

# 脳と音楽

音楽療法セミナー

2012年8月4日

富士吉田市

川村 光毅

HP : <http://www.actioforma.net/kokikawa/>

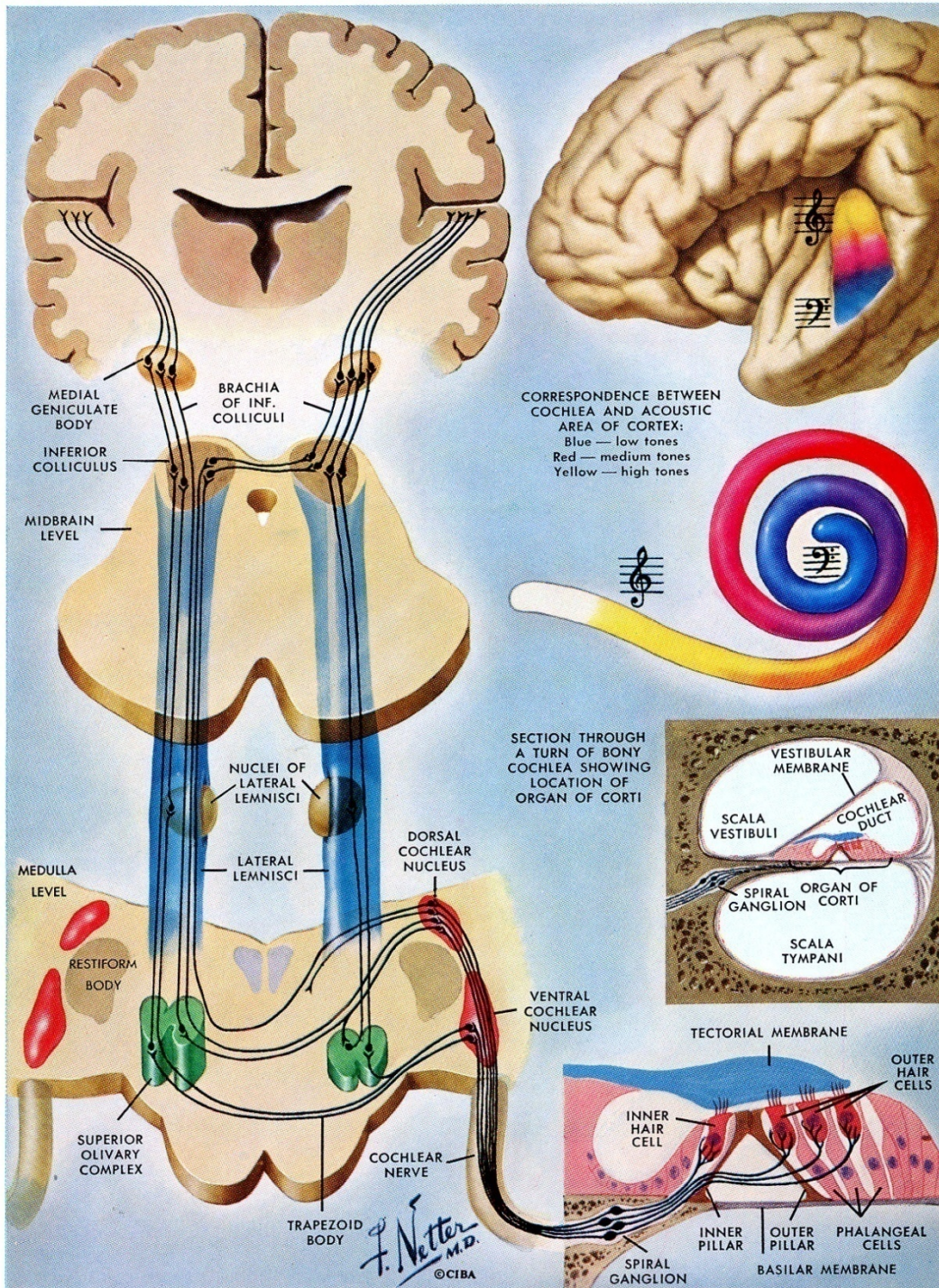








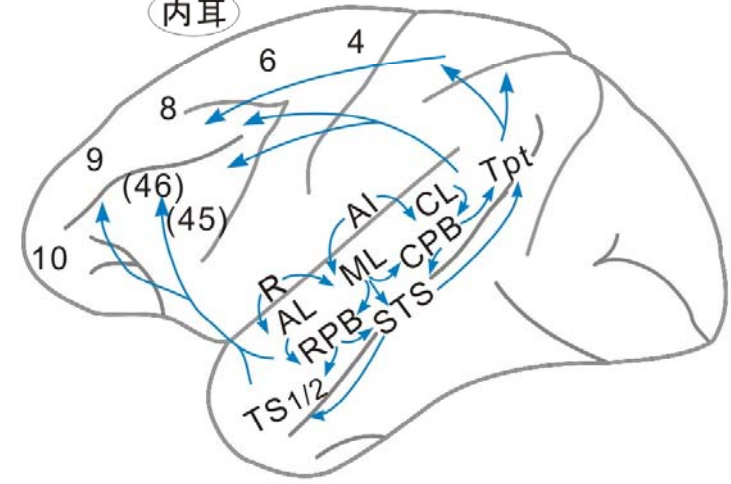
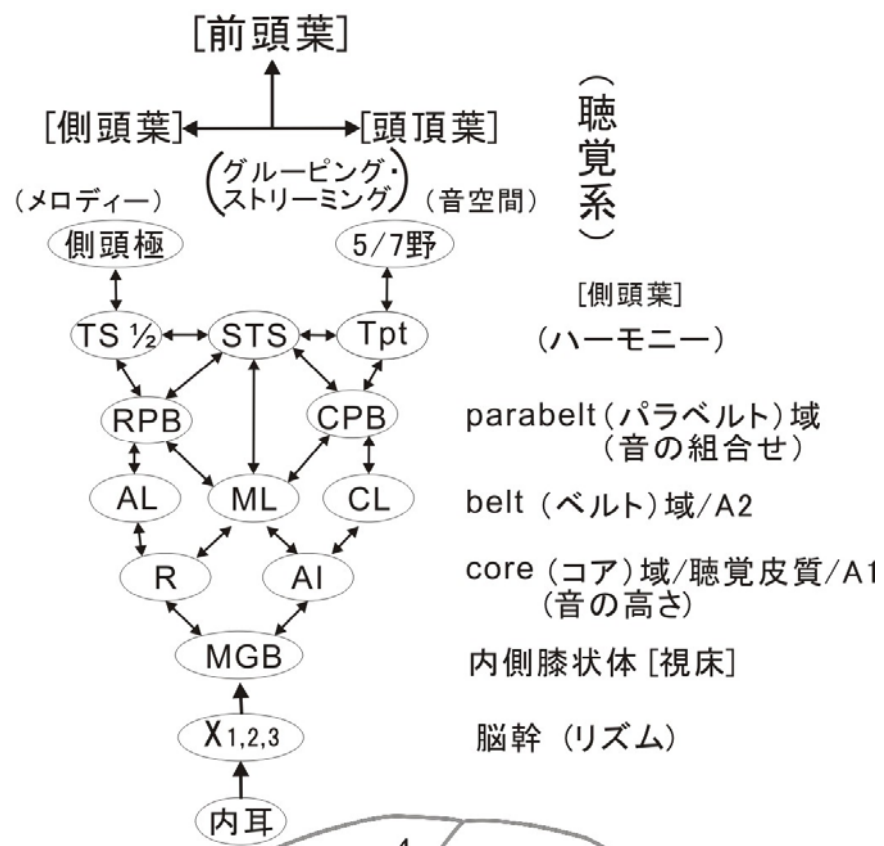
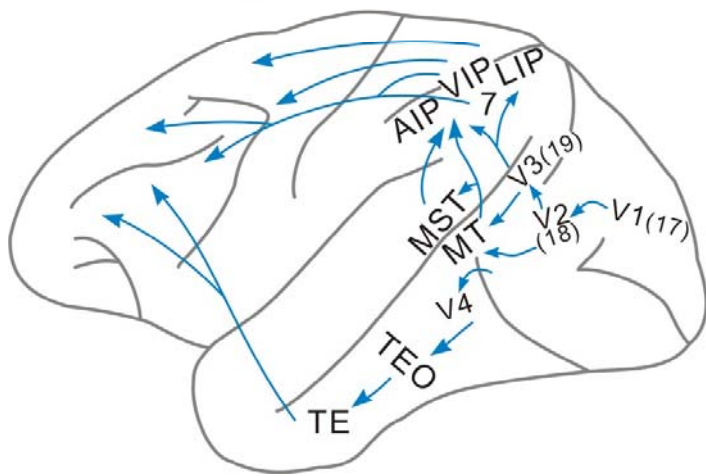
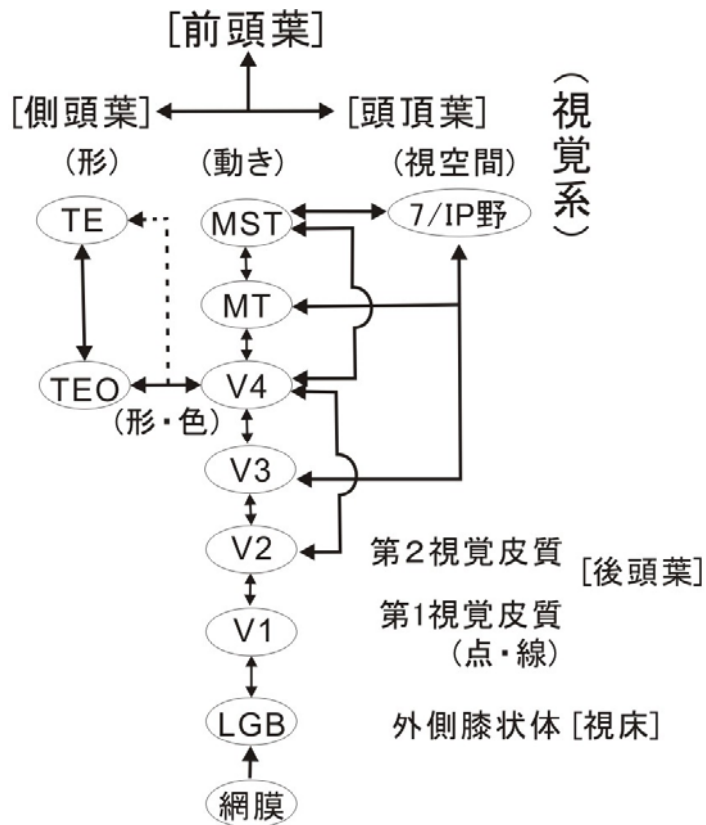






- 視聽覺

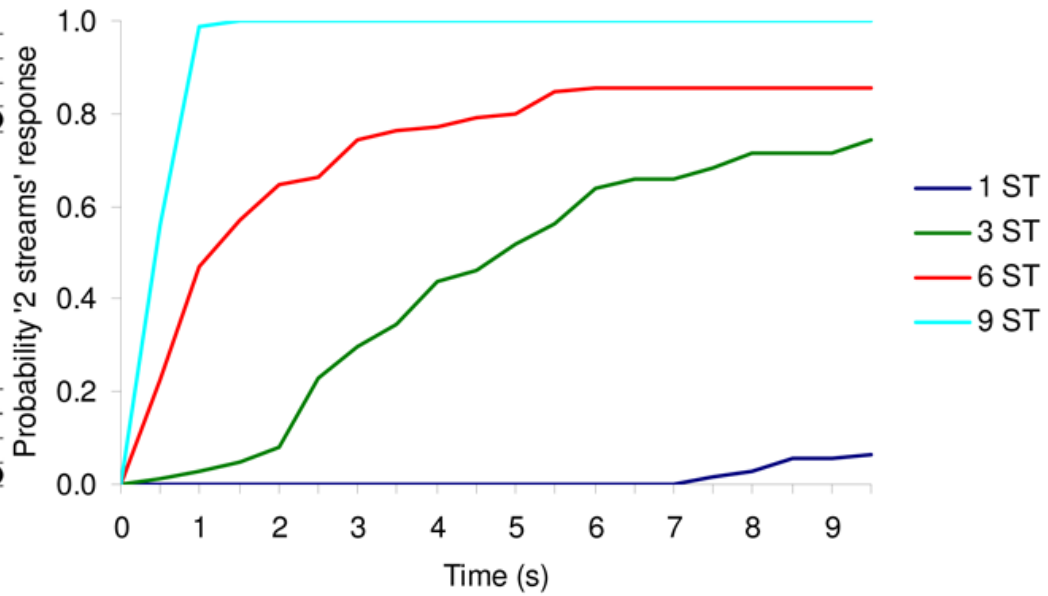
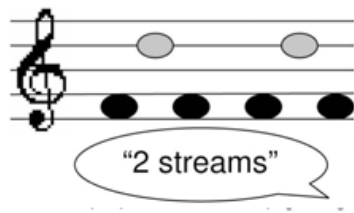
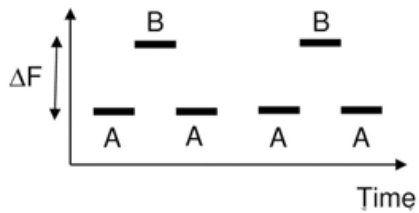
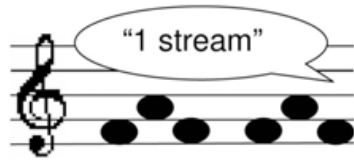
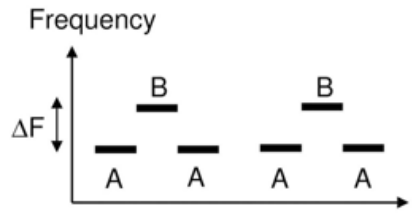
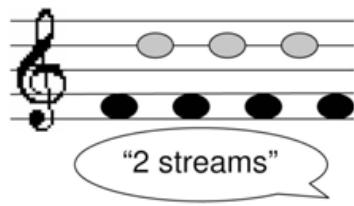
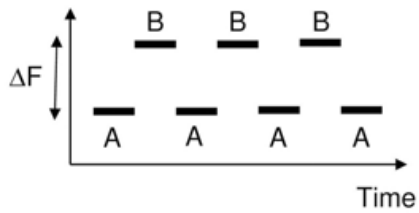
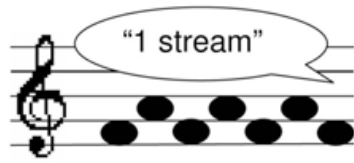
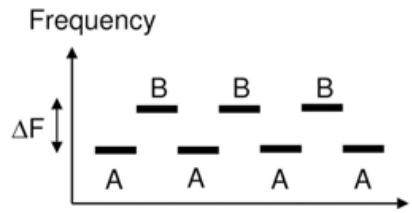






