

Beyin Çizgesi Yöntemi ve Kafatasından Almaşık Akım Uyarımı

Elektroensefalografi (EEG)
transkraniyel Alternatif Akım Uyarımı (tACS)

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İçindekiler

EEG (Nörogörüntüleme)

- Giriş
 - Nöron ve aksiyon potansiyeli
 - Kortikal yapı
- EEG nedir?
 - Genel bilgiler
 - Kayıt
 - Artifakt
- Sinyaller ve sinyal işleme
 - Zaman ve sıklık alanları
 - Karmaşık düzlem
 - Matematiği
- Yorumlanması
 - Potansiyeller
 - Osilasyonlar
- Ağ yapısı

tACS (Nöromodülasyon)

- Giriş
- Akım uyarımı
- Uyarım
- Akım yoğunluğu
- Değişkenler

Bilim dallarındaki ifadesi

Yaklaşım: İndirgemecilik, deneyselcilik, istatistik

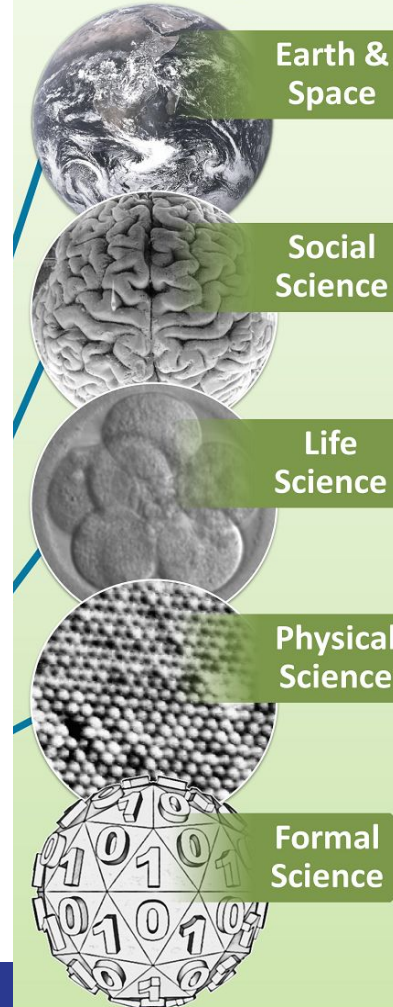
Nörogörüntüleme yöntemleri

Psikoloji: Psikofizyoloji, nöropsikoloji, duygu (affekt)

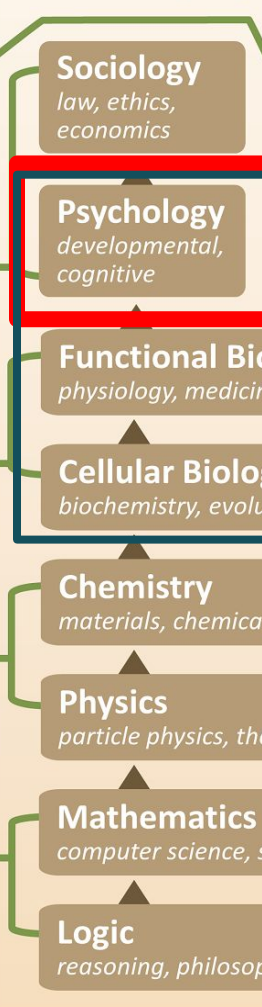
Bilişsel bilimler: Biliş, örgütlenme, ağ yapısı

