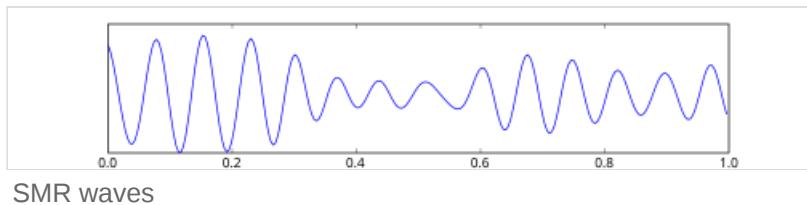




Sensorimotor rhythm

The **sensorimotor rhythm (SMR)** is a brain wave. It is an oscillatory idle rhythm of synchronized electric brain activity. It appears in spindles in recordings of EEG, MEG, and ECoG over the sensorimotor cortex. For most individuals, the frequency of the SMR is in the range of 7 to 11 Hz.^[1]



Meaning

The meaning of SMR is not fully understood. Phenomenologically, a person is producing a stronger SMR amplitude when the corresponding sensorimotor areas are idle, e.g. during states of immobility. SMR typically decreases in amplitude when the corresponding sensory or motor areas are activated, e.g. during motor tasks and even during motor imagery.^[2]

Conceptually, SMR is sometimes mixed up with alpha waves of occipital origin, the strongest source of neural signals in the EEG. One reason might be, that without appropriate spatial filtering the SMR is very difficult to detect because it is usually flooded by the stronger occipital alpha waves. The feline SMR has been noted as being analogous to the human mu rhythm.^[3]

Relevance in research

Neurofeedback

Neurofeedback training can be used to gain control over the SMR activity. Neurofeedback practitioners believe that this feedback enables the subject to learn the regulation of their own SMR. People with learning difficulties,^[4] ADHD,^[5] epilepsy,^[6] and autism^[7] may benefit from an increase in SMR activity via neurofeedback. In the field of Brain–Computer Interfaces (BCI), the deliberate modification of the SMR amplitude during motor imagery can be used to control external applications.^[8]

See also

- Electroencephalography – Electrophysiological monitoring method to record electrical activity of the brain

Brain waves

- Delta wave – (0.1 – 3 Hz)
- Theta wave – (4 – 7 Hz)
- Alpha wave – (8 – 12 Hz)
- Mu wave – (7.5 – 12.5 Hz)
- SMR wave – (12.5 – 15.5 Hz)
- Beta wave – (12 – 31 Hz)
- Gamma wave – (32 – 100 Hz)