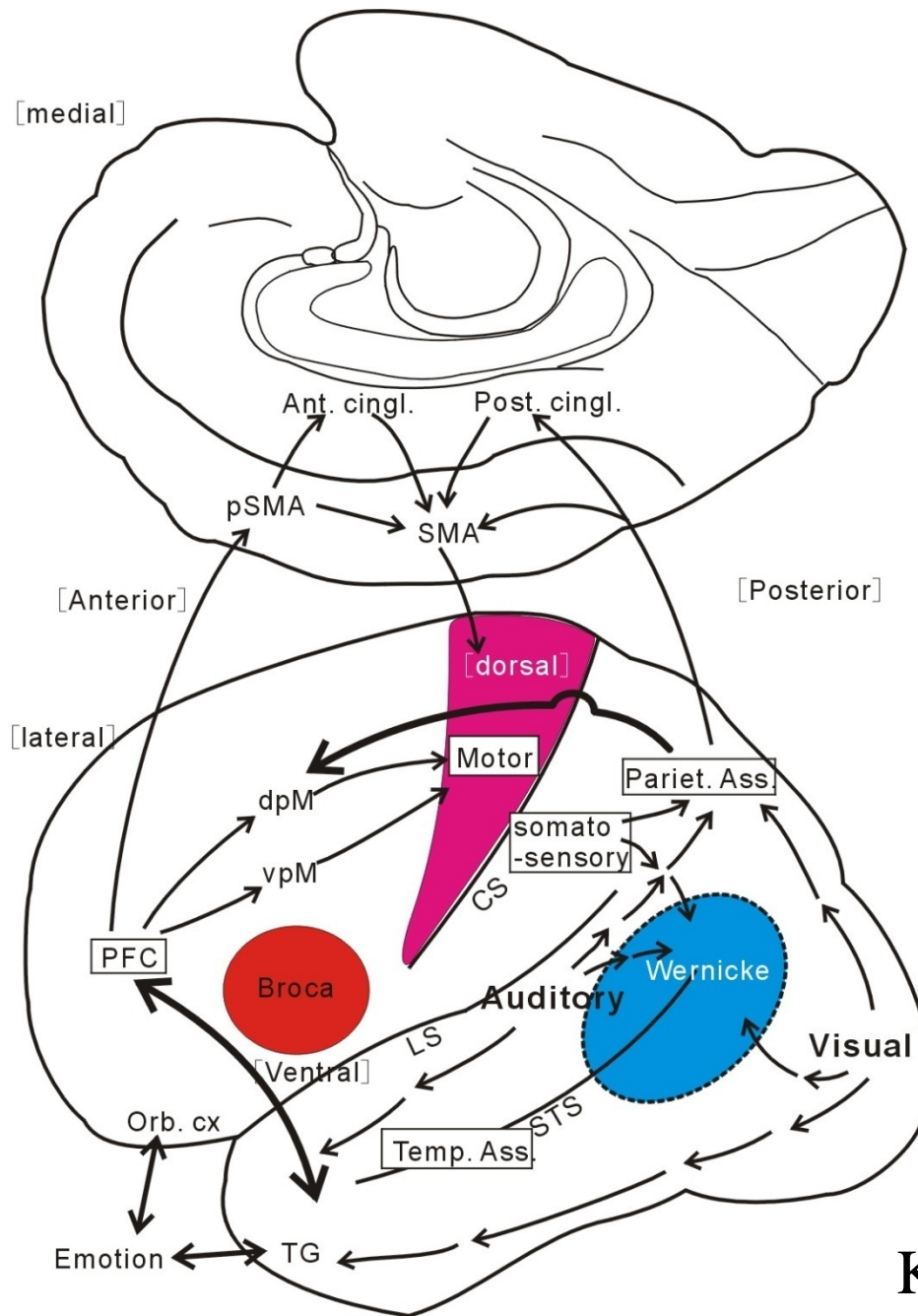
**STIMULUS**

**PERCEPT**

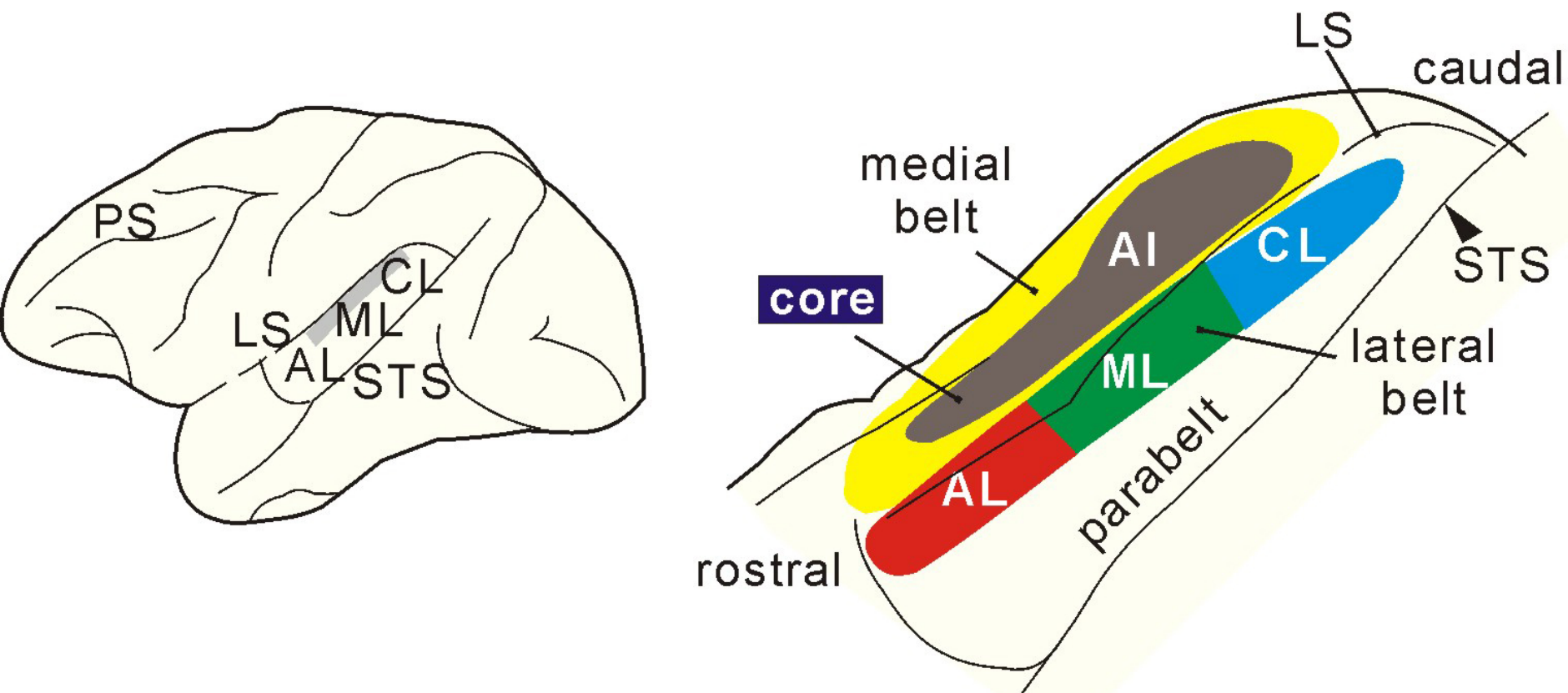


Micheyl et al., 2007





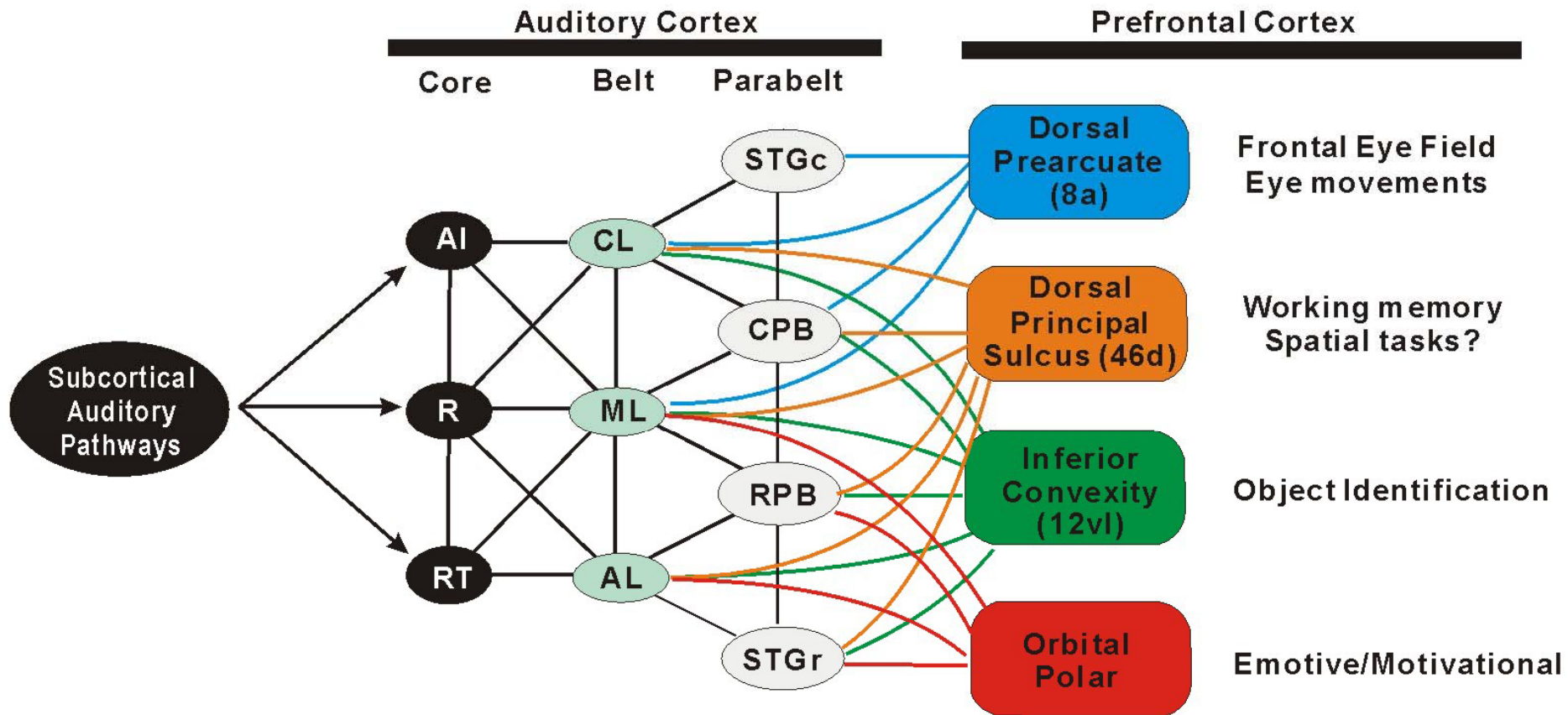
Kawamura, 2002



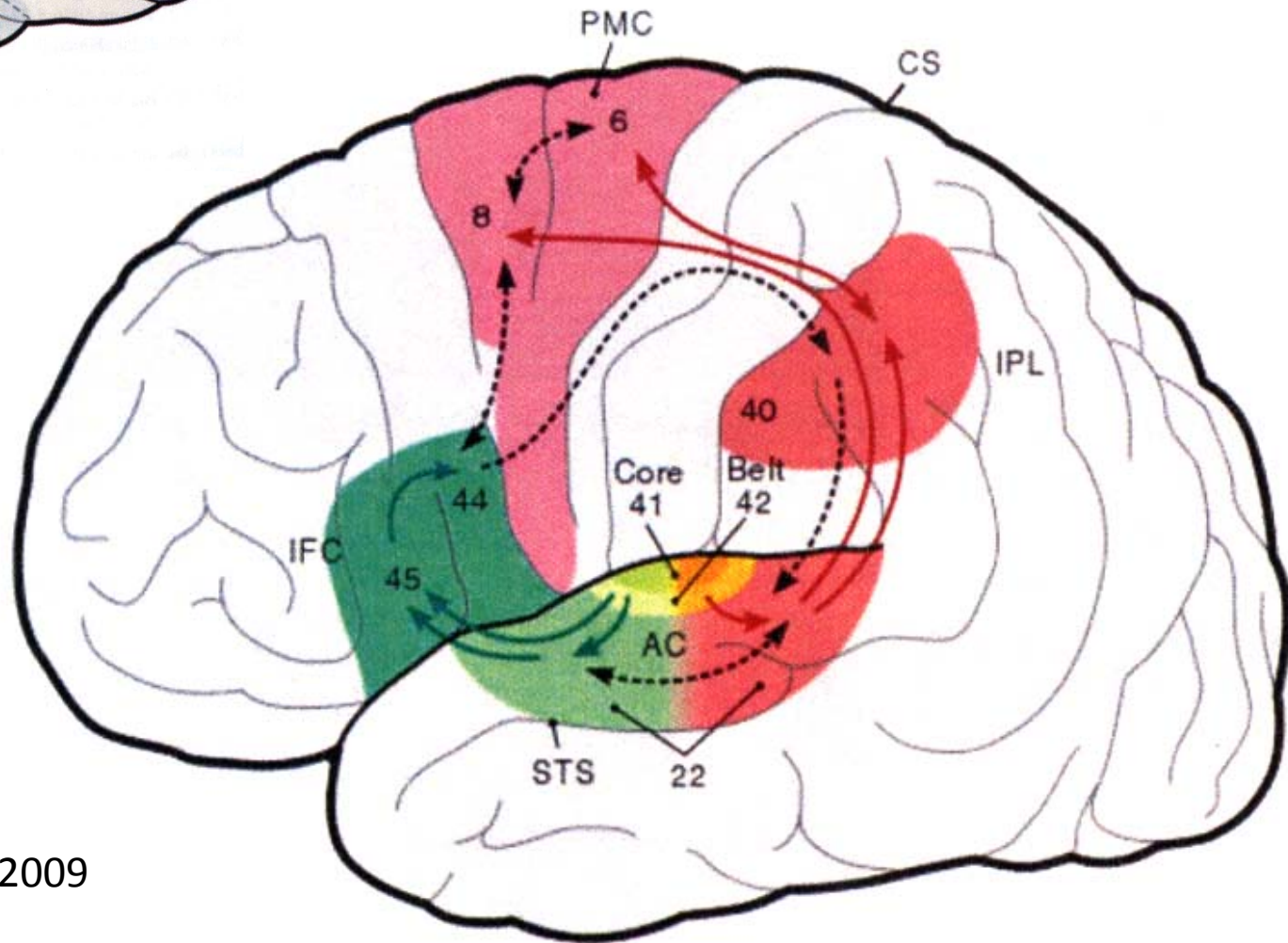
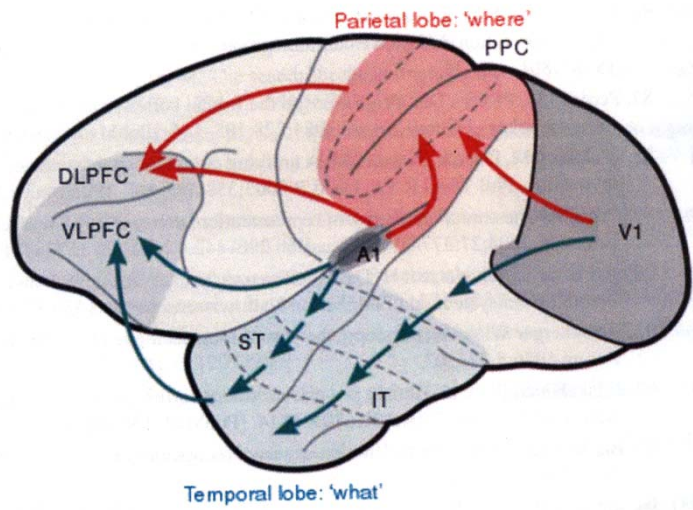
Monkey auditory cortex where tonotopic maps are recorded

(Romanski et al., 1999)



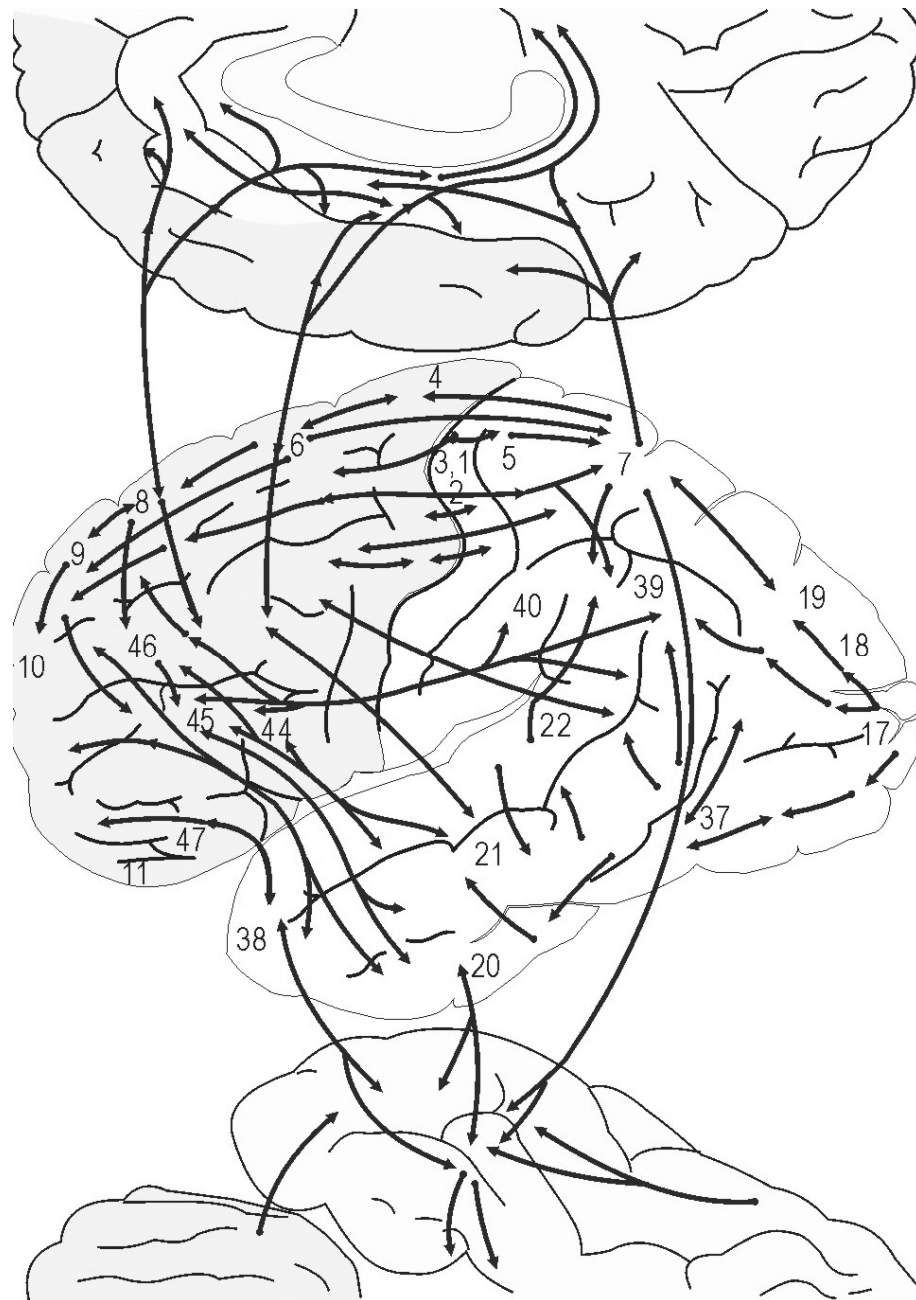


Auditory pathways to the prefrontal cortex  
(Kaas and Hackett, 1999)