Sinirbilim: Bilinç, nörofizyoloji, sinirsel iletişim

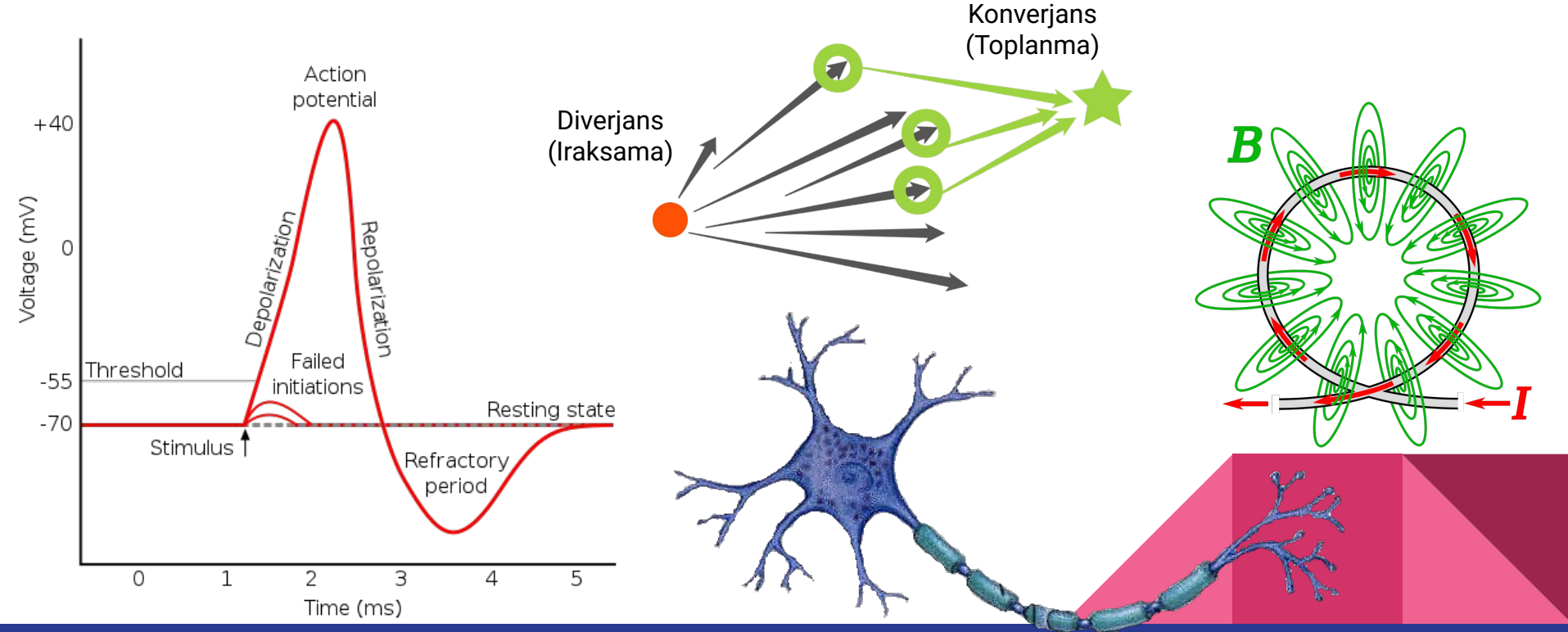
Branches of Science



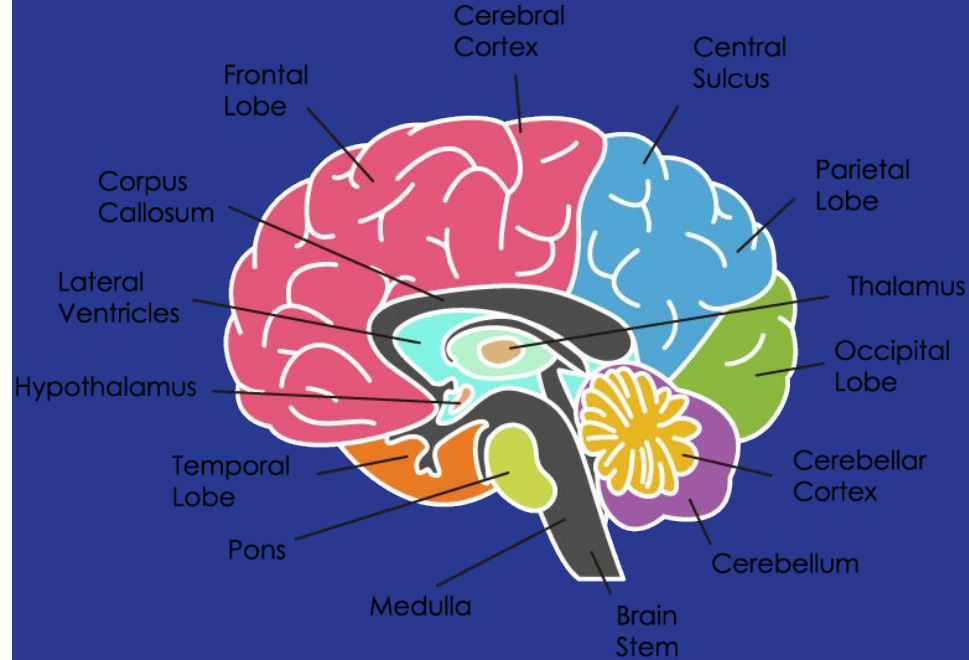
