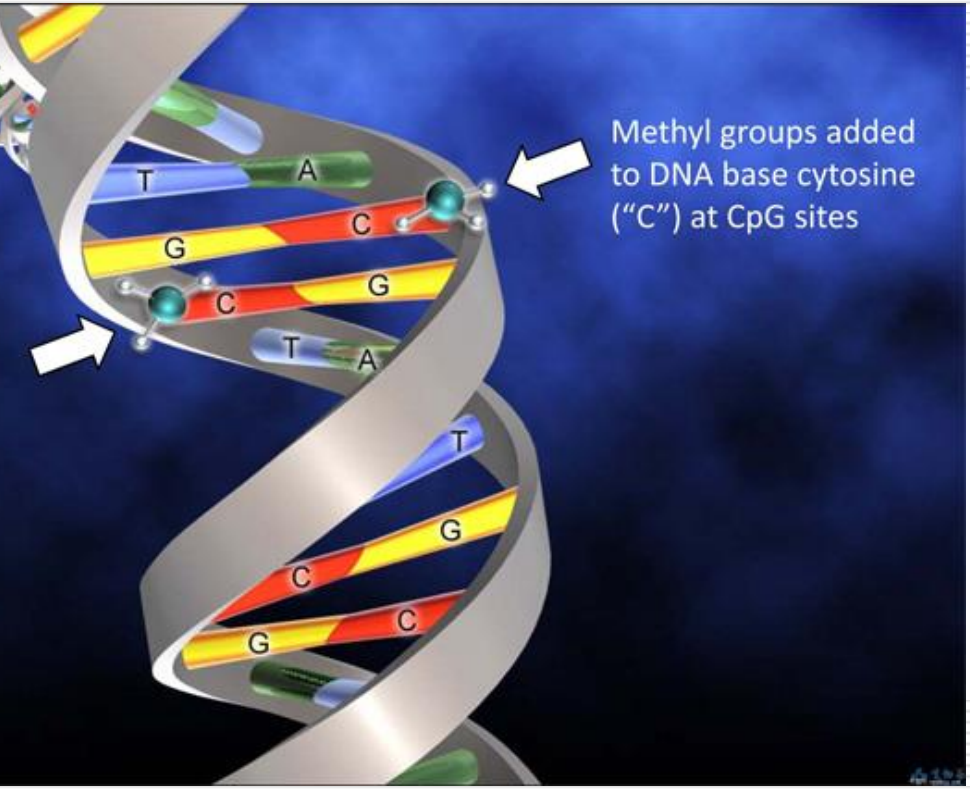
In the rat, the period between 4 and 14 days after birth is one during which it is difficult to produce elevations in ACTH and cortisol to stressors that provoke responses in older animals.

- This period is termed as a stress hyporesponsive period (SHRP). It has been assumed that this period evolved to protect the developing brain from potentially deleterious effects of elevated cortisol and the other neurochemicals associated with the mammalian stress response. The SHRP appears to be maintained by very specific stimuli that pups receive from the mother.

If the mother is removed for 12 to 24 hours, marked activation of the HPA system and elevated brain levels of cortisol are noted. However, if during this time maternal stimulation is mimicked by stroking the pup with a wet paintbrush and infusing milk into its stomach via a cannula, HPA activation and cortisol responses do not find out

We now know that not only deprivation of maternal care but also normal variations in rat mothering impact the developing neurobiology of stress. Mothers vary in how much they lick and groom their pups.

- In comparison with low-licking and -grooming mothers, highlicking and -grooming mothers have pups that, in adult period, are less fearful and better able to contain and terminate stress reactions. The molecular events set into motion by maternal care are increasingly understood. Particularly during the first week of the life in the rat, maternal licking and grooming regulate the extent to which cortisol genes in the hippocampus become methylated.