Rauschecker & Scott, 2009





- サカナ と トリ



# 濠上問答

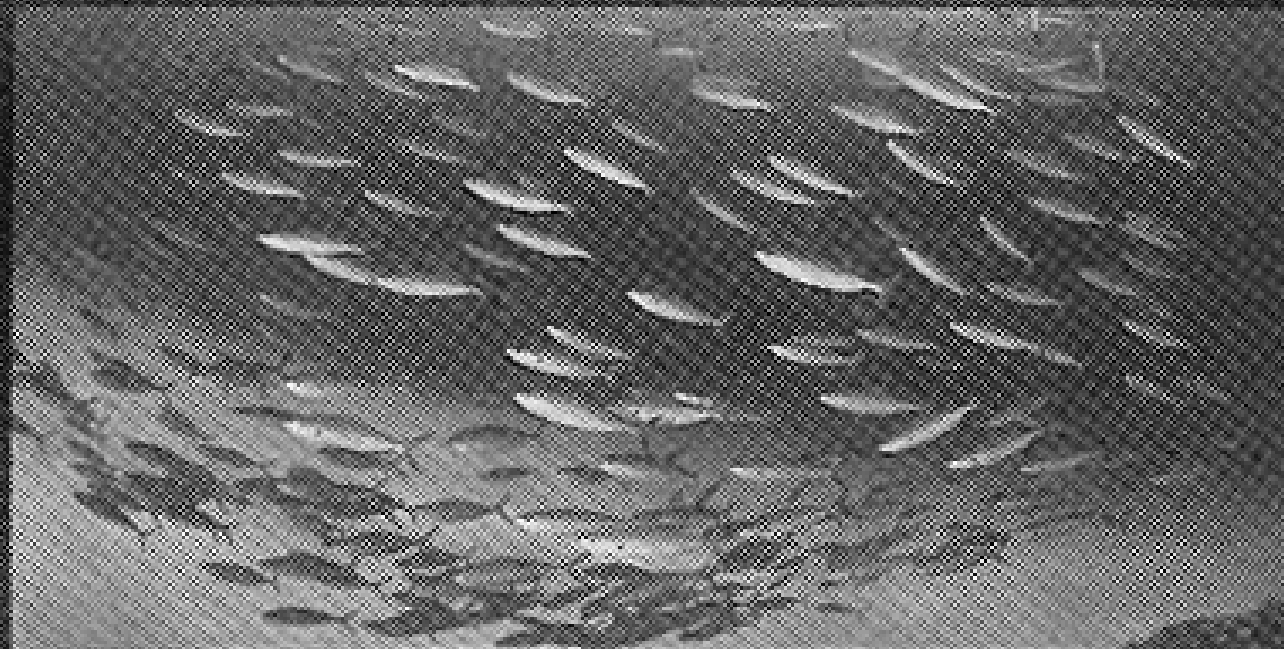
莊子與惠子遊於濠梁之上，莊子曰、鯉魚出游從容、是魚樂也。

惠子曰、子非魚、安知魚之樂、

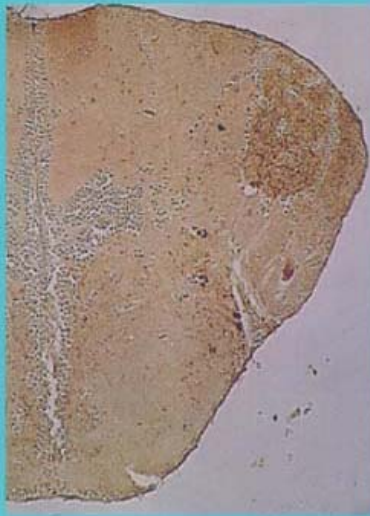
莊子曰、子非我、安知我不知魚之樂、

惠子曰、我非子、固不知子矣、子固非魚也、子之不知魚之樂、全矣、

莊子曰、請循其本、子曰、安知魚樂云者、既已知吾知之而問我、我知之濠上也、



# CGRP fibers in extended amygdala



medaka



mouse



medaka

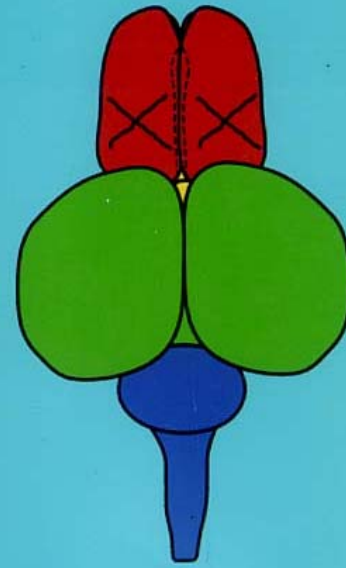
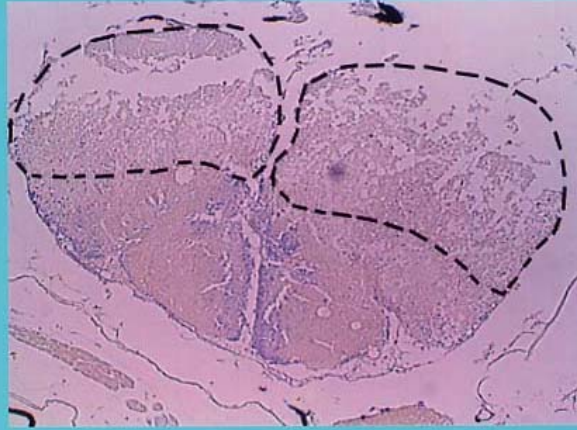


frog



mouse

# 手術個体(両側)



## 集合行動解析



~ 1:00



~ 2:00



~ 3:00

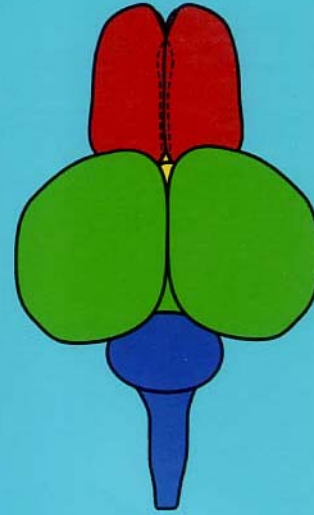
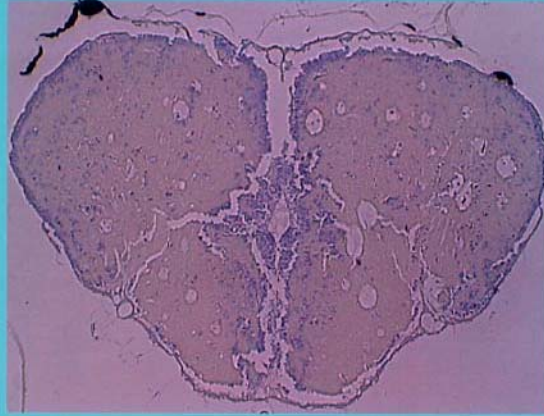


~ 4:00



# メダカの行動解析実験

## 偽手術個体



## 集合行動解析



~ 1:00



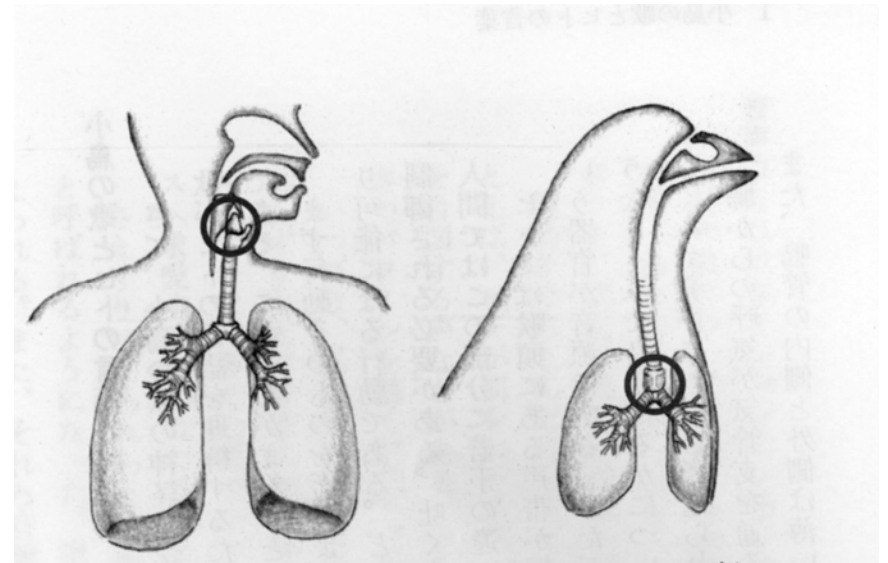
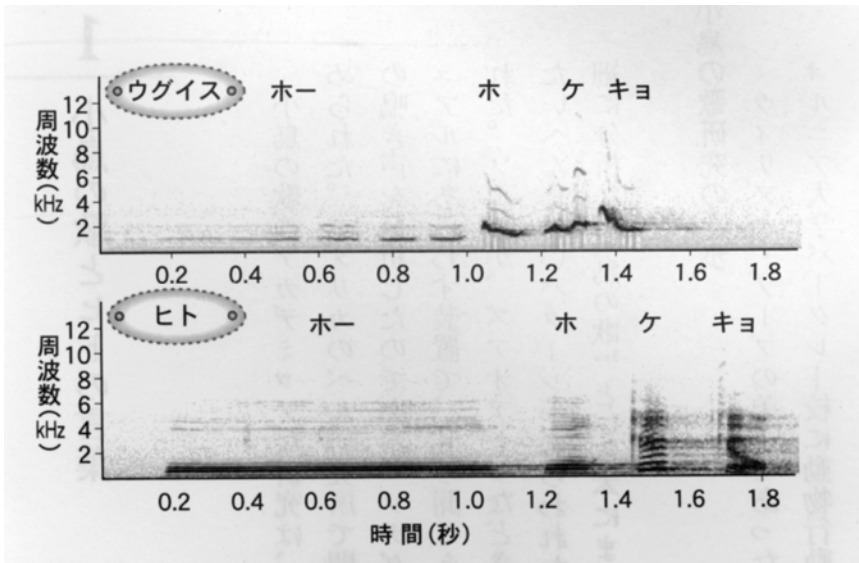
~ 2:00



~ 3:00

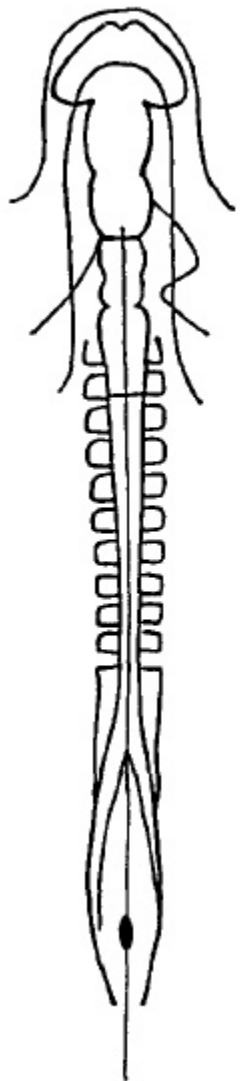


~ 4:00

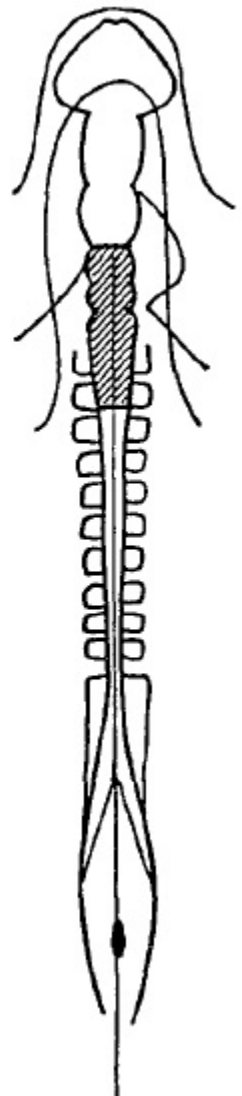
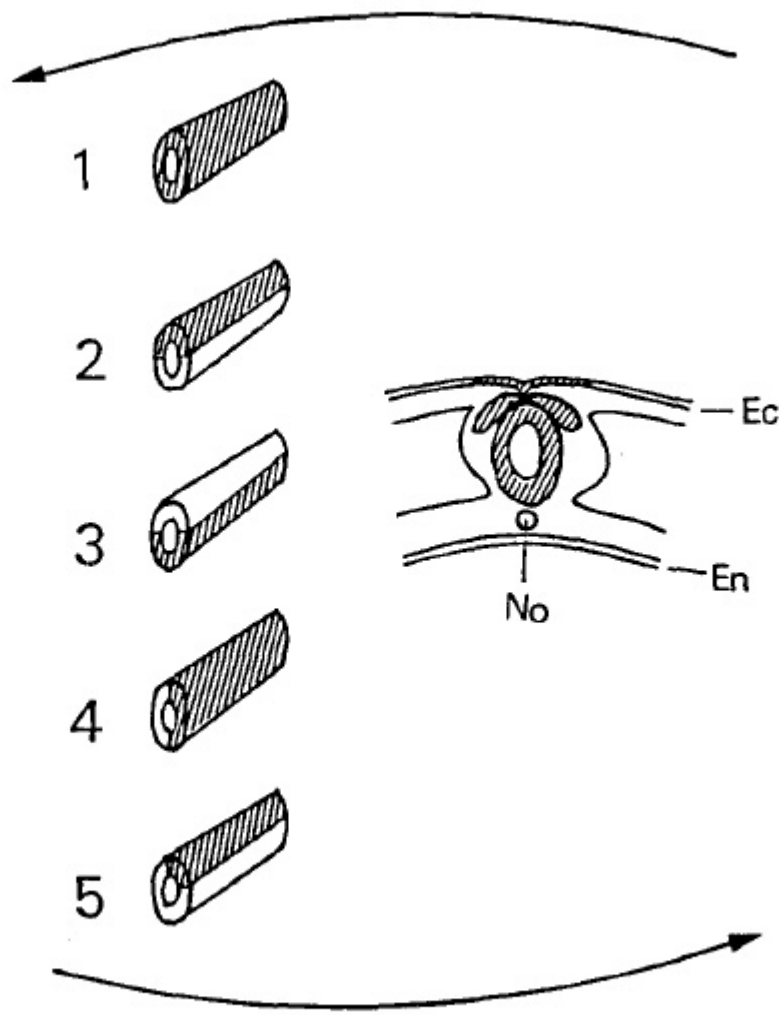


## 岡ノ谷 (小鳥の歌からヒトの言葉へ 2003)

ヒトの声帯(咽頭にある)とトリの鳴管(気管支にある)



Chick

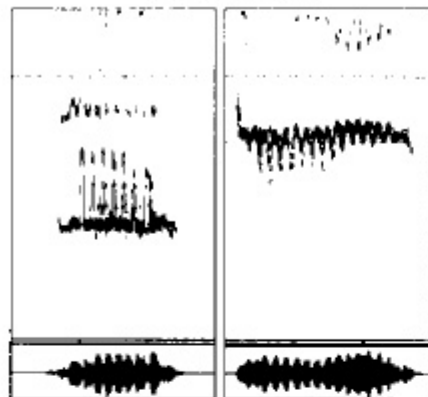


Quail

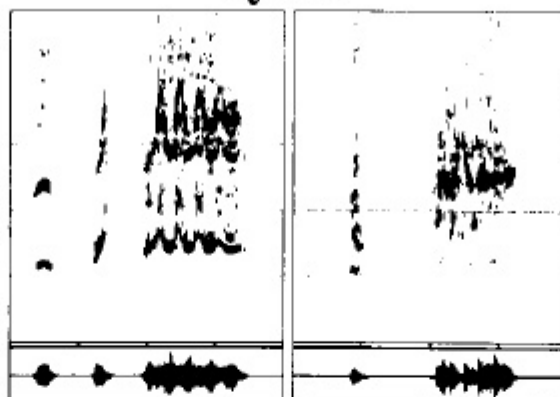




### Chicken

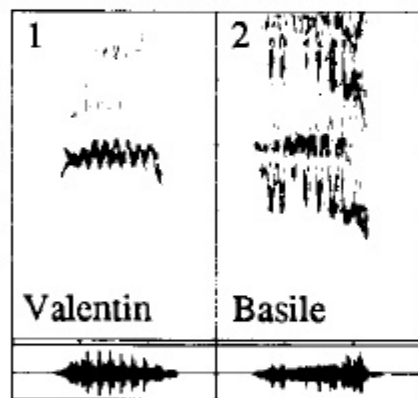


### Quail



2 kHz |  
0.2 s

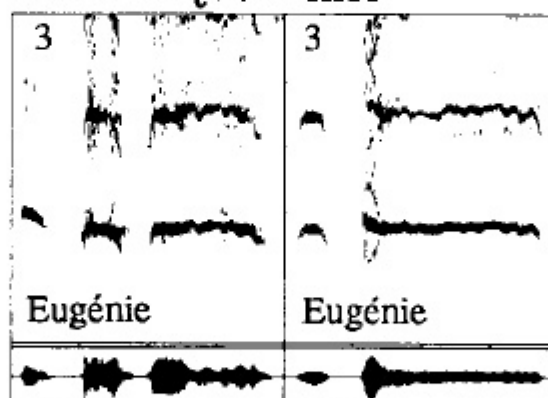
### Chicken-like



Valentin

Basile

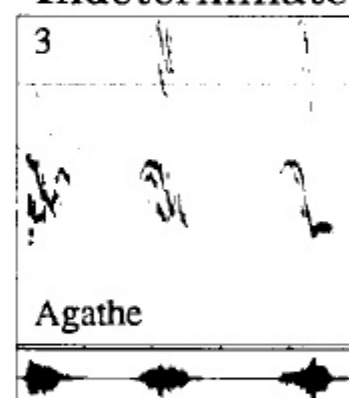
### Quail-like



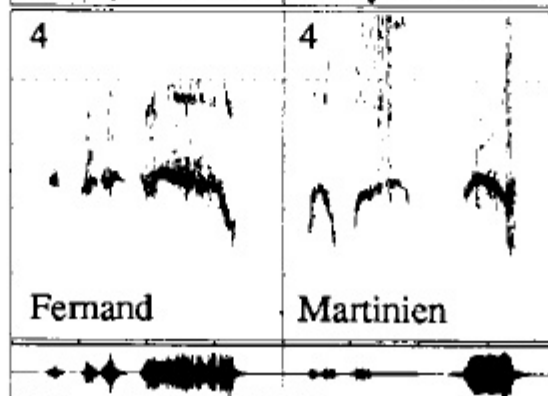
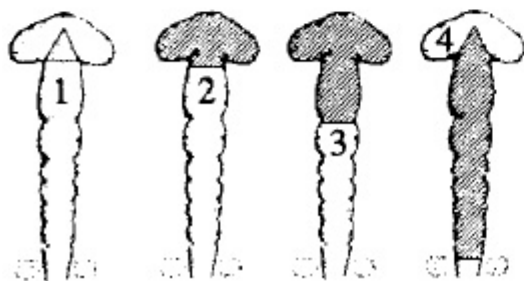
Eugénie

