

# Data for Brain Reference Architecture of NM24VestibuloOcularReflex

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# Data Description

- BRA Image

- BIF image

BIF image

- HCD image

HCD image

- FRG image

FRG image

- BRA Data

NM24VestibuloOcularReflex.bra

Table 3: BRA DATA SUMMARY

BRA Data			
Object Name	Template	Including Content(s)	
		BIF	HCD/FRG
ProjectID.bra	<i>version 2.0</i>	✓	✓

Table 4: BRA IMAGE SUMMARY

Graphic Files: BIF Image, HCD Image, FRG Image	
File Type	Object Name
BIF Image	NM24VestibuloOcularReflexBIF.xml
HCD Image	NM24VestibuloOcularReflexHCD.xml
FRG Image	NM24VestibuloOcularReflexFRG.xml

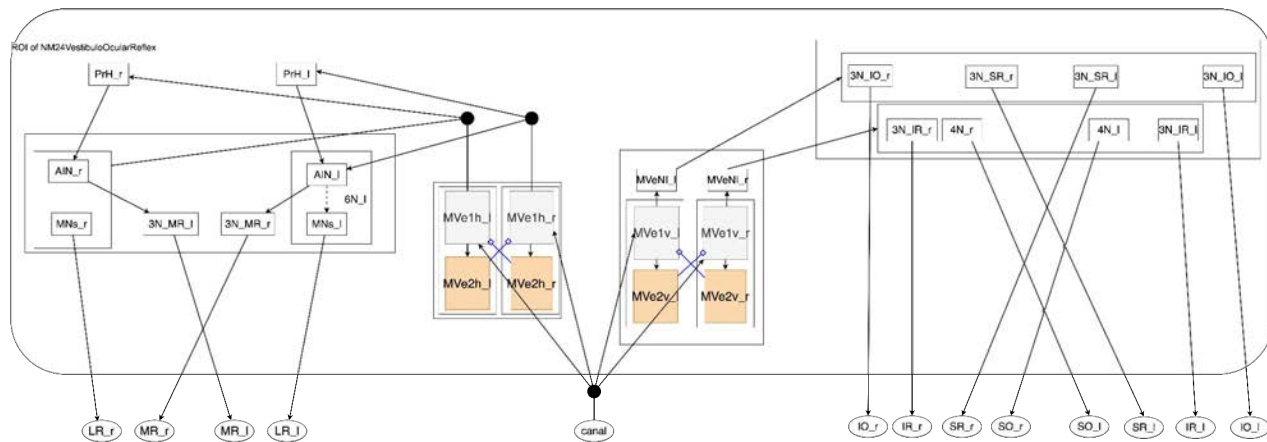
# Context

- Data for BRA of the vestibulo-ocular reflex (VOR), one of the key components of eye movements
- How to construct each BRA data
- Explanation of several hypotheses about new anatomical structures in some nuclei based on BIF/HCD/FRG

# Data sheet and BRA image

- Circuit: 45  
(7 ROIs)

Abbreviations	Full Names
MVe	medial vestibular nucleus
PrH	prepositus hypoglossal nucleus
3N	oculomotor nucleus
4N	trochlear nucleus
6N	abducens nucleus
AIN	abducens internuclear neurons
MNs	motoneurons
LR	lateral rectus
MR	medial rectus
IO	inferior oblique
SO	superior oblique
SR	superior rectus
IR	inferior rectus