Methyl groups added to DNA base cytosine ("C") at CpG sites
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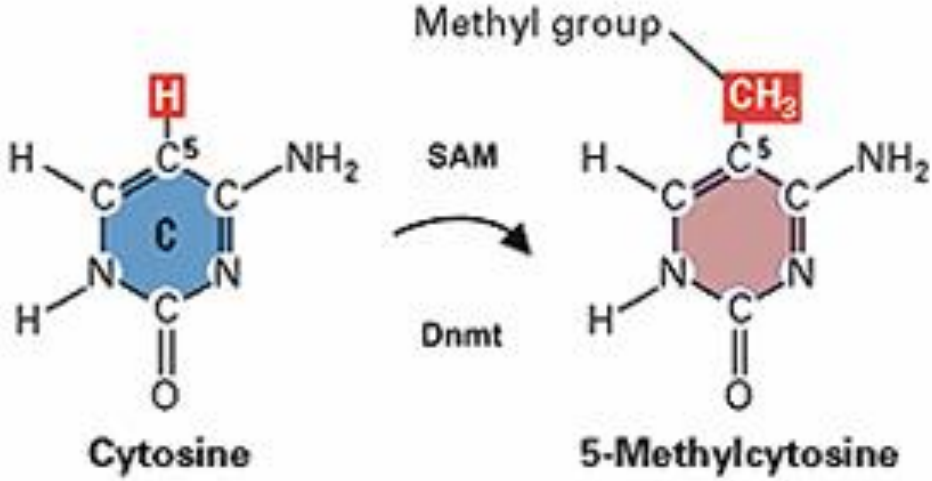
Methyl group