References

1. Arroyo, S.; Lesser, RP.; Gordon, B; Uematsu, S; Jackson, D; Webber, R (1993). "Functional significance of the mu rhythm of human cortex: an electrophysiologic study with subdural electrodes" (<https://doi.org/10.1016%2F0013-4694%2893%2990114-B>). *Electroencephalography and Clinical Neurophysiology*. **87** (3): 76–87. doi:[10.1016/0013-4694\(93\)90114-B](https://doi.org/10.1016/0013-4694(93)90114-B) (<https://doi.org/10.1016%2F0013-4694%2893%2990114-B>). PMID [7691544](https://pubmed.ncbi.nlm.nih.gov/7691544/) (<https://pubmed.ncbi.nlm.nih.gov/7691544/>).
2. Ernst Niedermeyer, Fernando Lopes da Silva Electroencephalography. Basic principles, Clinical Applications and Related Fields. 3rd edition, Williams & Wilkins Baltimore 1993
3. Kaplan, Bonnie J. (1979). "Morphological evidence that feline SMR and human Mu are analogous rhythms". *Brain Research Bulletin*. **4** (3): 431–433. doi:[10.1016/S0361-9230\(79\)80021-0](https://doi.org/10.1016/S0361-9230(79)80021-0) (<https://doi.org/10.1016%2FS0361-9230%2879%2980021-0>). PMID [487196](https://pubmed.ncbi.nlm.nih.gov/487196/) (<https://pubmed.ncbi.nlm.nih.gov/487196/>). S2CID [4774796](https://api.semanticscholar.org/CorpusID:4774796) (<https://api.semanticscholar.org/CorpusID:4774796>).
4. Tansey MA (February 1984). "EEG sensorimotor rhythm biofeedback training: some effects on the neurologic precursors of learning disabilities". *Int J Psychophysiol*. **1** (2): 163–77. doi:[10.1016/0167-8760\(84\)90036-9](https://doi.org/10.1016/0167-8760(84)90036-9) (<https://doi.org/10.1016%2F0167-8760%2884%2990036-9>). PMID [6542077](https://pubmed.ncbi.nlm.nih.gov/6542077/) (<https://pubmed.ncbi.nlm.nih.gov/6542077/>).
5. Vernon, David; Tobias Egner; Nick Cooper; Theresa Compton; Claire Neilands; Anna Sheri; John Gruzelier (January 2003). "The effect of training distinct neurofeedback protocols on aspects of cognitive performance". *International Journal of Psychophysiology*. **47** (1): 75–85. doi:[10.1016/S0167-8760\(02\)00091-0](https://doi.org/10.1016/S0167-8760(02)00091-0) (<https://doi.org/10.1016%2FS0167-8760%2802%2900091-0>). PMID [12543448](https://pubmed.ncbi.nlm.nih.gov/12543448/) (<https://pubmed.ncbi.nlm.nih.gov/12543448/>).
6. Egner, Tobias; M Barry Sterman (February 2006). "Neurofeedback treatment of epilepsy: from basic rationale to practical application". *Expert Review of Neurotherapeutics*. **6** (2): 247–257. doi:[10.1586/14737175.6.2.247](https://doi.org/10.1586/14737175.6.2.247) (<https://doi.org/10.1586%2F14737175.6.2.247>). PMID [16466304](https://pubmed.ncbi.nlm.nih.gov/16466304/) (<https://pubmed.ncbi.nlm.nih.gov/16466304/>). S2CID [38841067](https://api.semanticscholar.org/CorpusID:38841067) (<https://api.semanticscholar.org/CorpusID:38841067>).
7. Pineda, Jaime; Brang, D.; Hecht, E.; Edwards, L.; Carey, S.; Bacon, M.; Futagaki, C.; Suk, D.; Tom, J.; Birnbaum, C.; Rork, A. (2008). "Positive behavioral and electrophysiological changes following neurofeedback training in children with autism" (<https://zenodo.org/record/895353>). *Research in Autism Spectrum Disorders*. **2** (3): 557–581. doi:[10.1016/j.rasd.2007.12.003](https://doi.org/10.1016/j.rasd.2007.12.003) (<https://doi.org/10.1016%2Fj.rasd.2007.12.003>).
8. Andrea Kübler and Klaus-Robert Müller. An introduction to brain computer interfacing. In Guido Dornhege, Jose del R. Millán, Thilo Hinterberger, Dennis McFarland, and Klaus-Robert Müller, editors, Toward Brain–Computer Interfacing, pages 1–25. MIT press, Cambridge, MA, 2007

Further reading

- Robbins, Jim (2000). *A Symphony in the Brain*. Atlantic Monthly Press. ISBN 978-0-87113-807-1.
 - Sterman, M. B.; Wywicka, W. (1967). "EEG correlates of sleep: Evidence for separate forebrain substrates". *Brain Research*. **6** (1): 143–163. doi:10.1016/0006-8993(67)90186-2 ([https://doi.org/10.1016/0006-8993\(67\)90186-2](https://doi.org/10.1016/0006-8993(67)90186-2)). PMID 6052533 (<https://pubmed.ncbi.nlm.nih.gov/6052533/>).
 - Wywicka, W.; Sterman, M. B. (1968). "Instrumental conditioning of sensorimotor cortex eeg spindles in the waking cat". *Physiology and Behavior*. **3** (5): 703–707. doi:10.1016/0031-9384(68)90139-X ([https://doi.org/10.1016/0031-9384\(68\)90139-X](https://doi.org/10.1016/0031-9384(68)90139-X)).
 - Warren, Jeff (2007). "The SMR". *The Head Trip: Adventures on the Wheel of Consciousness* (<https://archive.org/details/headtrip00jeff>). Toronto: Random House Canada. ISBN 978-0-679-31408-0.
 - Arns, Martijn; Sterman, Maurice B. (2019). *Neurofeedback: How it all started*. Nijmegen, The Netherlands: Brainclinics Insights. ISBN 9789083001302.
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