Eugénie

### Indeterminate

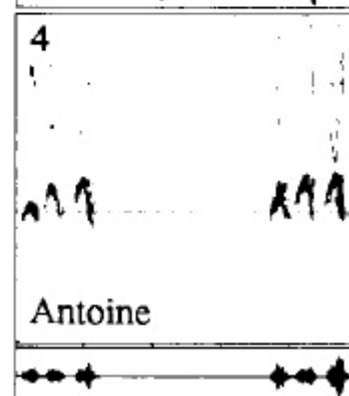


Agathe



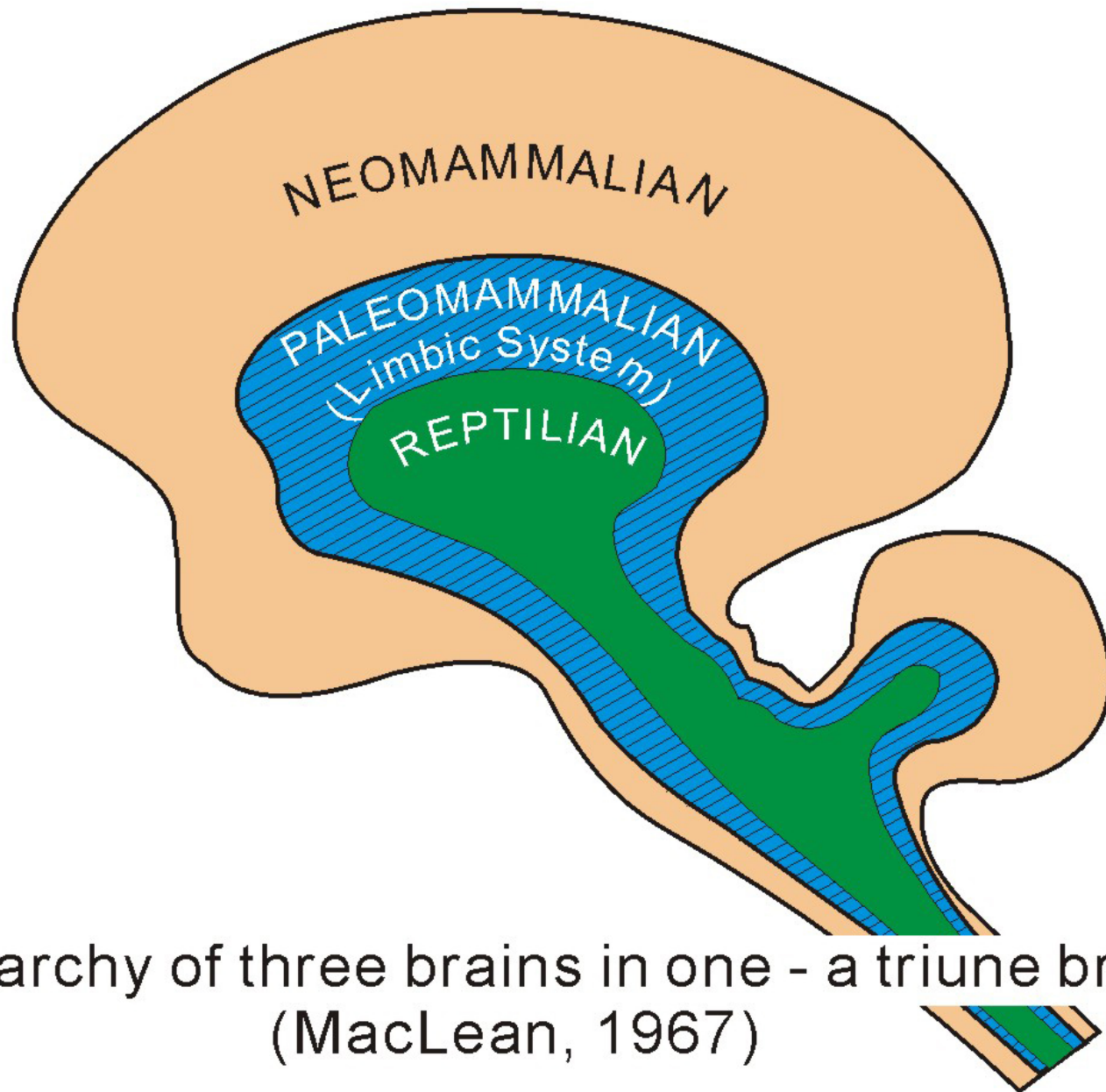
Fernand

Martinien



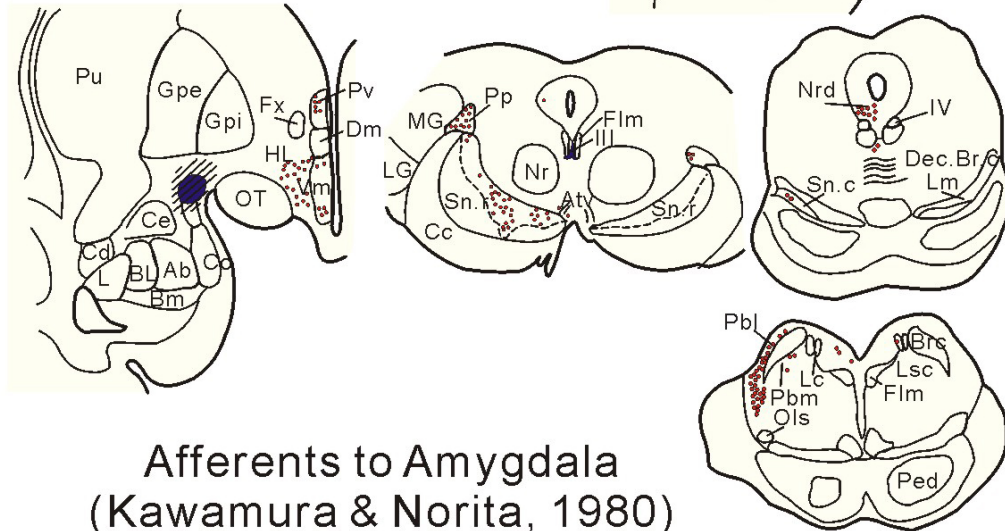
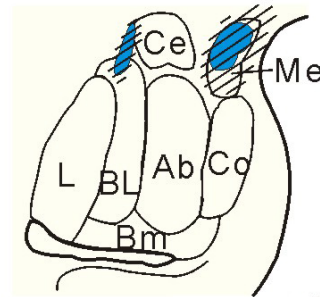
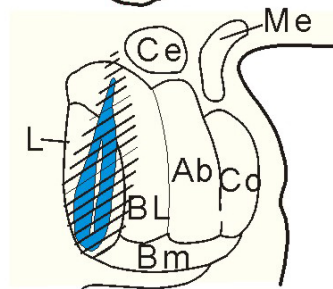
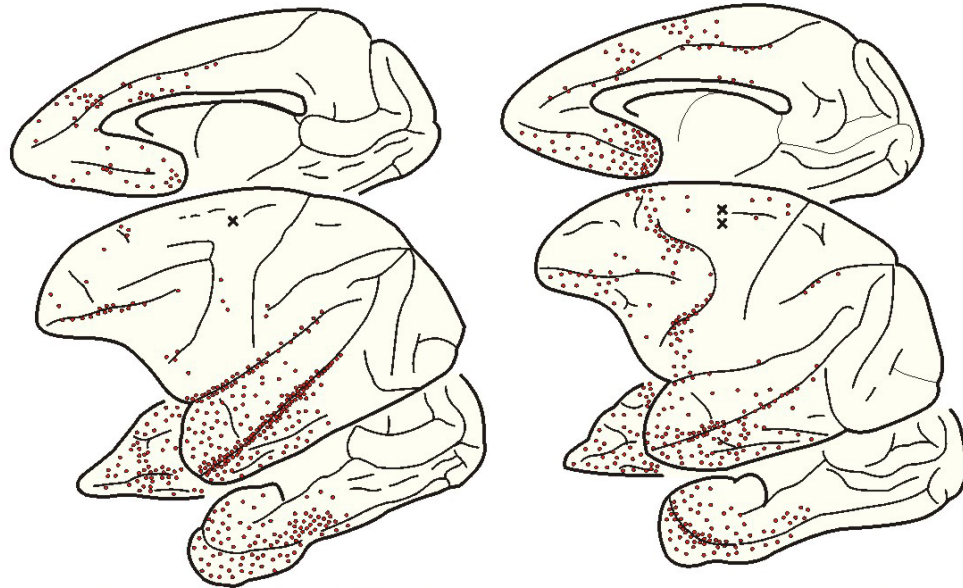
Antoine

- 情動 大脳辺縁系

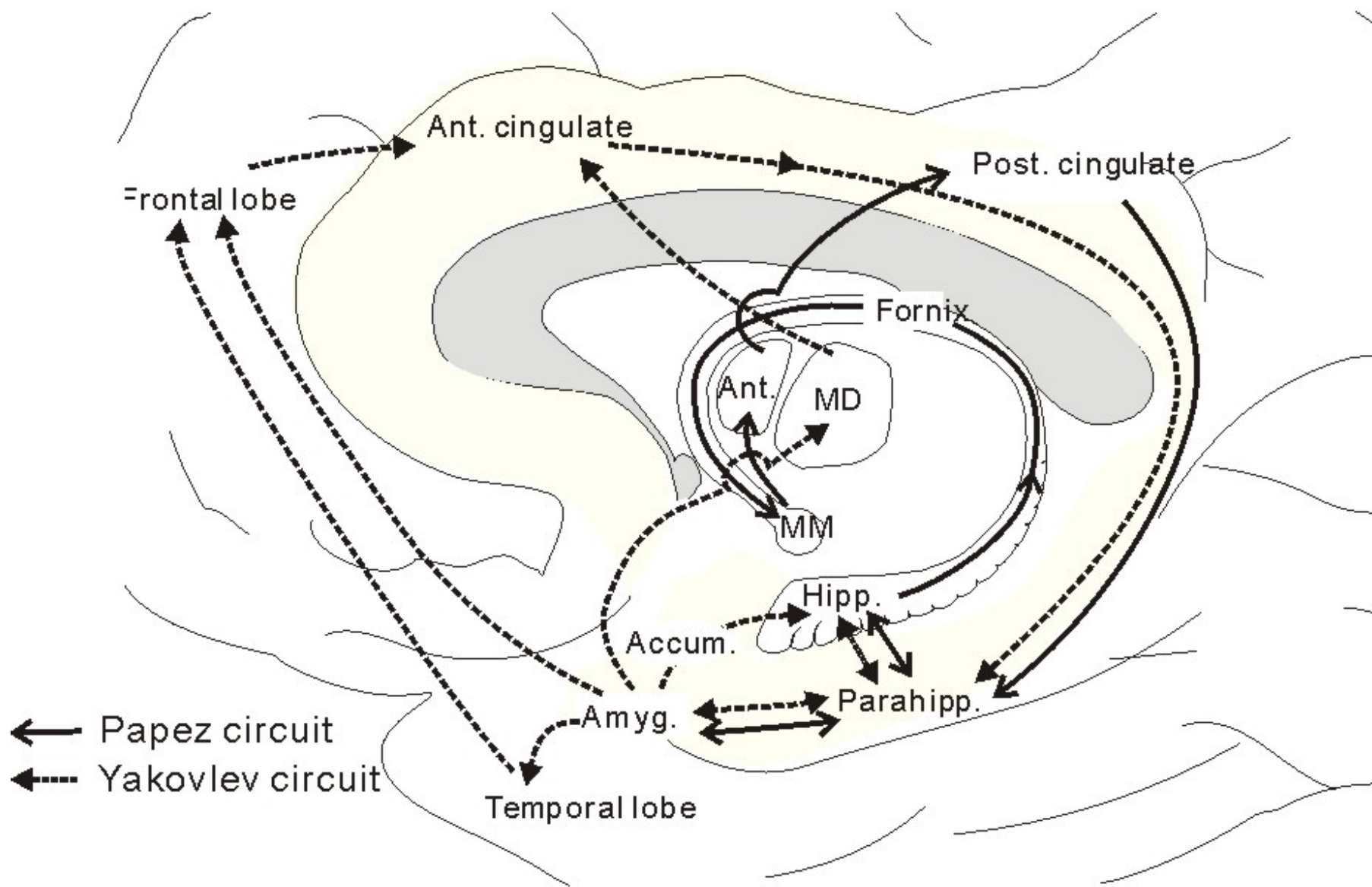


A hierarchy of three brains in one - a triune brain  
(MacLean, 1967)