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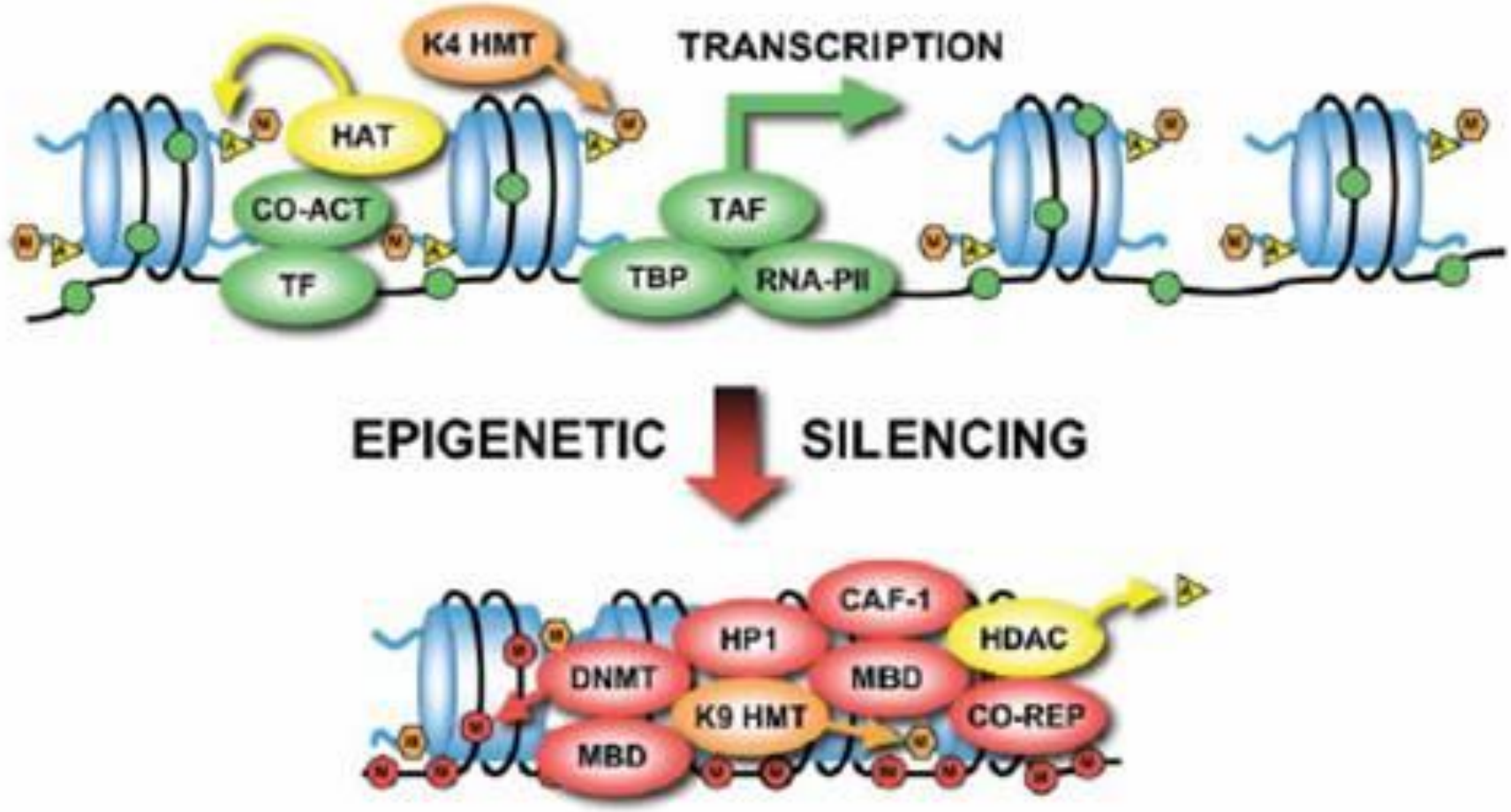
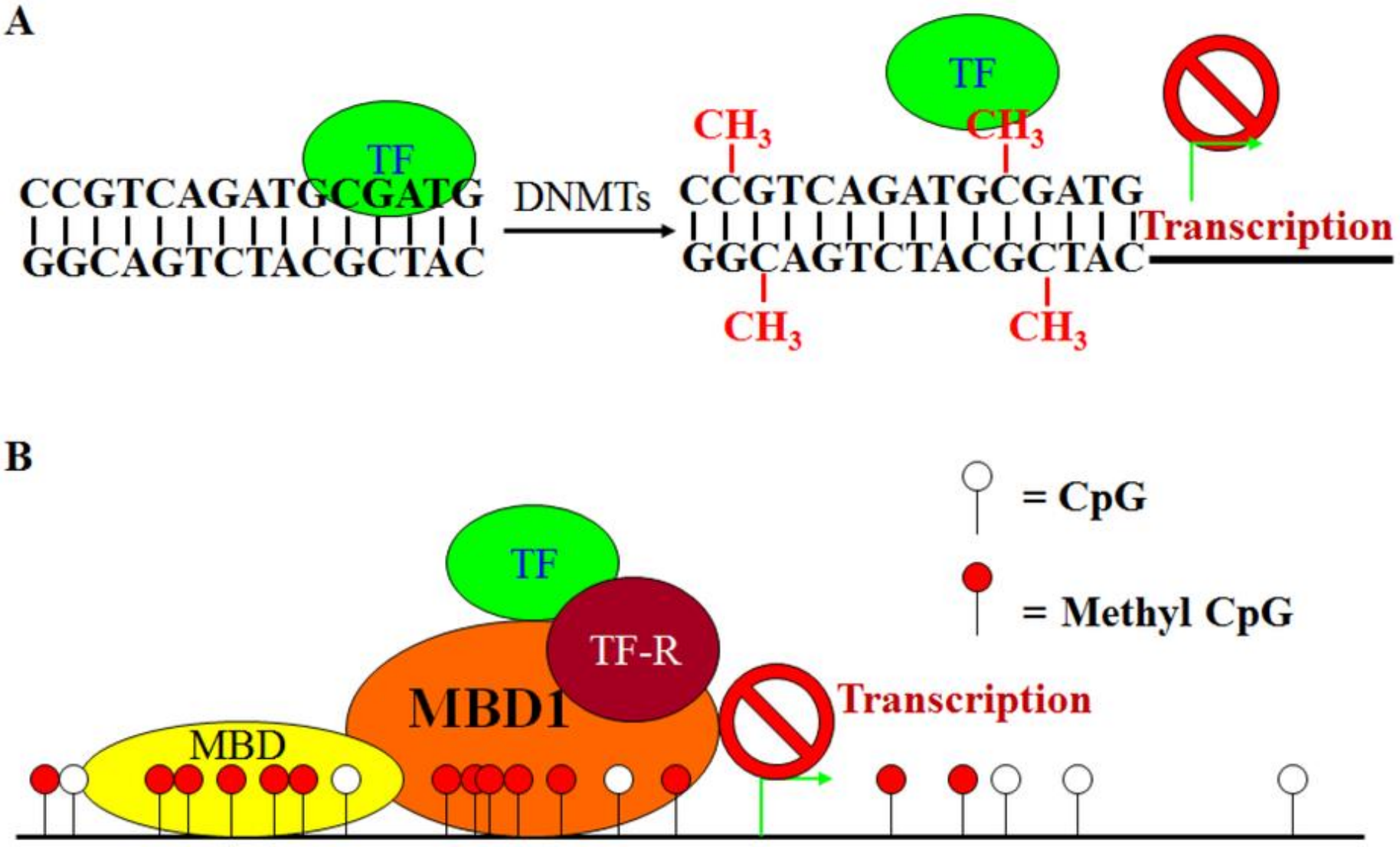
Human Molecular Genetics, 2005, Vol. 14, Review Issue 1