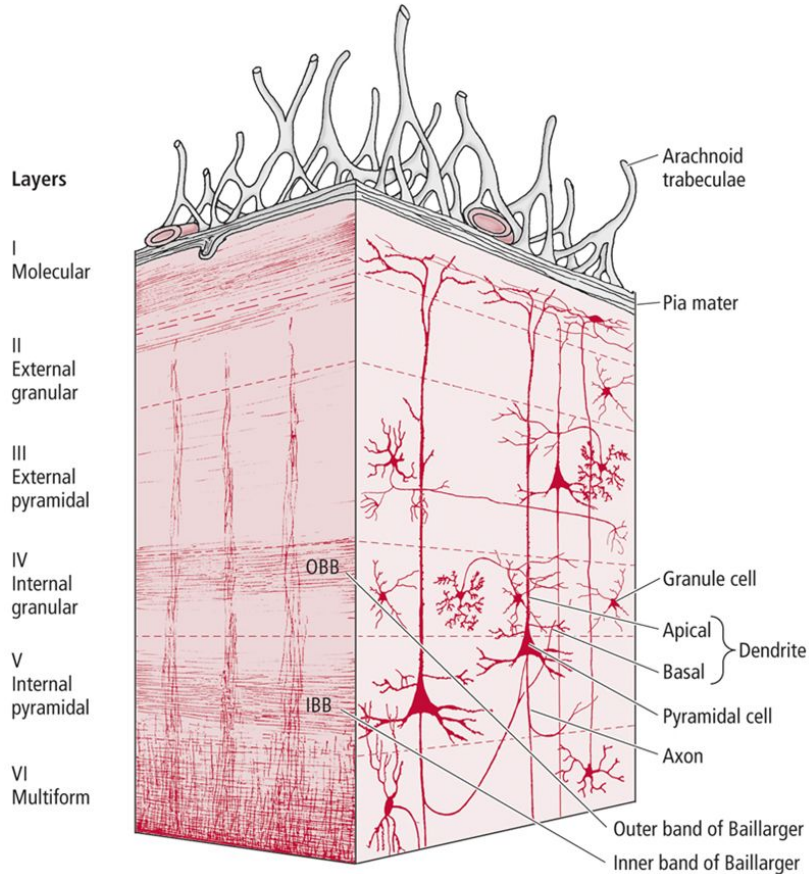
Hierarchy of



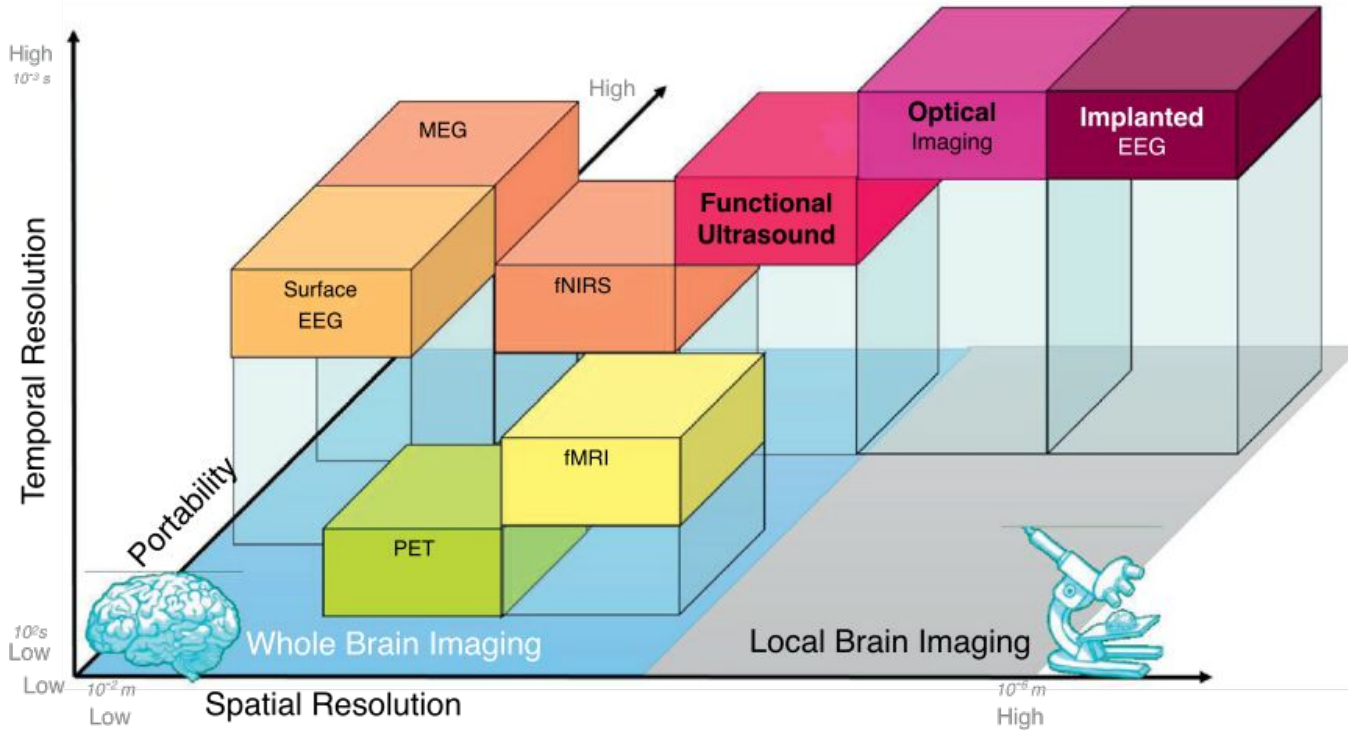
Nöron (sinirgözesi) ve aksiyon potansiyeli