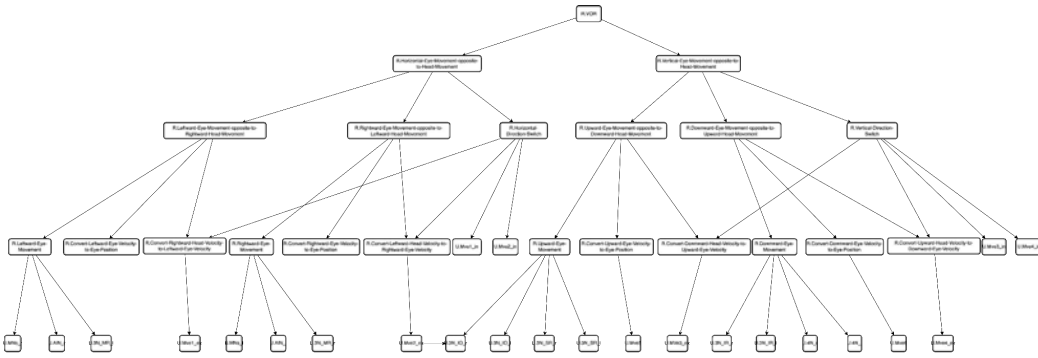
- Connections: 42

BIF image

# Data sheet and BRA image

Node IDs of FRG: 42

Node ID	Node ID	Subcircuit	Circuit ID	Projected Circuit Collection	Uniform Circuits	Input Circuits	Output Circuits	[M] Uniform Circuit Collections	[M] Merged Input Circuit Collections	[M] Merged Output Circuit Collections	Interface	Implementation
U1Mach1	U1Mach1		Mach1_1	Mach1_1		Mach1_1	Mach1_1	Mach1_1		Mach1_1	Mach1_1 + U1Mach1	U1Mach1_1 + FE1B
U1Mach2	U1Mach2		Mach1_1	Mach1_1		Mach1_1	Mach1_1	Mach1_1		Mach1_1	Mach1_1 + U1Mach2	U1Mach1_1 + FE1B
U1canal	U1canal		canal	Mach1_1		canal	Mach1_1	canal		Mach1_1		N/A
U1MR1	U1MR1		MR1_1	MR1_1		MR1_1	MR1_1	MR1_1		MR1_1	MR1_1 + U1MR1 + AR1_1	U1MR1_1 + FE1B
U1AR1	U1AR1		AR1_1	MR1_1		AR1_1	MR1_1	AR1_1		MR1_1	AR1_1 + U1AR1 + MR1_1	U1AR1_1 + FE1B
U12M1B1	U12M1B1		MR1_1	MR1_1		MR1_1	MR1_1	MR1_1		MR1_1	MR1_1 + U12M1B1 + AR1_1	U12M1B1_1 + FE1B
U1MR1	U1MR1		MR1_1	MR1_1		MR1_1	MR1_1	MR1_1		MR1_1	MR1_1 + U1MR1 + AR1_1	U1MR1_1 + FE1B



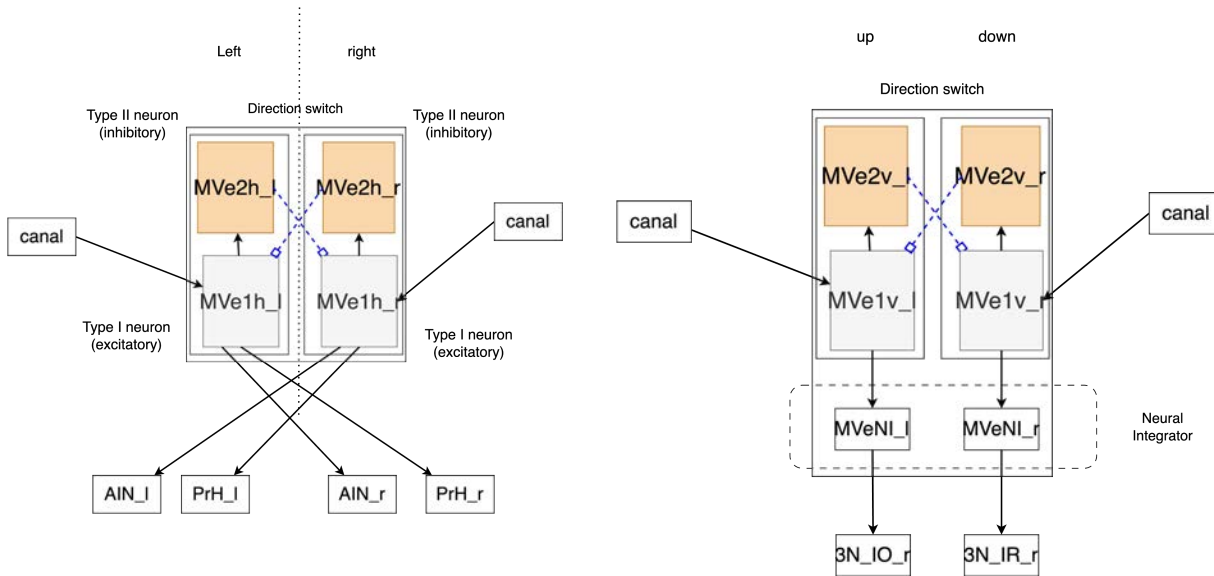
FRG image

# How to construct FRG data

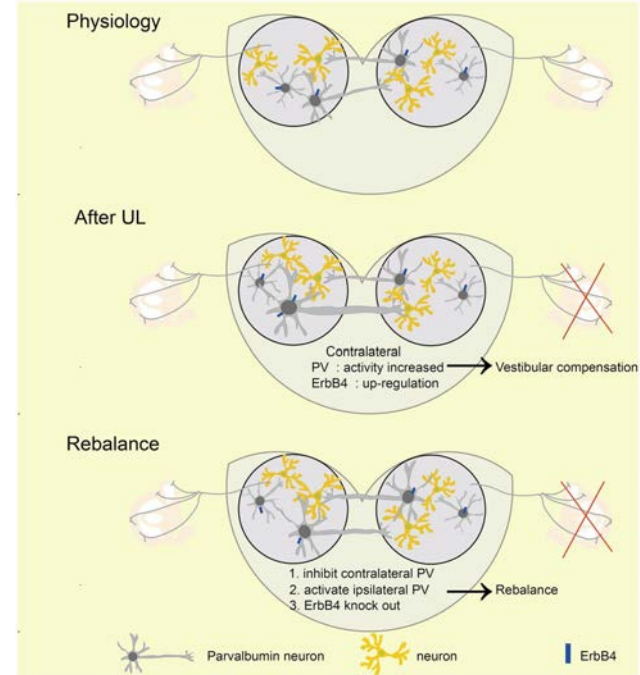
- Define **TLF** (top-level function)
  - **VOR**: To move the eyeballs in the direction opposite to head movement
- Hierarchical functional decomposition of TLF based on BIF
  - **Eye movement opposite to head movement + Direction Switching**
- Which are functionally decomposed into the following components  
(In the case of R.Leftward Eye Movement Opposite to Rightward Head Movement)
  - **R.Convert Rightward Head Velocity to Leftward Eye velocity**
  - **R.Convert Leftward Eye Velocity to Eye Position**
  - **R.Leftward Eye Movement** ( regulation of extraocular muscles )