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= CpG
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MBD
Transcription

- Methylation effectively silences genes. Licking and grooming reduce methylation of hippocampal cortisol genes. Cortisol genes determine how many hippocampal glucocorticoid receptors an animal will have. Because hippocampal cortisol are involved in terminating stress responses of the HPA system, high levels of hippocampal cortisols mean efficient control of HPA stress response, whereas low levels mean poor or sluggish regulation, more prolonged stress reactions, and vulnerability to stress load over the animal's lifetime.

- These epigenetic effects of maternal care are potentially irreversible, except through pharmacological manipulations that induce widespread demethylation. This is a powerful example of how stress neurobiology can be programmed by social experiences during sensitive periods of development.

Early Adverse Experience in Nonhuman Primates

It is generally assumed that events, whether they are positive or negative, have less of an effect on structures and circuits that are already well developed than on those that are rapidly developing. Nonhuman primates are born more mature than are rats; thus, we would expect that postnatal experiences would have somewhat different effects in the primate. This appears to be true, despite the fact that, as in rats, disruptions of parental care in nonhuman primates also affect the neural substrates of stress vulnerability and resilience.

- Nonhuman primates form specific attachments to caregivers. Separation from the attachment figure provokes acute behavioral distress and increases activity of the HPA and cortisol systems. Behavioral distress, however, does not necessarily mirror physiological stress reactions.

For example, if the infant monkey can see and call to its mother, vocal distress and behavioral agitation are much greater than if it is isolated from any contact. Nonetheless, physiological stress responses, particularly of the HPA system, are much greater under conditions of isolation.

- Studies of nonhuman primates also demonstrate that poor rearing conditions, including peer-only rearing, isolation rearing, repeated separations, and conditions that disrupt responsive maternal care can have long-term impacts on the neurobiology of stress and negative emotionality.

For example, variable foraging paradigms that result in neglectful maternal care also produce offspring who as adults are more fearful, low in dominance, high in brain levels of ACTG, and who exhibit persistent alterations in somatostatin and metabolites of serotonin, dopamine, and NE.

POSTNATAL HUMAN DEVELOPMENT AND STRESS

- Neurobiological systems involved in stress include genetic, organ, behavioral, and emotional components that mature and become more organized as children develop.

Infancy and Early Childhood

In adults, cortisol is usually bound to proteins (e.g., corticosteroid-binding globulin; CBG). However, CBGs in newborns are initially low, although they increase over the first six months after birth. As a result, unbound levels of cortisol decrease slightly over the initial months after birth, while plasma or total cortisol increases.

- Newborns, however, do not show the typical adult rhythm in cortisol production, characterized by higher levels in the morning at wake-up that decrease toward the afternoon and evening.
- They show two peaks, 12 hours apart, that do not depend upon the time of day. But by three months, a qualitative shift in physiological development takes place, and the single early morning cortisol peak and evening nadir (lowest level) are generally established.

- The diurnal rhythm also continues to develop over infancy and early childhood, reflecting changes in daytime sleep patterns.
- Specifically, until children give up their daytime naps, decreases in cortisol from mid-morning to mid-afternoon are not observed; after this, the diurnal rhythm of children is consistent with that of adults.