Kortikal yapı



Çözünürlük (Uzamsal, Zamansal)

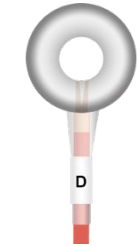
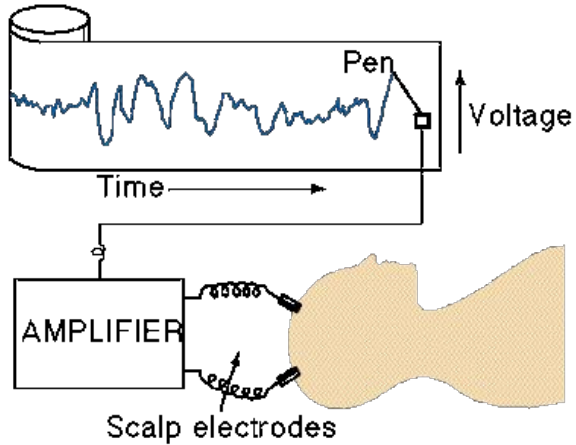
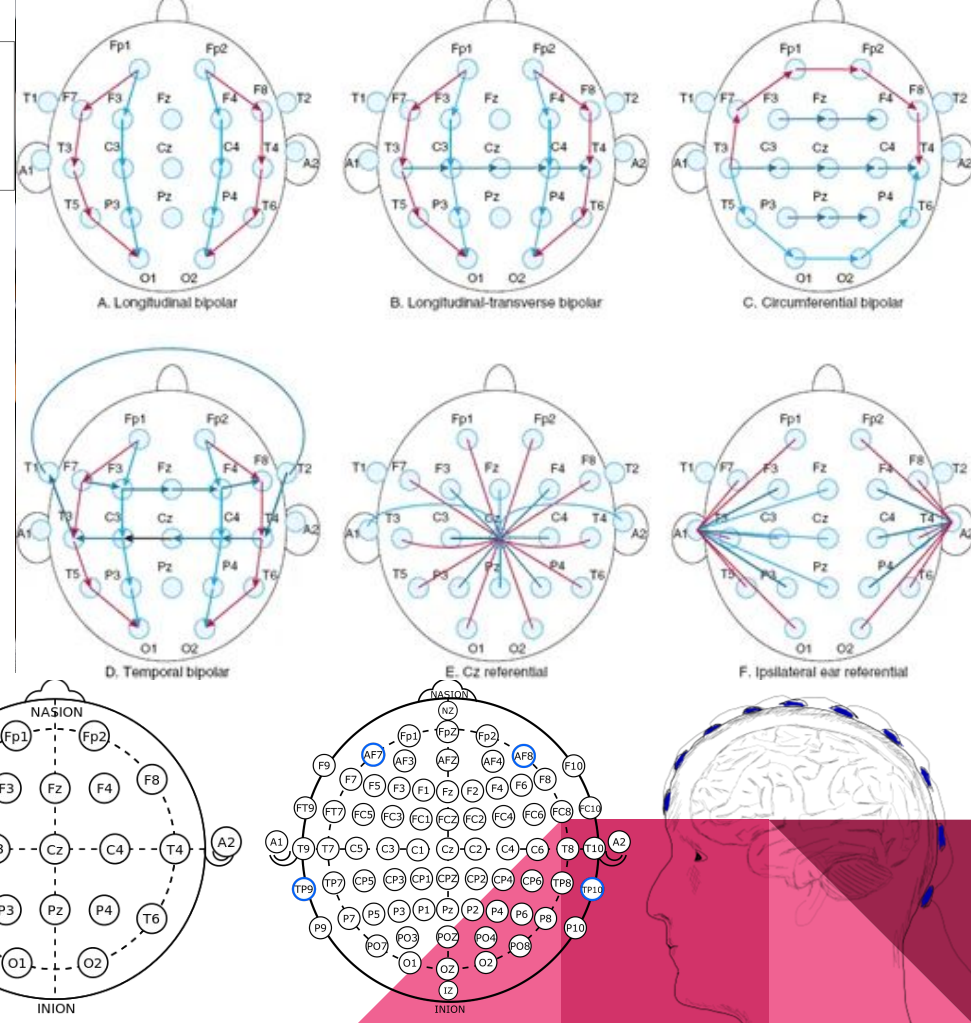
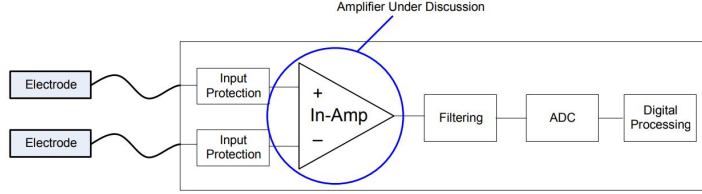