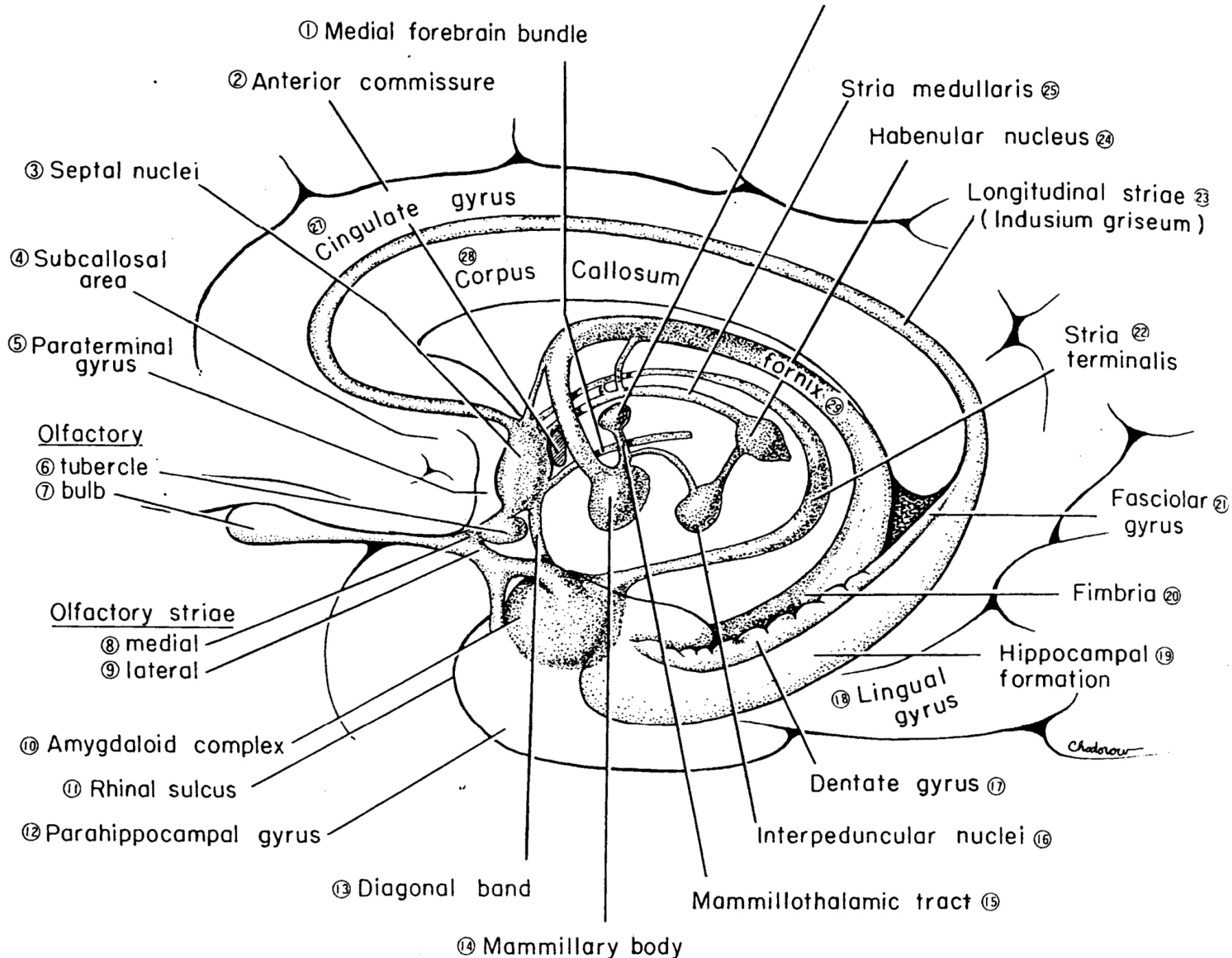




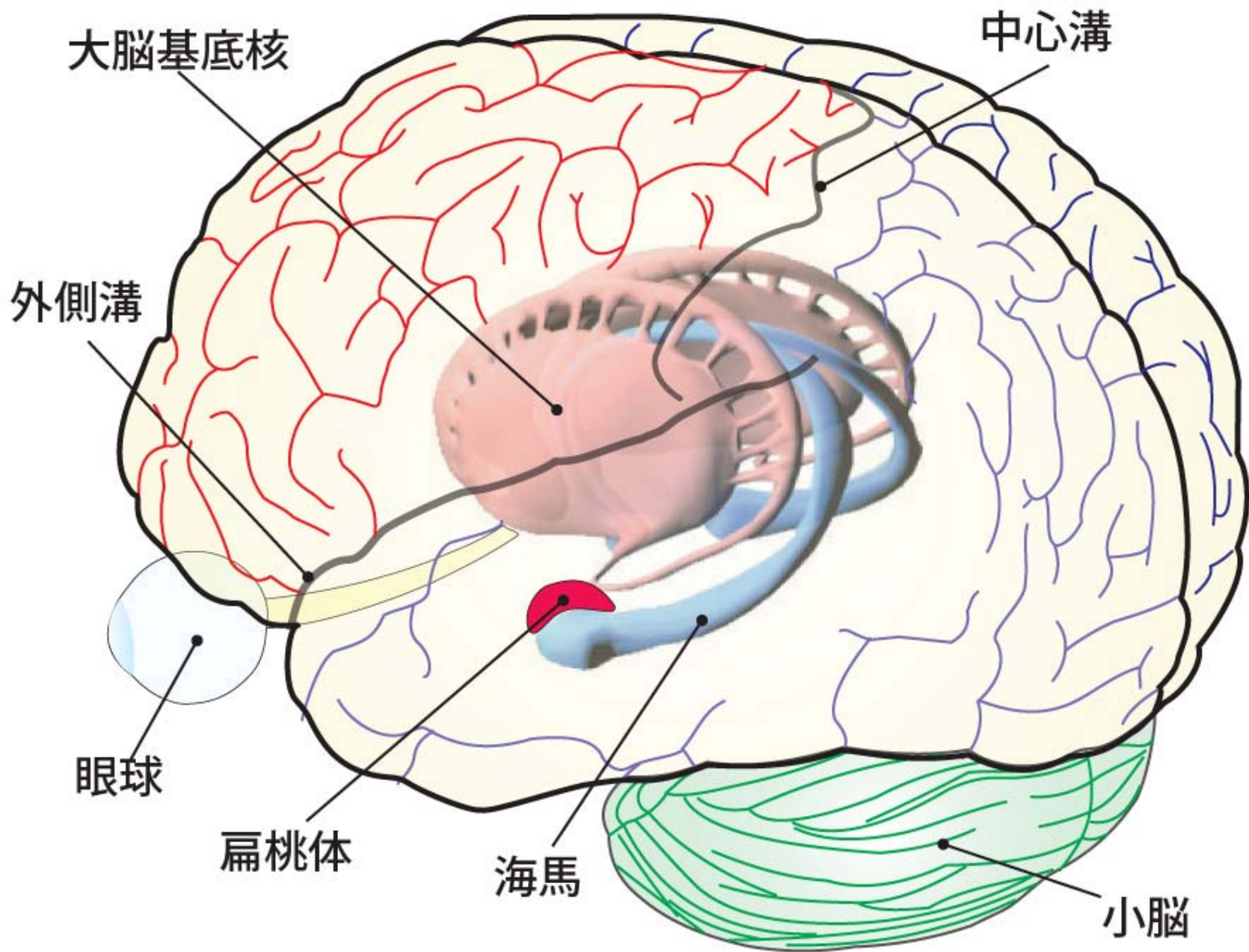
Afferents to Amygdala  
(Kawamura & Norita, 1980)