Indeed, by the end of the first year of life, infants in supportive caregiving relationships appear to have entered the human functional equivalent of the rodent stress-hyporesponsive period.

Later Childhood and Adolescence

- There is increasing evidence that the period of relative stress hyporesponsivity or buffering does not end with infancy but extends over most of the childhood years. As is the case with toddlers, it is difficult to find laboratory situations that provoke large increases in cortisol throughout childhood

- Among the oldest active longitudinal studies, with birth years extending from 1903 to the 1920s, was Terman's on a sample of talented children: By the 1990s, investigators who continued this project had completed 13 waves of data spanning 70 years (Crosnoe & Elder 2004, Holahan et al. 1995, Shanahan & Elder 2002). Notably, however, previous long-term longitudinal studies typically began in adolescence and often assumed that what had transpired before—in the first years of life—was of little consequence.

- Heart rate (HR), heart rate variability (HRV), and parasympathetic control measured in the first year of life are stable up to 5 years (Bar-Haim et al. 2000, Bornstein & Suess 2000, Calkins & Keane 2004). Skin conductance activity in typically developing 1-year-olds predicts mother-rated aggressive behavior problems at age 3 years (Baker et al. 2013)..

- Thus, hormones and measures of autonomic function during infancy carry through to multiple measures of physical, autonomic, and behavior characteristics in childhood and later. Together, these results provide evidence of early postnatal origins of more mature development

- Low birth weight (<2 kg) is predictive of motor problems at age 16 years (Whitaker et al. 2006); height and head circumference at 1 year predict IQ and neurodevelopmental outcomes at 9 and 10 years (Fattal-Valevski et al. 2009); and being small for gestational age has an independent effect on 16-year full-scale IQ, controlling for other pre- and postnatal risk factors (Lorenz et al. 2009).

- Even infantile colic (excessive crying in an otherwise healthy baby classically defined by Wessel criteria as at least three hours of crying at least three days a week for three weeks; Wessel et al.1954) appears to be associated with migraines in children ages 6 to 18 years (Gelfand et al. 2012, Guidetti et al. 1984). Other early childhood periodic syndromes (benign paroxysmal vertigo or benign paroxysmal torticollis) are thought to be expressions of genes that later in life also manifest as migraine (Giffin et al. 2002).

- Studies of stability in cognition have demonstrated consistencies as well. Six-month-olds' performance in an action interpretation task predicts their performance on theory of mind tasks at 4 years (Aschersleben et al. 2008).

- Infant information-processing abilities in the first six months of life in three domains (attention, speed, and memory) relate to language and executive functions (working memory, inhibition, and shifting) at age 1.8, age 4, and age 11 years; academic achievement at age 14 years; span of apprehension and intelligence at age 18 years; and IQ and academic achievement at age 21 years; even after contributions of biological and psychological third variables have been partialed.

- Infants in the first year of life do not command much in the way of verbal abilities per se; however, some speaking patterns we acquire early appear to last a lifetime (Flege 1991). Longitudinal studies demonstrate stability and prediction from a variety of early preverbal skills to measures of later language. Indian infants adopted by American families and only exposed to English relearn Indian-dialect phonemes more quickly than do American children who had never heard the Indian
- phonemes (Singh et al. 2011).

- The trajectory of learning to discriminate vowels between 7 and 11 months predicts children's language abilities and preliteracy skills at age 5 years, an association that holds regardless of socioeconomic status as well as the level of children's language skills at 18 and 24 months of age.

- Infants' early phonetic perception, their pattern-detection skills for speech, mismatch responses to native-language sounds (Kuhl et al. 2008), and processing efficiency for words (Fernald et al. 2006) have all been linked to advanced later language abilities.

- Studies of communication skills and expressive vocabulary at 8 and 12 months also show predictive relations to mother-reported child symbolic use of objects at 2 years, and 12-month-olds' vocabulary as measured by the CDI predicts their verbal IQ at age 4. Finally, 3-month-old boys' differential vocalizations to their mothers versus a stranger predicts cognitive and academic functioning at 12 years, high school grade-point average and SAT scores,and education completed by age 28 (Roe 2001)

- Thanks for the attention