Nörogörüntüleme Yöntemleri

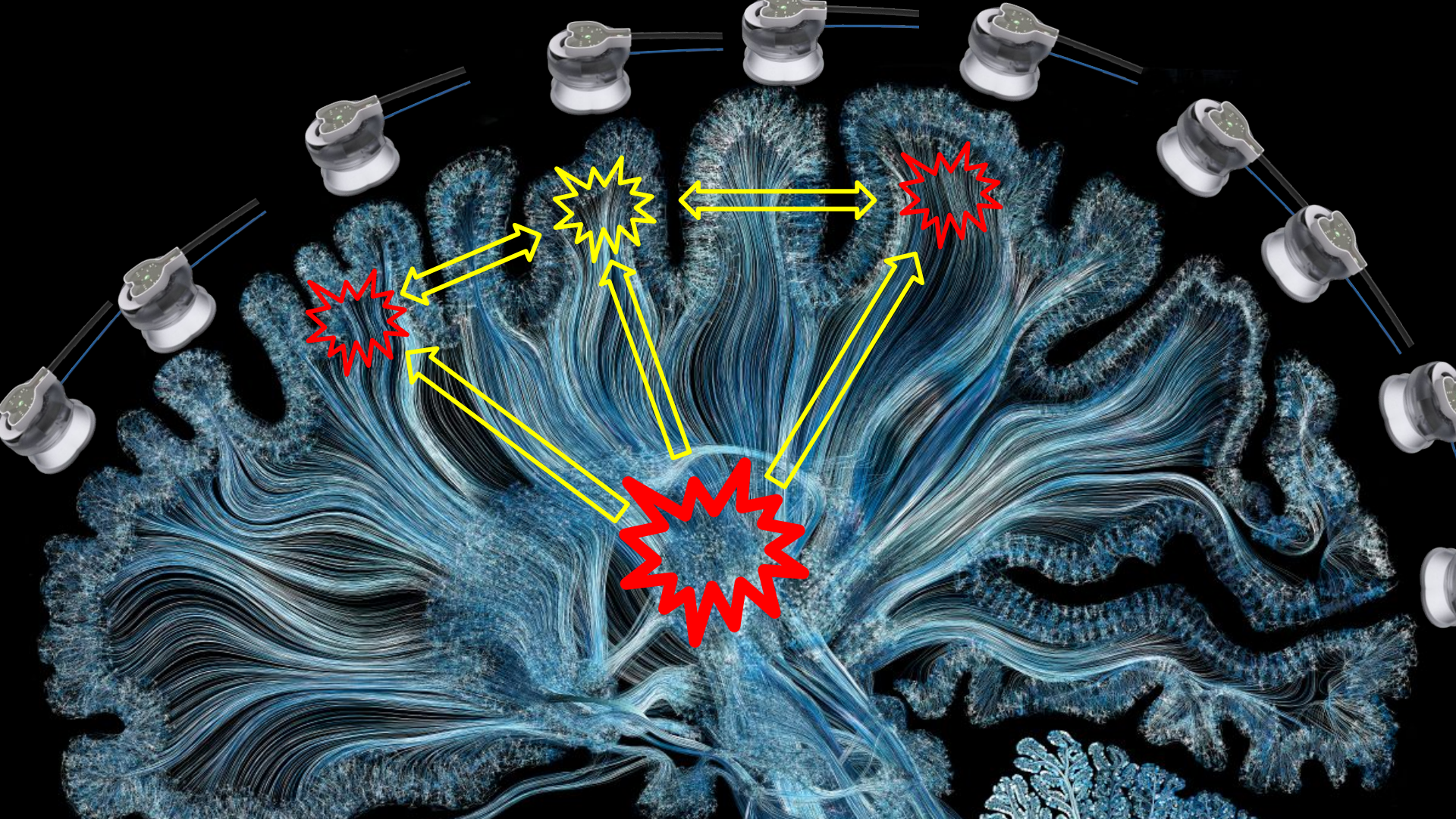
- **EEG**
 - Elektrik alan (e^-)
- **MEG**
 - Manyetik alan (B)
- **fMRI**
 - Manyetik güç (T)
 - Radyo dalgası (GHz)
- **PET**
 - Gamma ışıma (γ)
- **fNIRS**
 - Kızılötesi ışıma (IR)