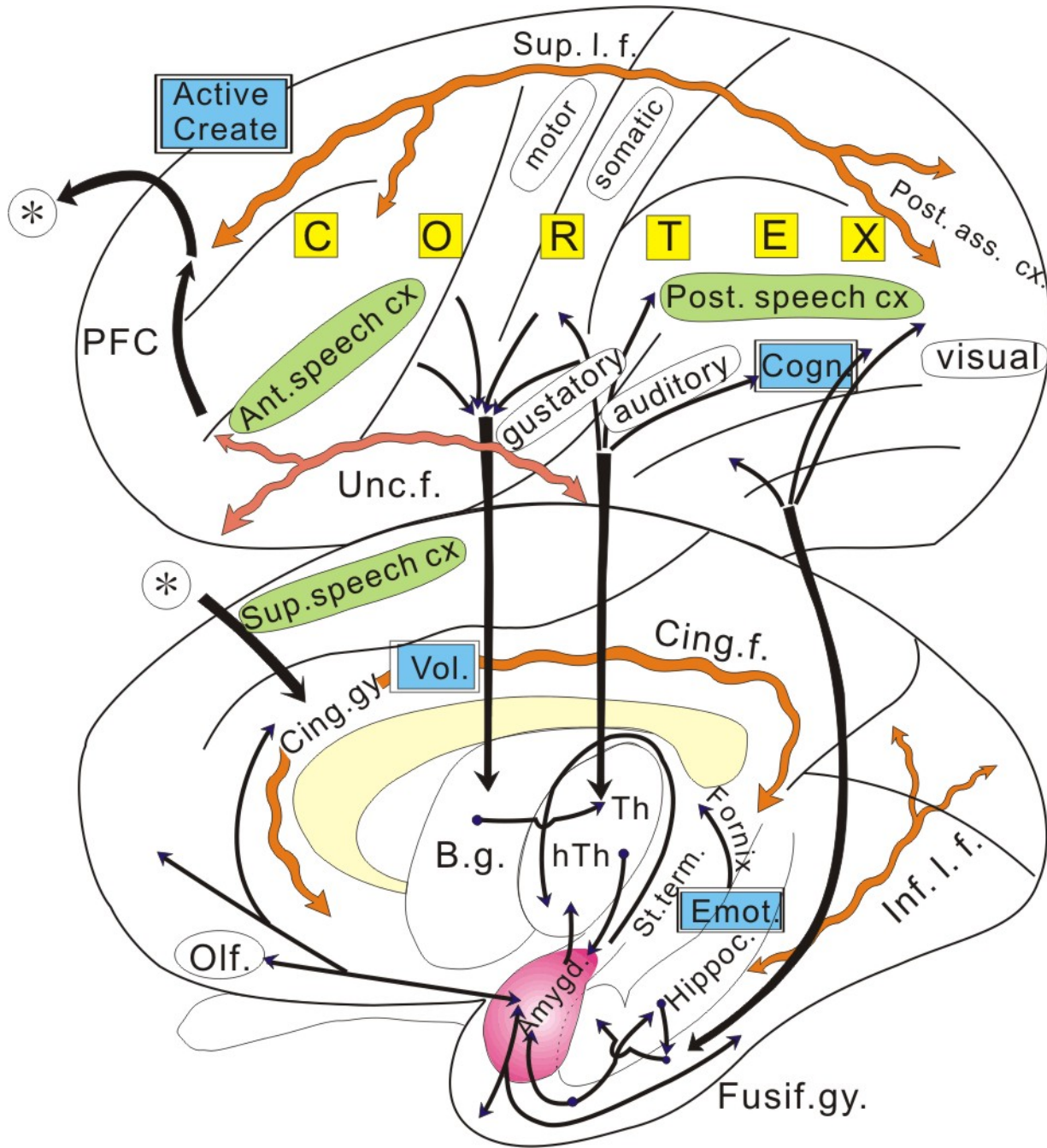


← Papez circuit  
 - - - Yakovlev circuit





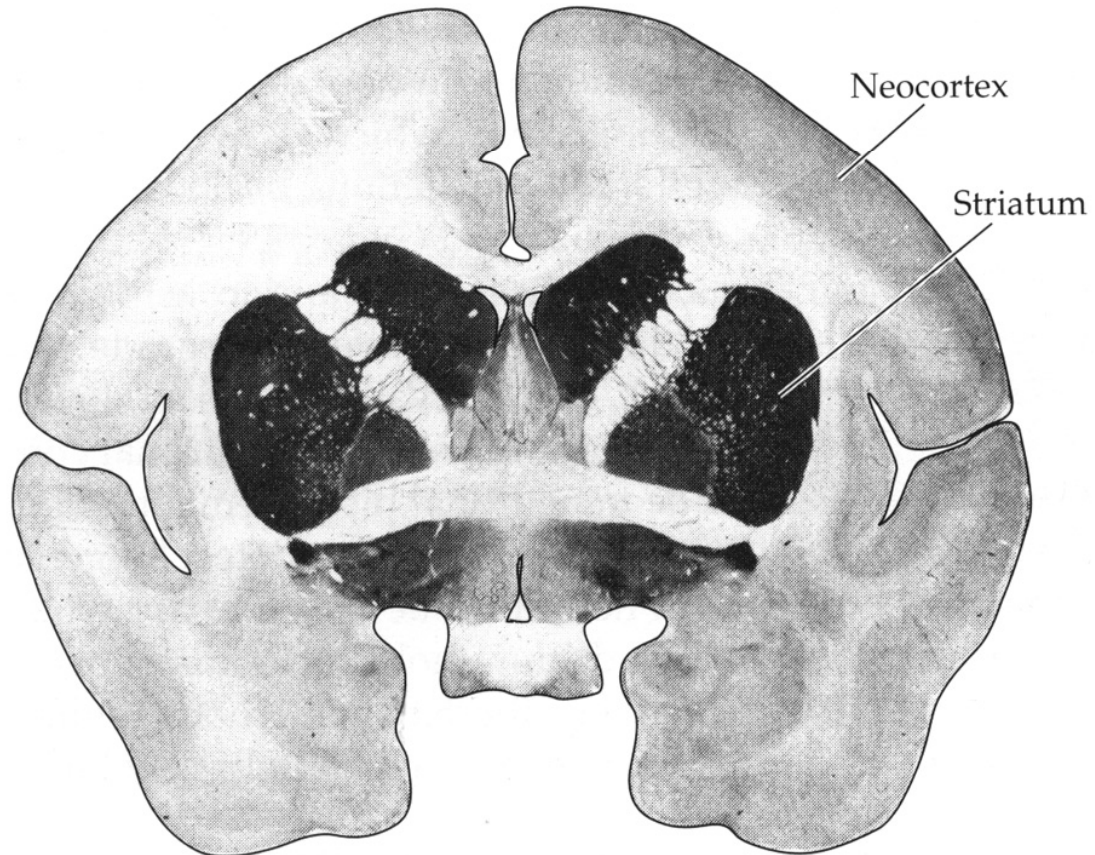




- 大腦基底核

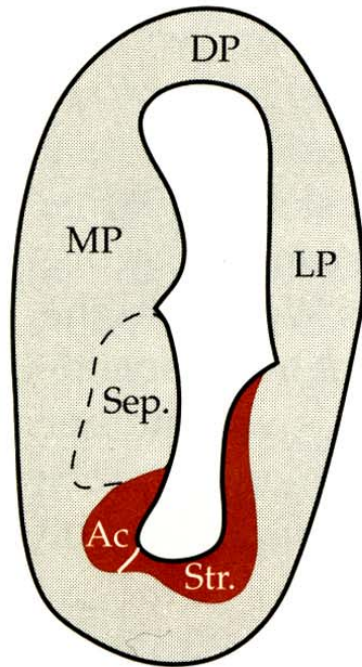


(B) Squirrel monkey telencephalon

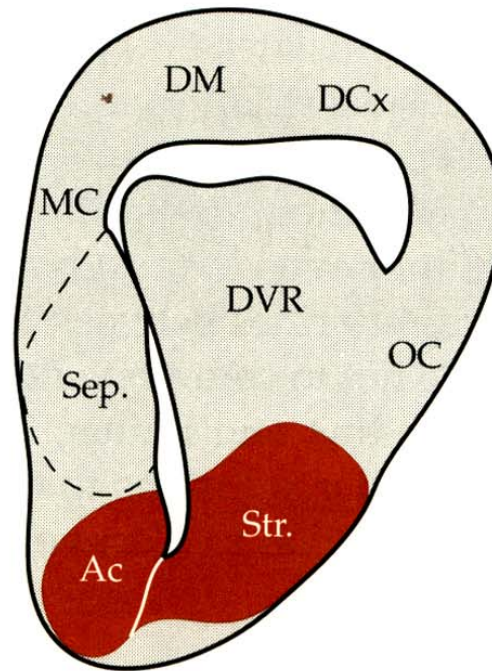




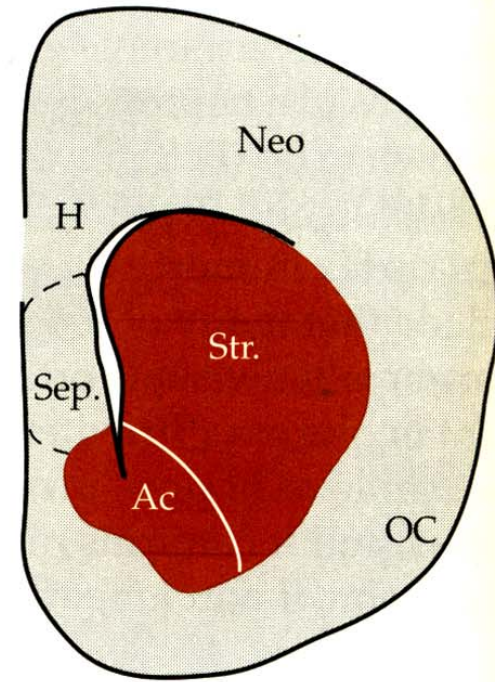
(A) Amphibians



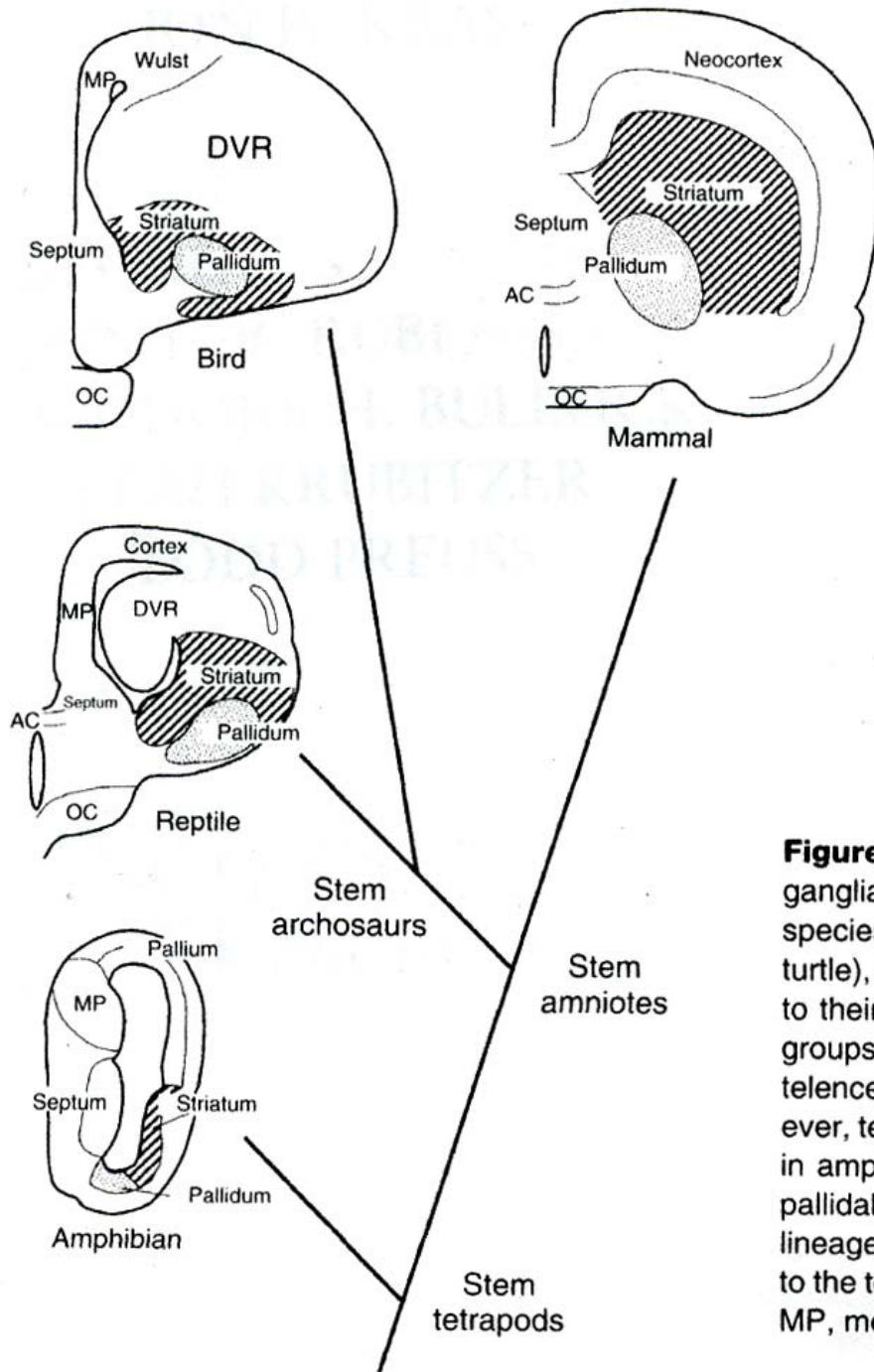
(B) Reptiles



(C) Mammals

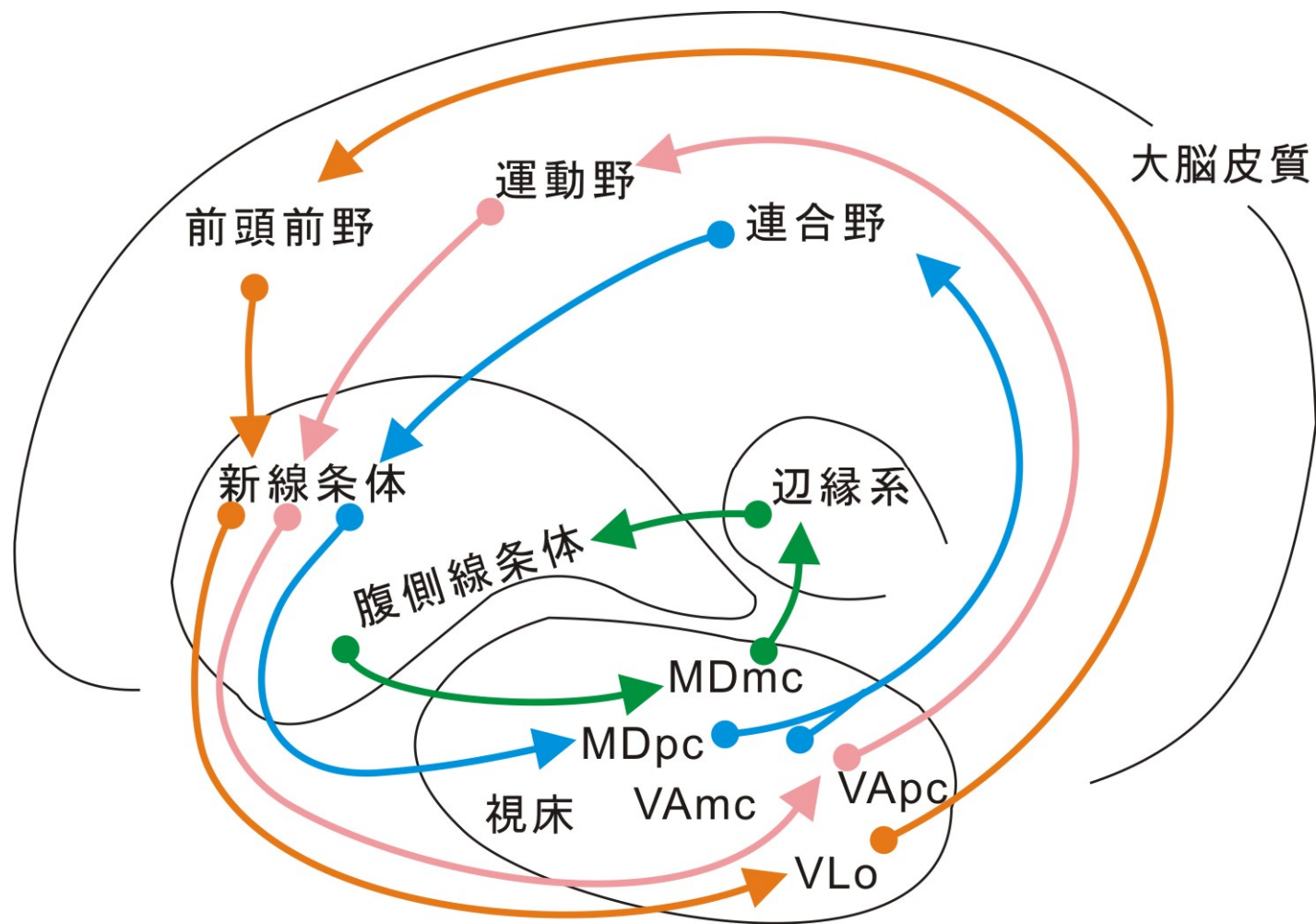


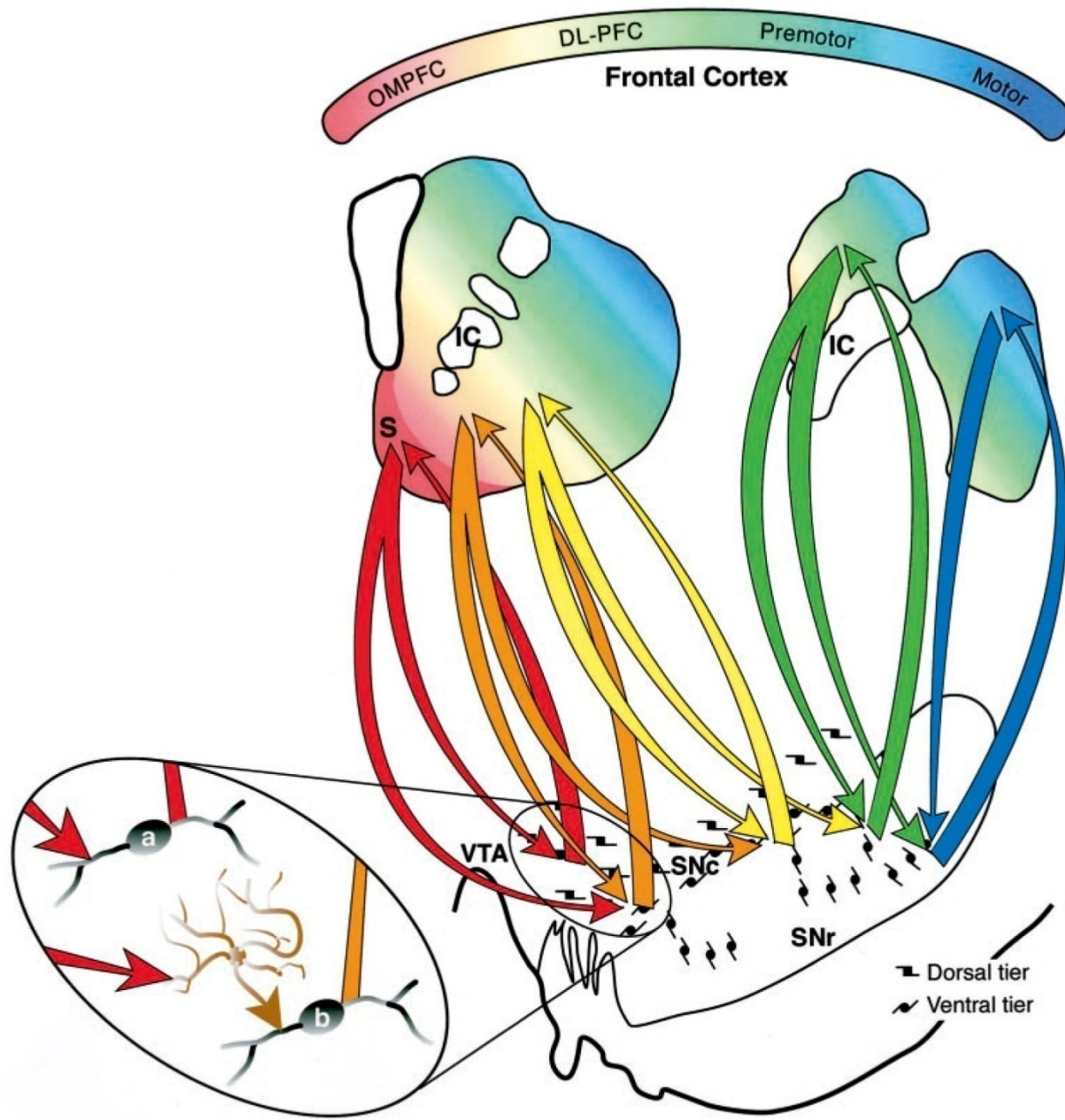
**Figure 8.12 The Position of the Forebrain's Basal Ganglia in Tetrapods** The striatum (Str.) and nucleus accumbens (Ac; also called the ventral striatum) occupy topologically equivalent positions in the telencephalon of (A) amphibians, (B) reptiles, and (C) mammals. The nucleus accumbens is generally located in the medial subpallium, just ventral to the septum (Sep.). The striatum, in contrast, generally lies lateral to the nucleus accumbens and occupies most of the ventrolateral subpallium. Other abbreviations: DCx = dorsal cortex; DM = dorsomedial cortex; DP = dorsal pallium; DVR = dorsal ventricular ridge; H = hippocampus; LP = lateral pallium; MC = medial cortex; MP = medial pallium; Neo. = neocortex; OC = olfactory cortex. (After Reiner et al., 1998; Marín et al., 1998.)



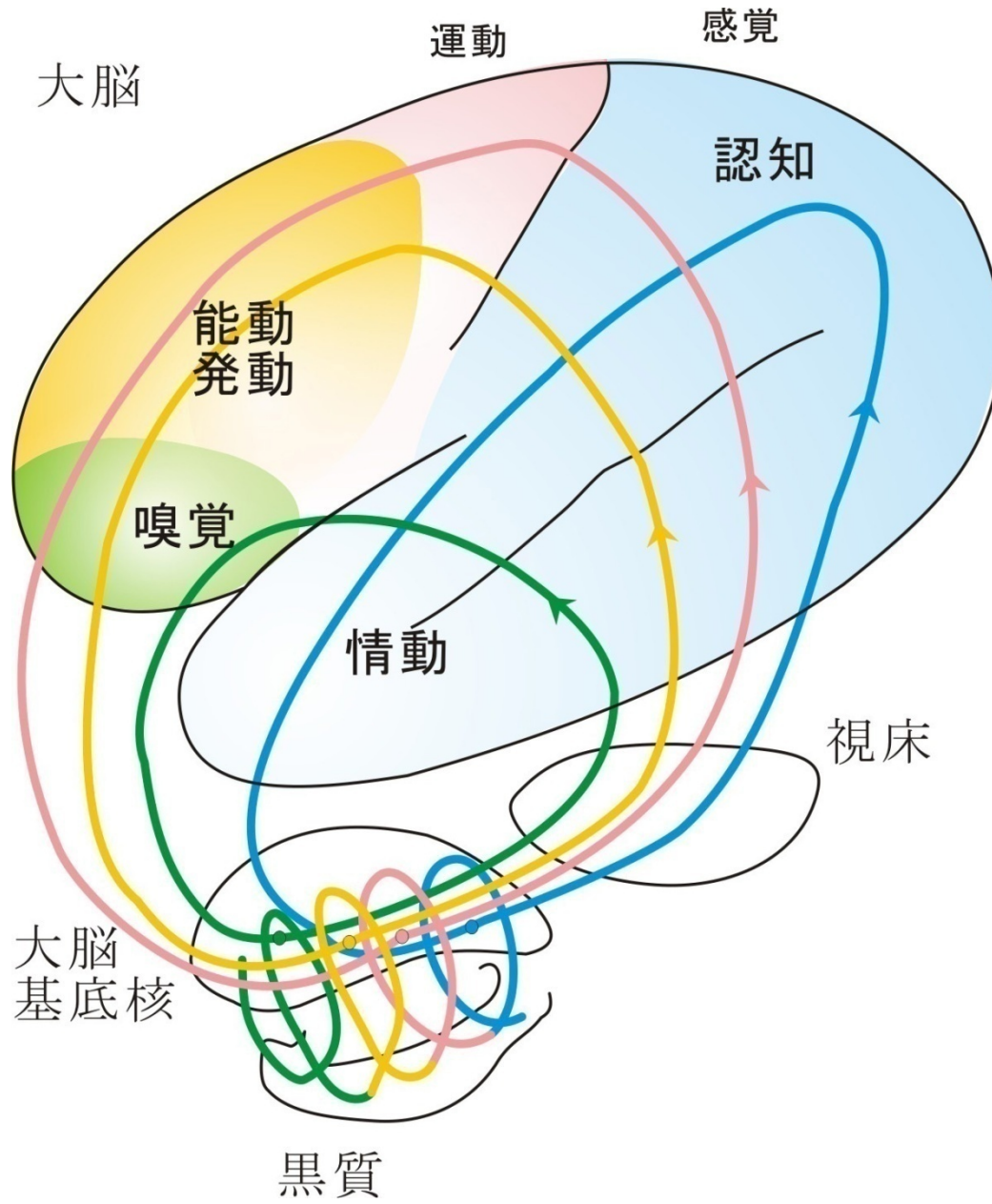
**Figure 3** Schematics of frontal sections through the basal ganglia of the right telencephalic hemisphere in representative species from four tetrapod groups: amphibian (a frog), reptile (a turtle), bird (a pigeon), and mammal (a rat), arranged according to their evolutionary divergences. The basal ganglia in all four groups consists of a striatum and a pallidum located in the basal telencephalon, beneath the pallial regions. The pallidum, however, tends to be more laterally located in reptiles and birds than in amphibians and mammals. The phylogenetic distribution of pallidal laterality suggests that this trait arose in the reptilian lineage and was retained in birds. Medial is to the left and dorsal to the top in all schematized sections. AC, anterior commissure; MP, medial pallium; OC, optic chiasm.











$$F_1 = F_3(F_2(F_1)) = \langle G_1, G_2 \rangle$$

$$= x_1x_2 + y_1y_2 + z_1z_2 + w_1w_2$$

Cholin  
5-HT  
Dopamin

**Active will**

**Motion**

**Cognition**

$$G_1 = (x_1, y_1, z_1, w_1)$$

$$G_2 = (x_2, y_2, z_2, w_2)$$

**Emotion**

Nigra  
VTA  
Hippoc  
Amygd

$$F_3 = F_2(F_1(F_3)) = \langle G_3, G_1 \rangle$$

$$= x_3x_1 + y_3y_1 + z_3z_1 + w_3w_1$$

$$F_2 = F_1(F_3(F_2)) = \langle G_2, G_3 \rangle$$

$$= x_2x_3 + y_2y_3 + z_2z_3 + w_2w_3$$

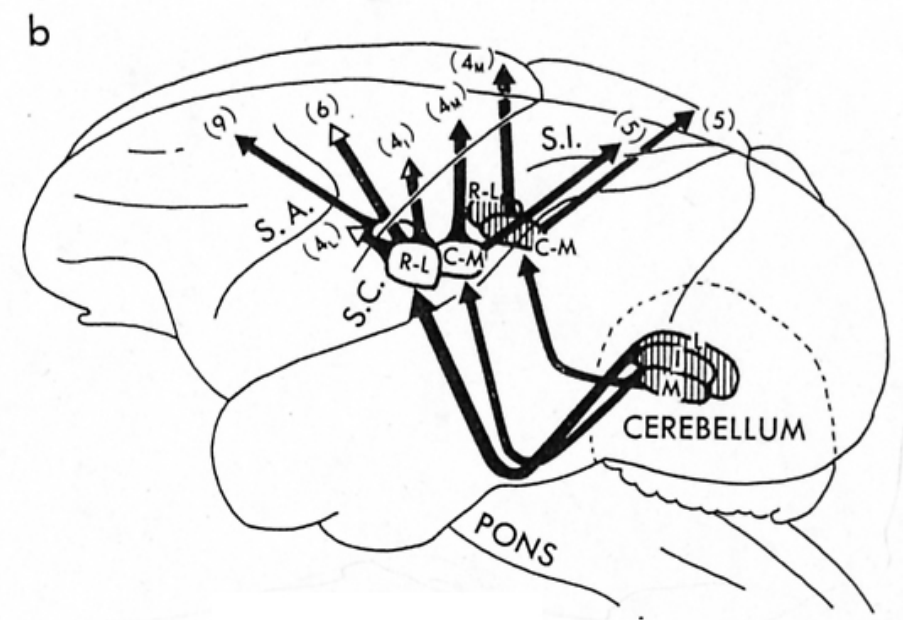
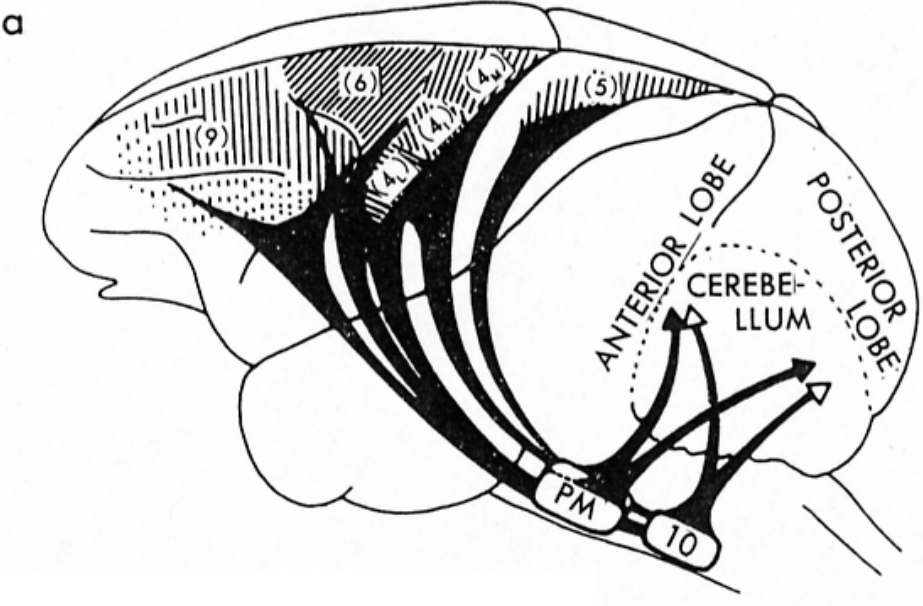
$$G_3 = (x_3, y_3, z_3, w_3)$$