# Proposed hypothesis

- Direction switching is accomplished by commissural inhibition in MVe
- In vertical VOR, MVe also plays a role as neural integrator



## Commissural Inhibition in MVe

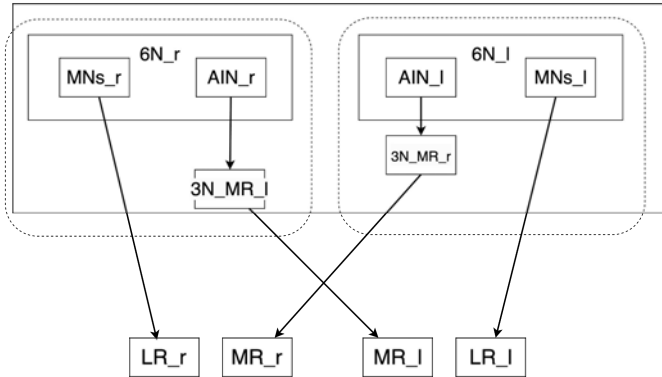


(Zhang et al., 2023)

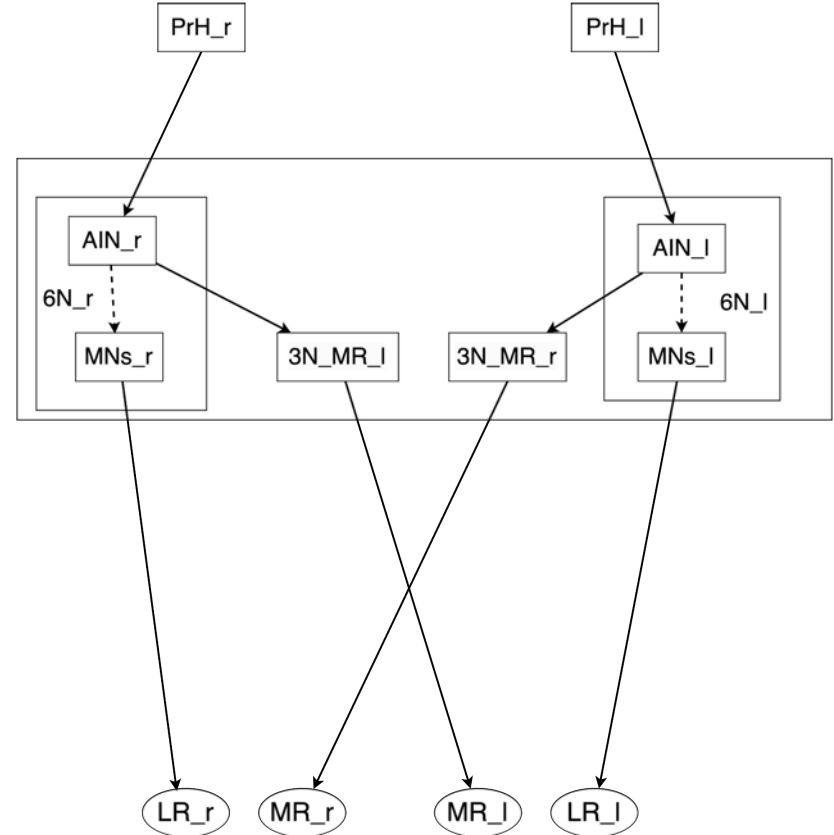
# Proposed hypothesis

- 6N is divided into MNs and AINs
- Temporal discrepancy due to the differing number of processing steps
- The presence of a direct AIN-to-MNs connection

Conventional Model:



Hypothesized BIF:





# Caveats for Data Usage / Future Publication

- This data includes several hypotheses for anatomical structures and functions relating to some nuclei such as MVe and 6N, thus requiring careful considerations when used.

- Poster Presentation at JNNS

- └ Hypothesized functional decomposition of nuclei involved in Vestibulo-Ocular Reflex based on Network motifs ┘