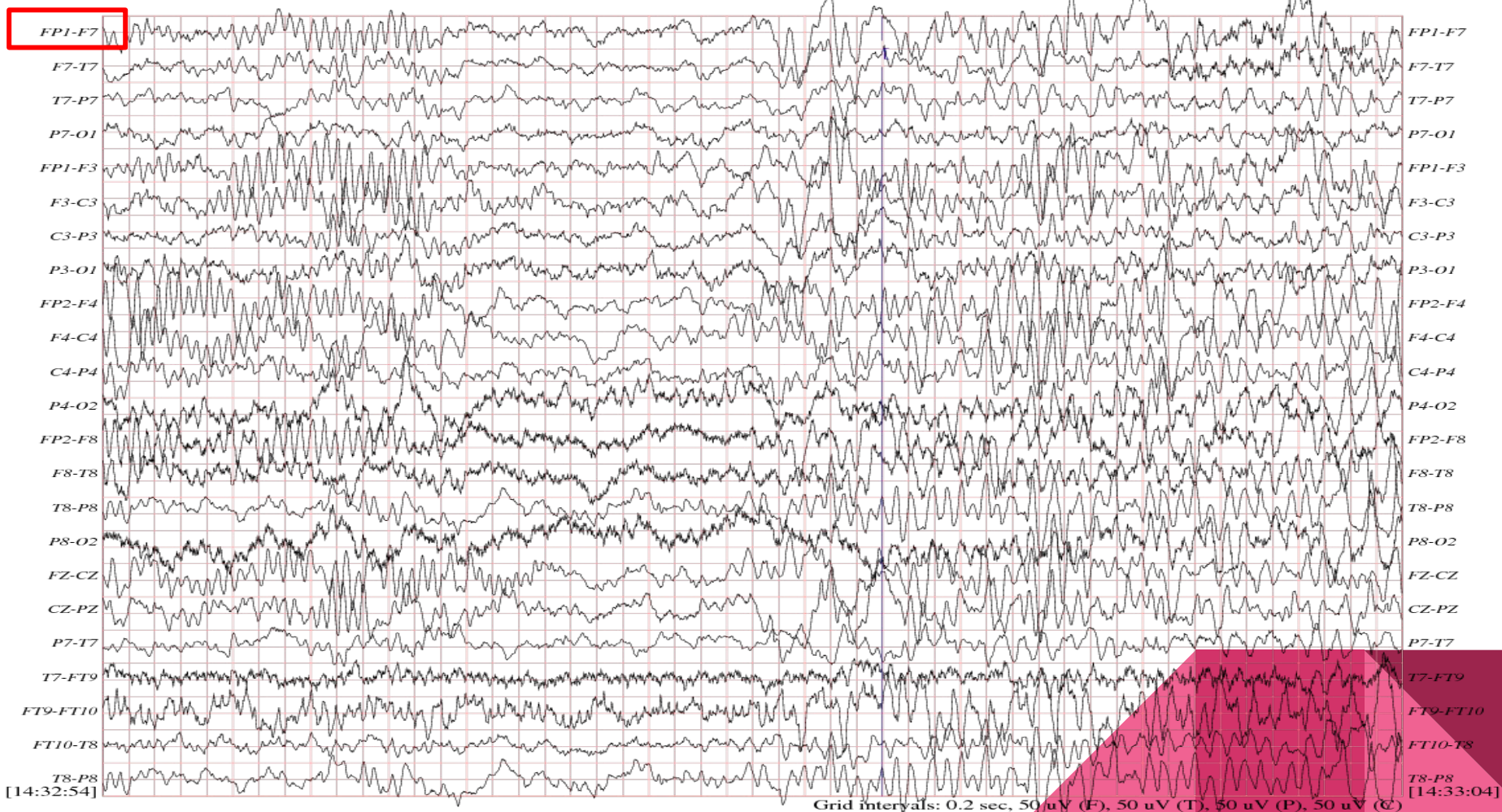
EEG

- Elektrik aktivitenin doğrudan ölçümü
- Elektrotlar, yükseltici ve dönüştürücü
- Yerleştirme (10-20 sistemi)
- Montajlar









Grid intervals: 0.2 sec, 50 μ V (F), 50 μ V (T), 50 μ V (P), 50 μ V (C)

Adımlar

A. Kayıt:

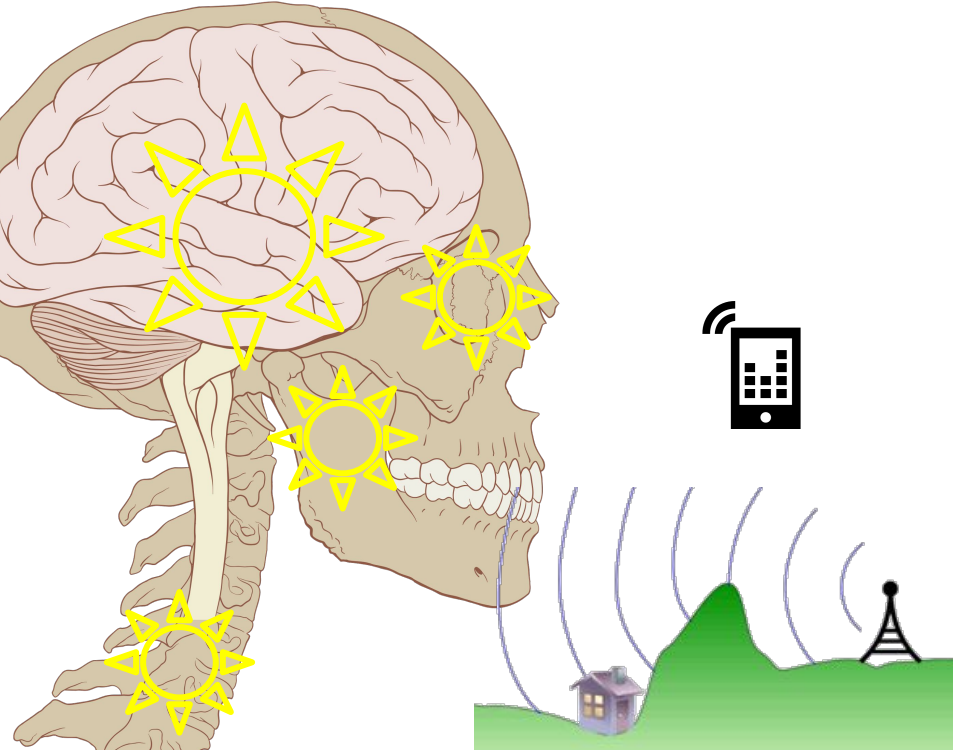
1. Katılımcıyla Ön Görüşme
 - a. Kabul/red
 - b. Test ve ölçekler
2. Kurulum
3. Hazırlık
 - a. Yerleştirme
 - b. Empedans düşürme
4. Yönergeleme ve Deneme Çekimi
5. Kayıt
 - a. Spontan: Gözler açık & Gözler kapalı
 - b. Paradigma/Görev ...
6. Son Görüşme ve Temizlik



B. Analiz:

1. Ön-işleme:
 - a. Filtreleme
 - b. Dilimleme (Segmentation)
 - c. Temizleme (Artifact rejection)
2. Sinyal Analizi
 - a. Zaman ve/veya frekans alanlarında
 - b. Bağlantısallık...
 - c. Genel Ortalama (Gruplar içinde)
3. İstatistiksel Analiz
4. Yorumlama