Cerebell  
Brainstem

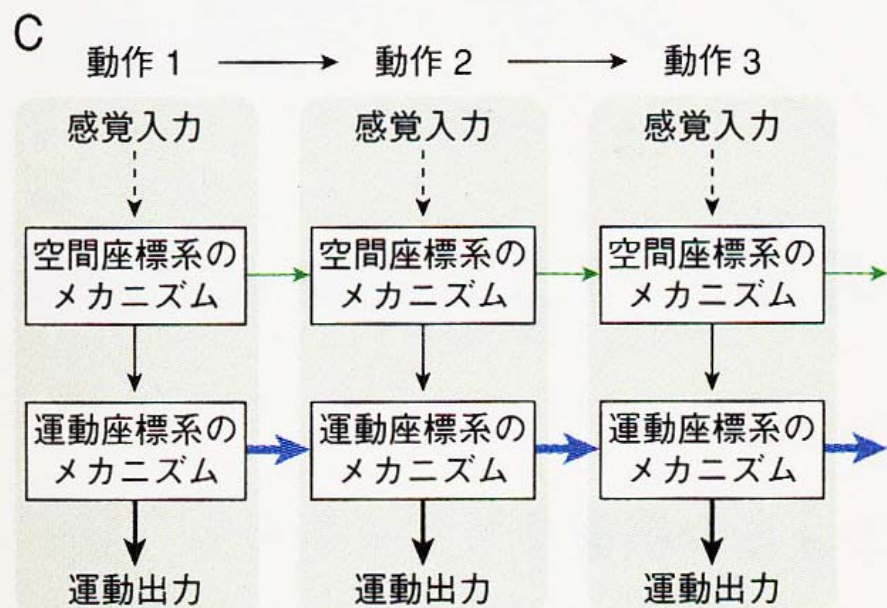
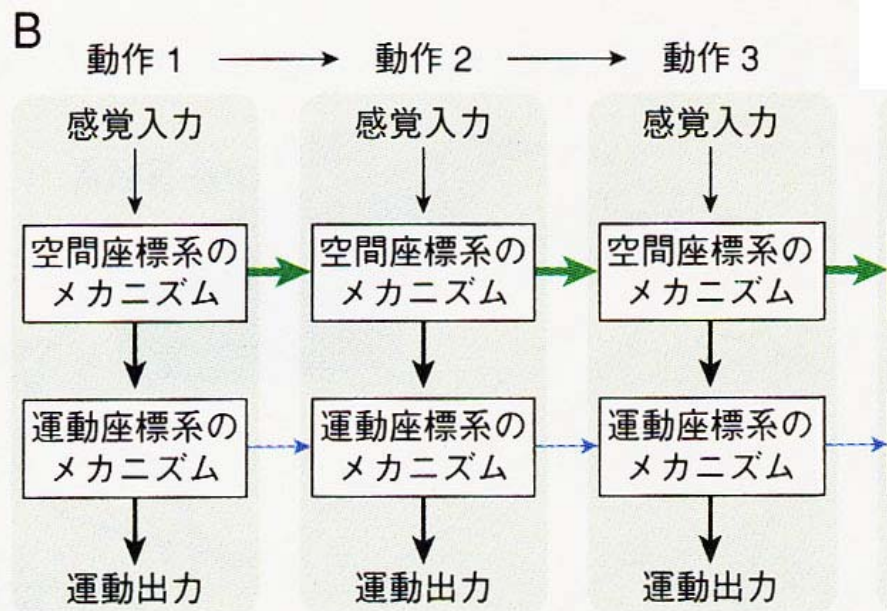
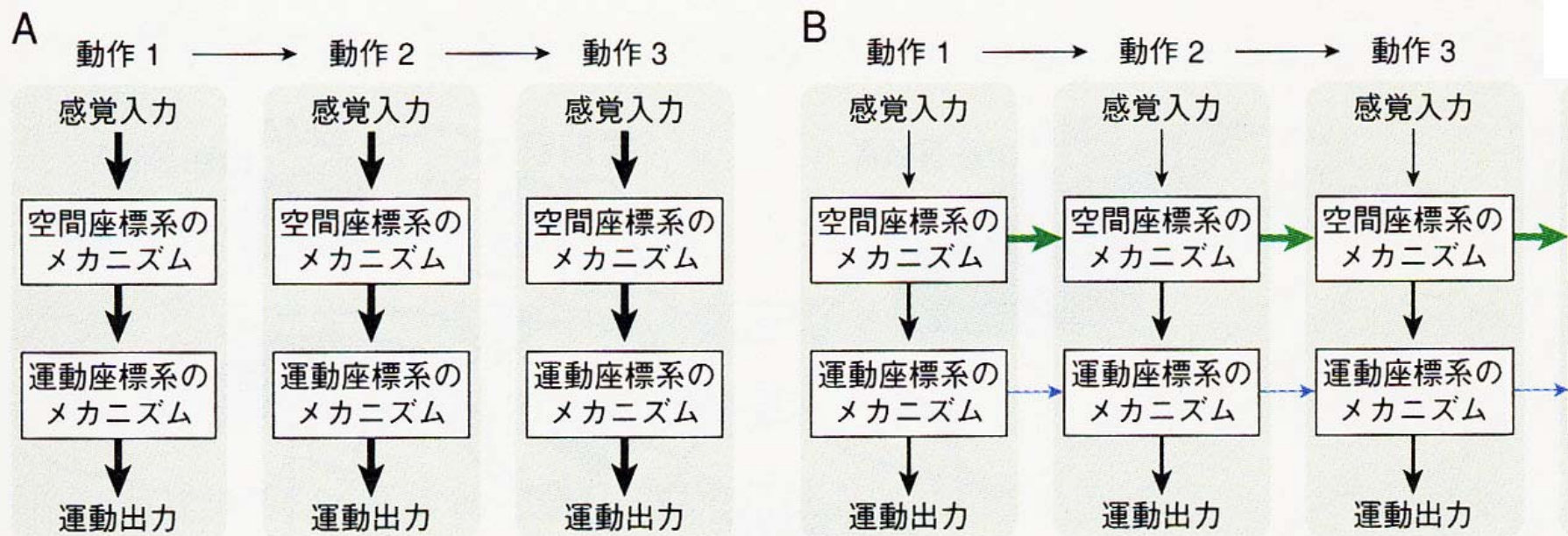
$$\langle G_1, G_2 \rangle + \langle G_2, G_3 \rangle + \langle G_3, G_1 \rangle \doteq 0$$

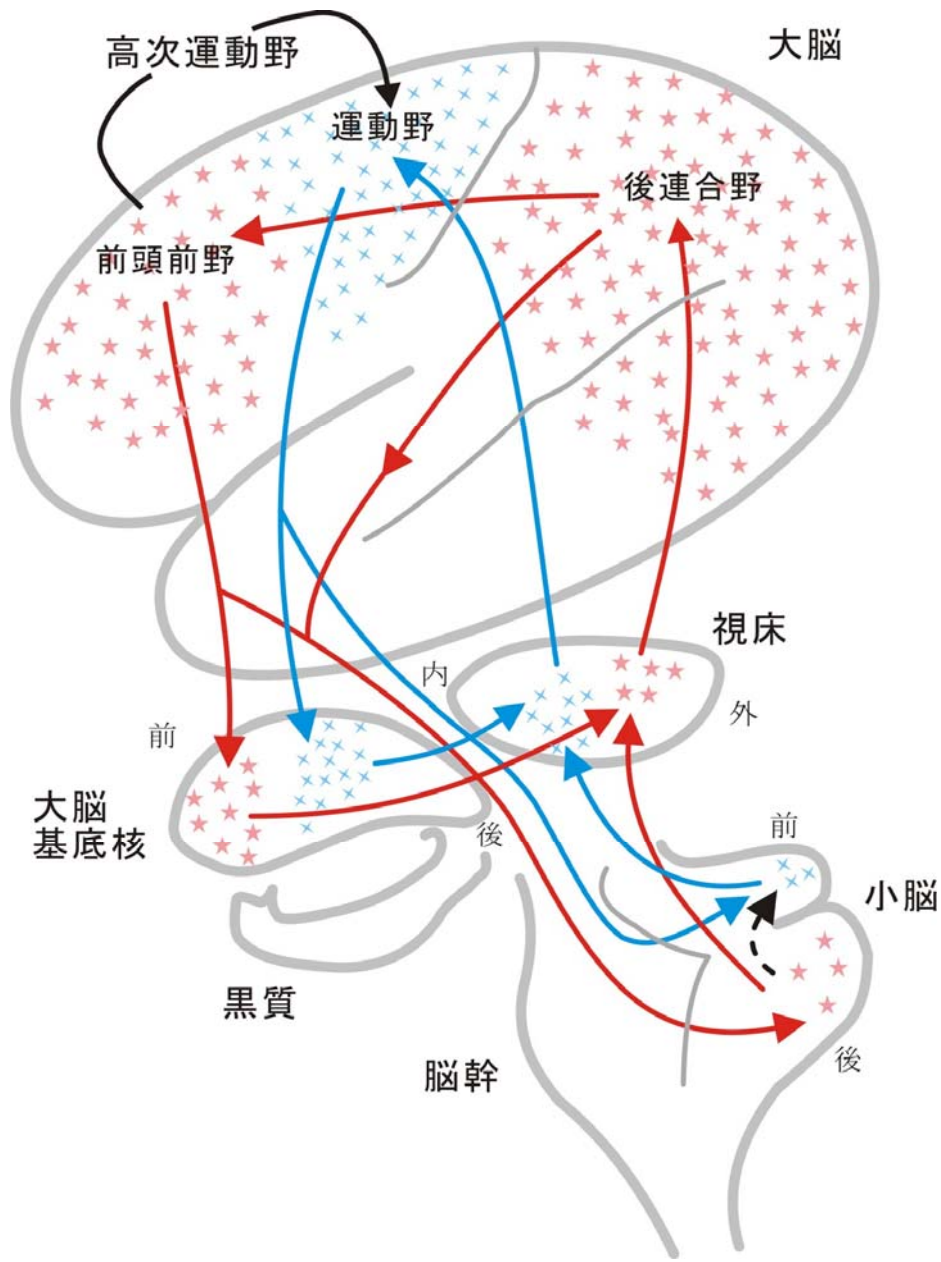


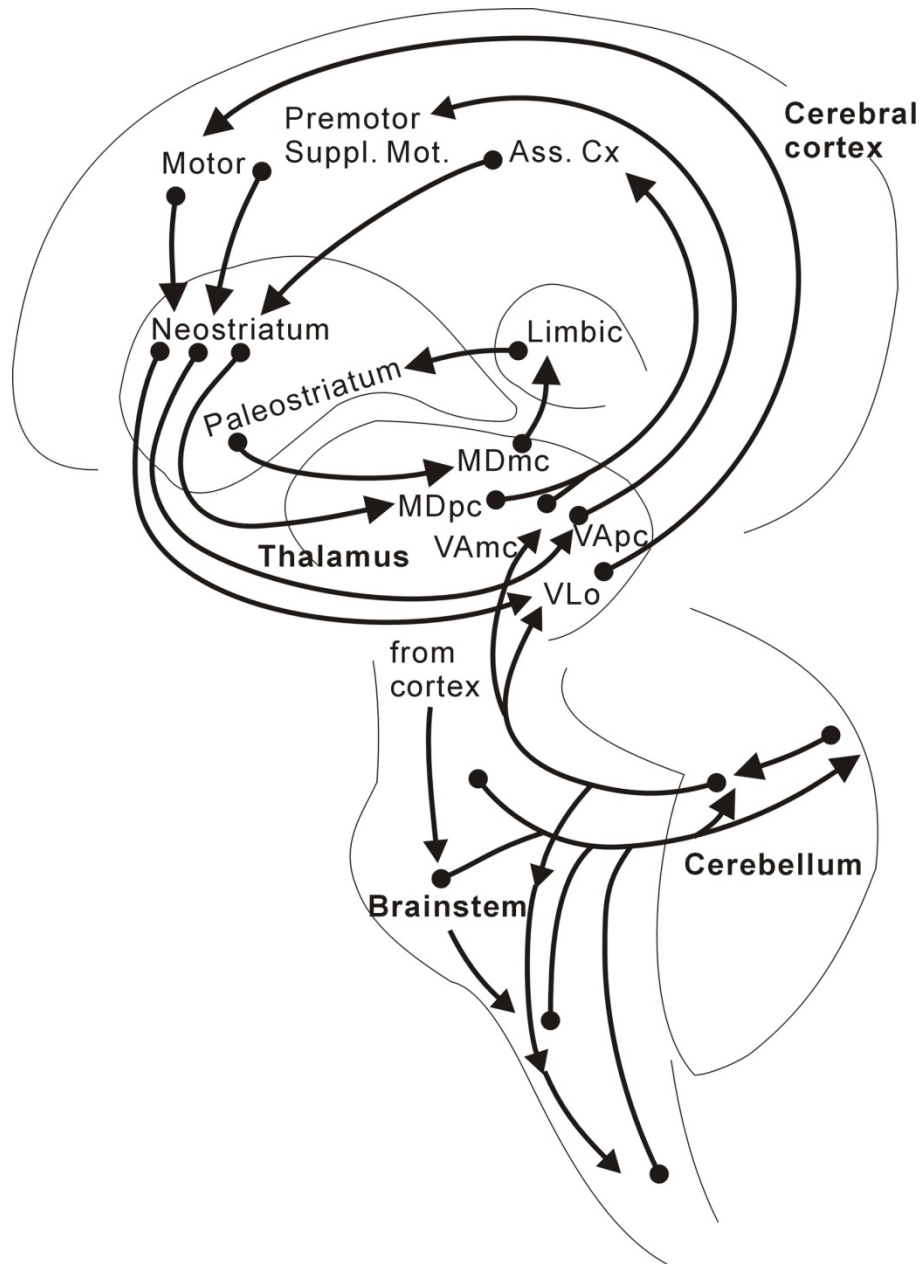
- 小腦

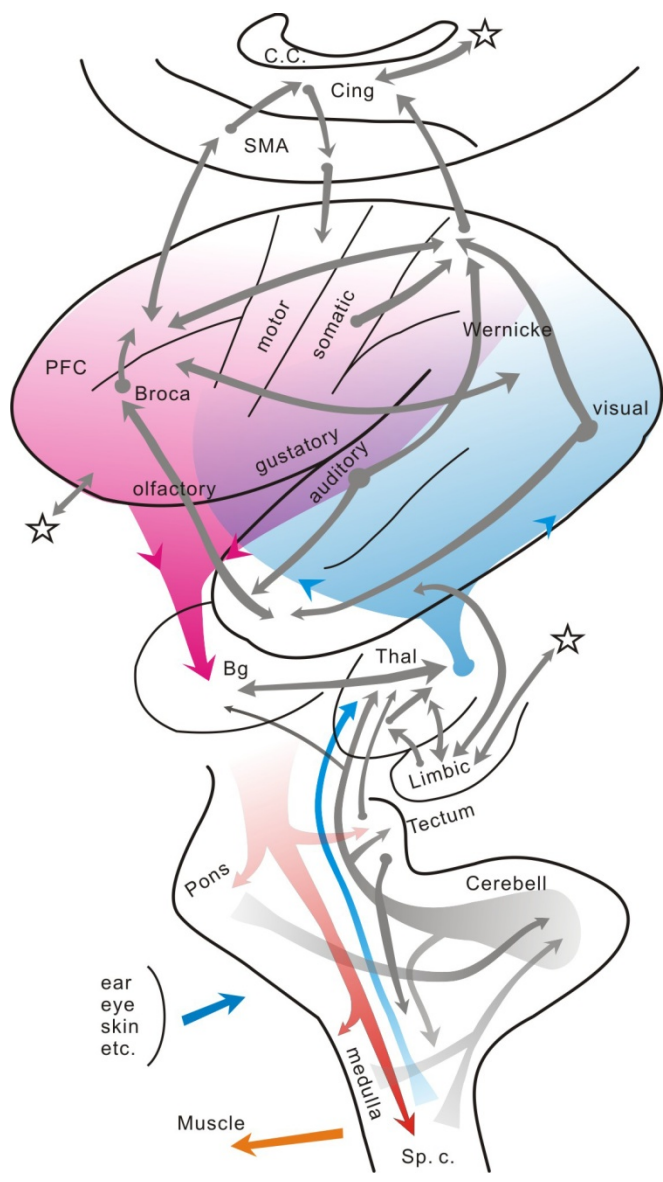




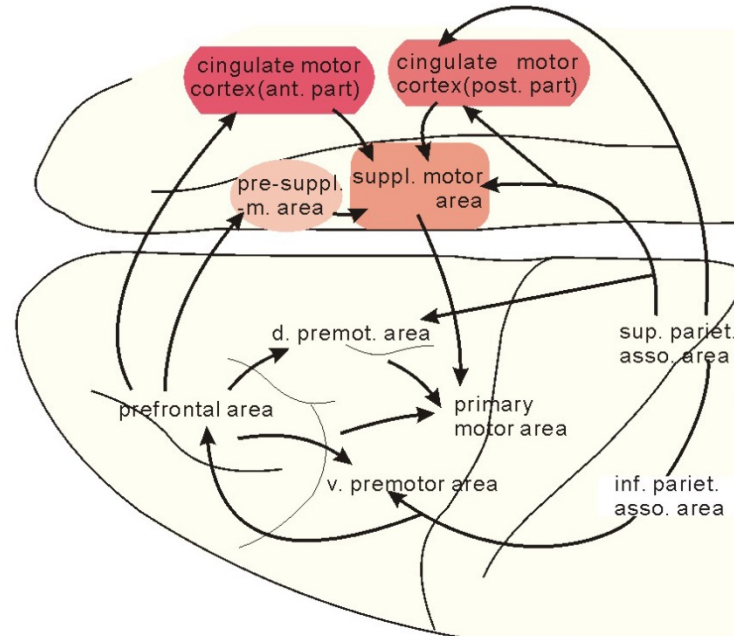
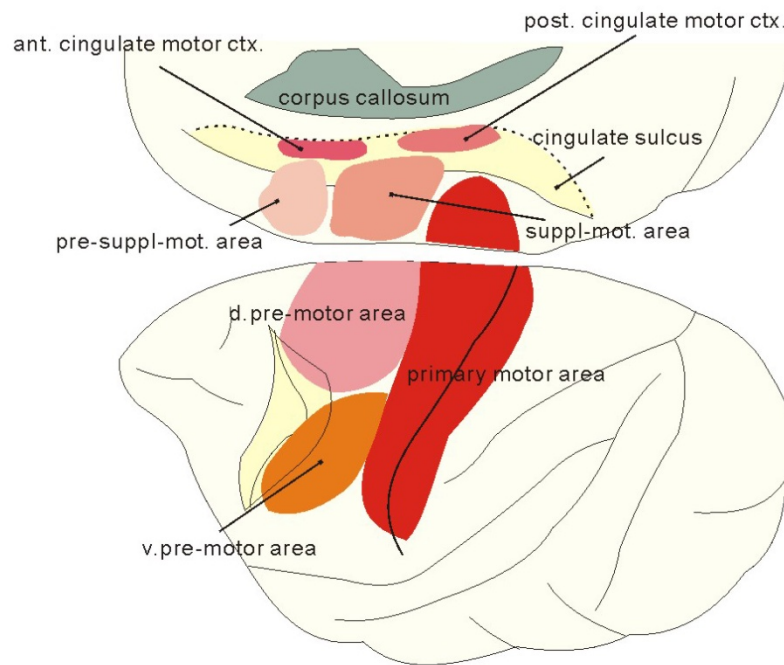




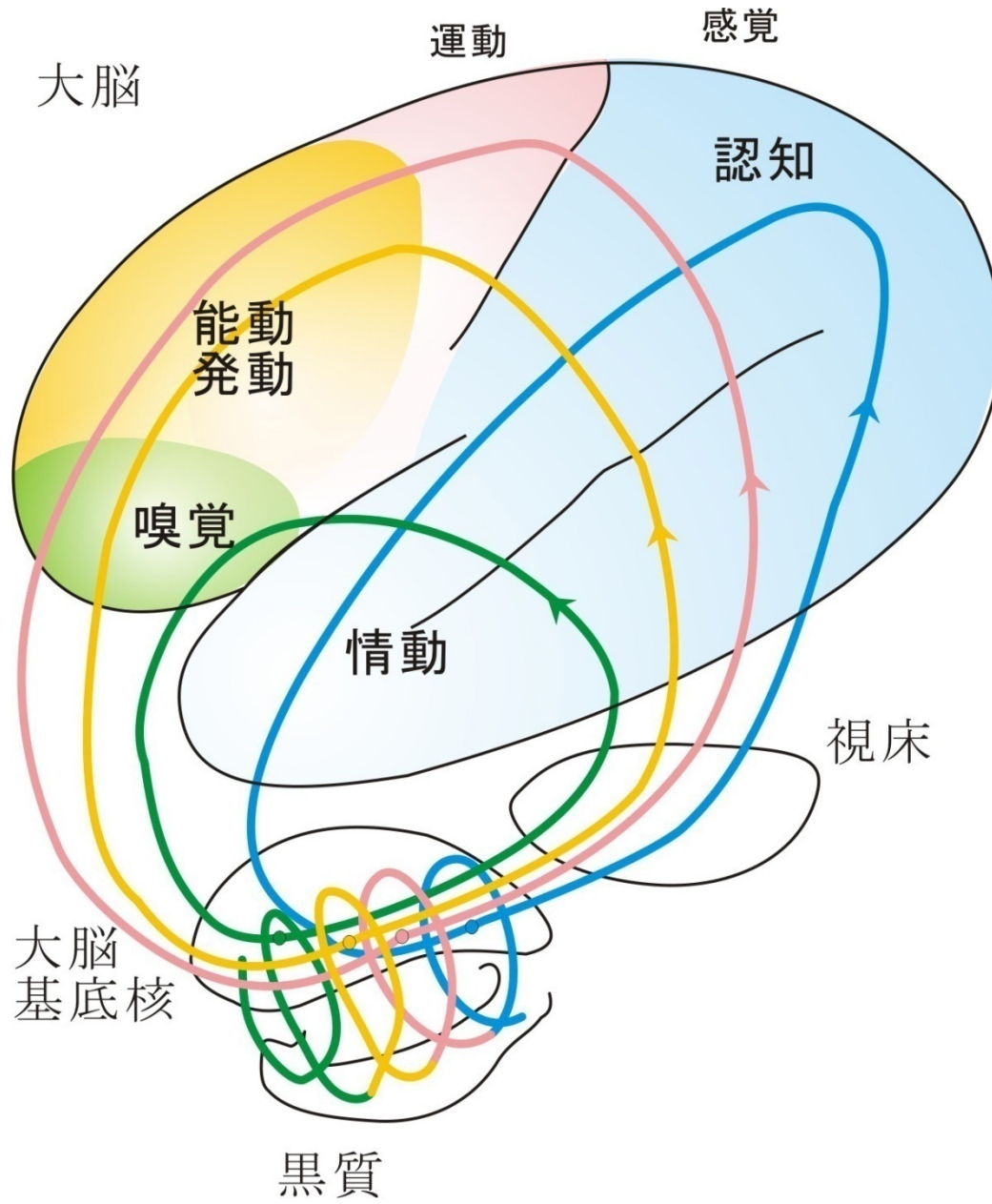




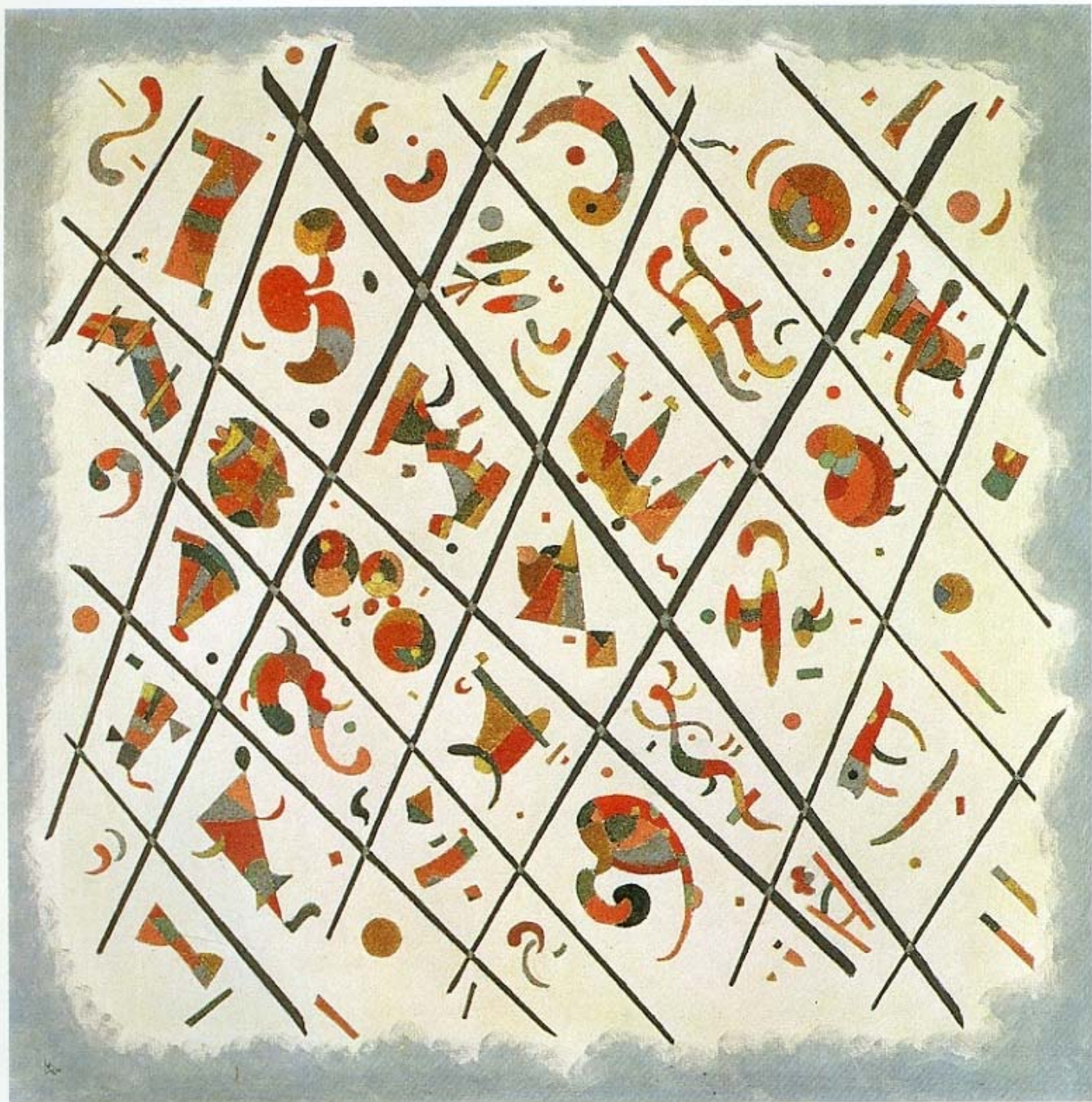


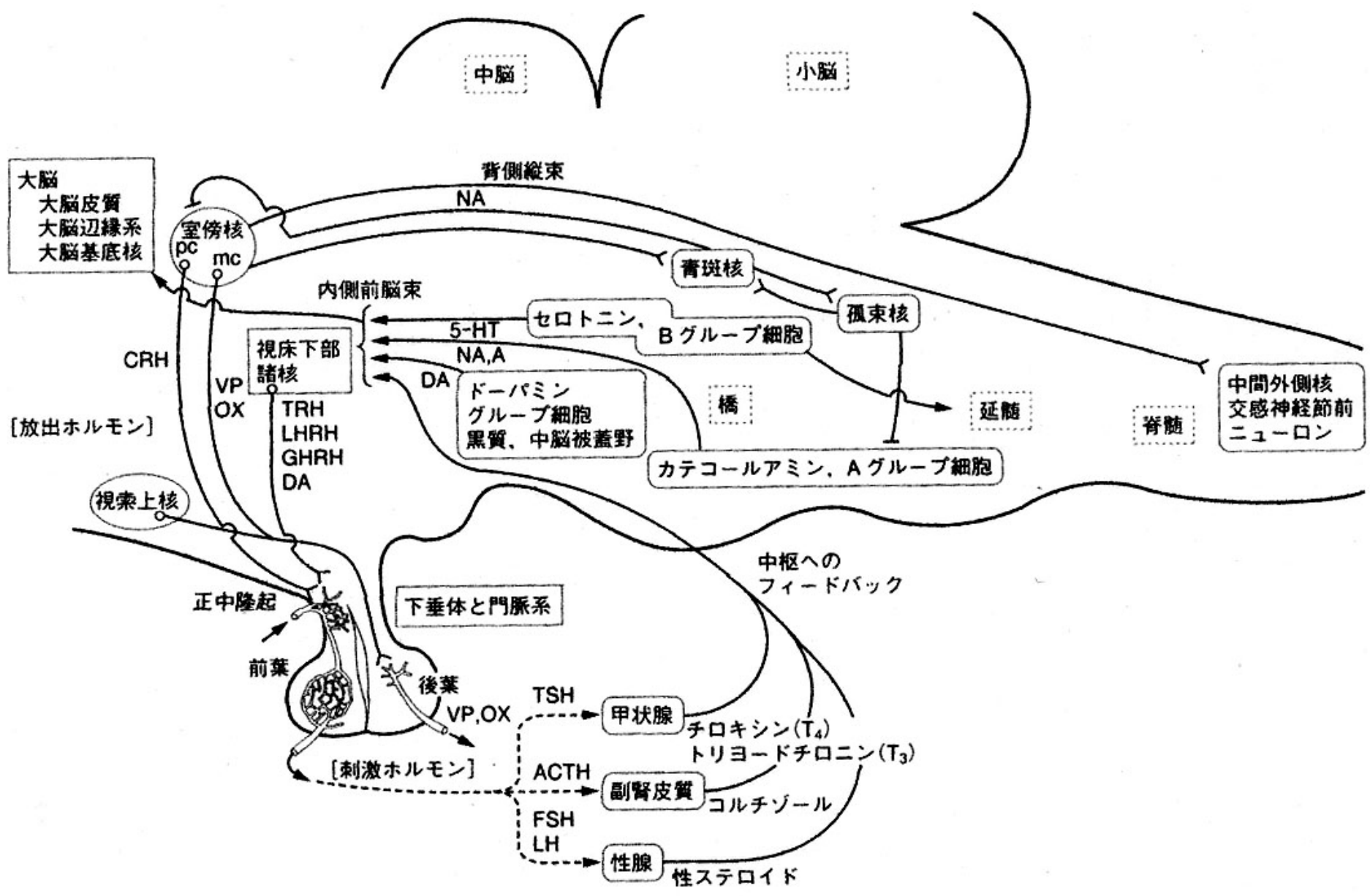


Connections involving motor areas (Tanji, 1999)









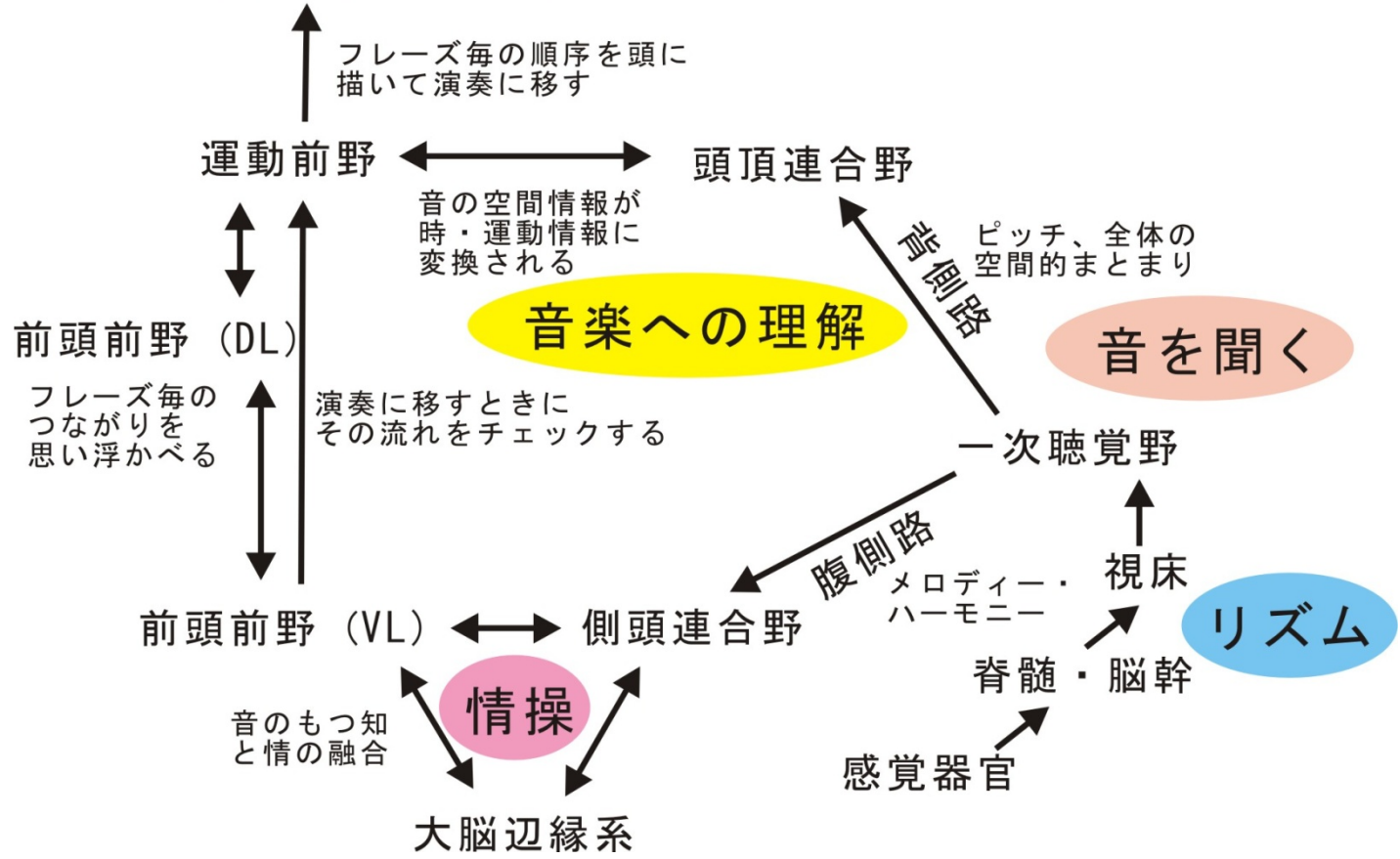


- 音楽へのいとなみ

# 演奏への集中力

演奏が行われるときには、小脳・線条体系(図4参照)も関与する

高次運動野 → 一次運動野 → 脳幹・脊髄 → 運動器官





I play violin and enjoy music

- Thank you



# 音楽と色彩

- スクリャービンのLa Poeme de l'extase, Op54を聴いて、思い浮かんだ色の時系列データ(一橋和義)
- ●目的
- スクリャービンのLa Poeme de l'extase, Op54を聴いて、思い浮かんだ色を時系列で示す。
- ●実験方法
- 強い共感覚として、目の前に特定の色がはっきり見えたということにはなかった。そこで、音から得られる色のイメージを弱共感覚として捉えることにした。まず、色鉛筆を持って、画用紙に曲を聴きながら適当に手を動かして曲のイメージで色を変え着色した。3回聴いて着色した結果、大体同じような傾向が確認できた。今度はエクセルのシートに曲を聴きながら1秒ごとに色をつけていった(曲は止めなかった)。
- ●結果、考察
- 画用紙着色では、毎回厳密に同じ結果にはならなかったが、ほぼ同じ傾向の色、特に最初1分の黄緑～黄色、桃色、4分、8分の赤、紫、11分のオレンジ、20～22分の黄色、空色は再現性が高かった。以上から弱い共感覚は色のイメージとして捉えられたと思われる。
- ●表の読み方
- 縦軸: 秒、横軸: 1分目～22分目 {曲は22分としてあります(余韻をあわせて)}
- \* 読みやすいように、縦軸(秒)には、10秒ごとに赤●を、間の5秒に青▼を入れた。また、横軸(分)には、5分ごとに赤字とした。



A scenic view of Mount Fuji with a field of red poppies in the foreground. The mountain is covered in snow and set against a clear blue sky. The foreground is a vast field of vibrant red poppies.

# 脳と音楽

## 音楽療法セミナー

Thank you

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