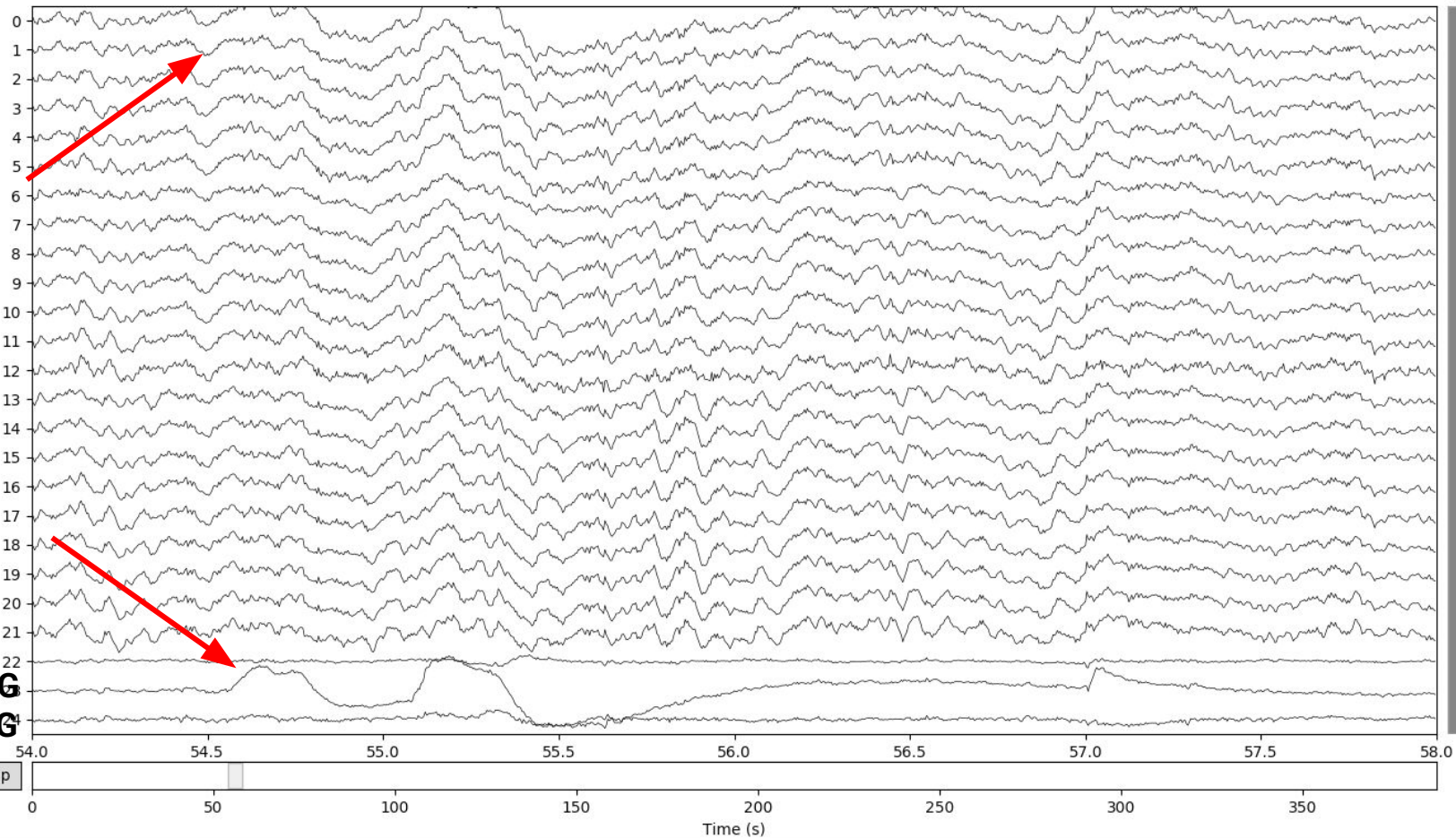
Yapay sinyaller (Artifact)

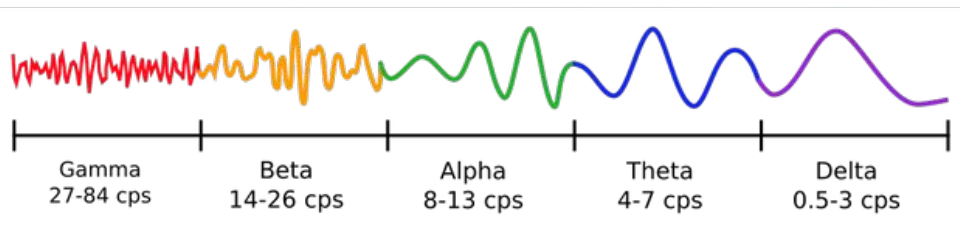
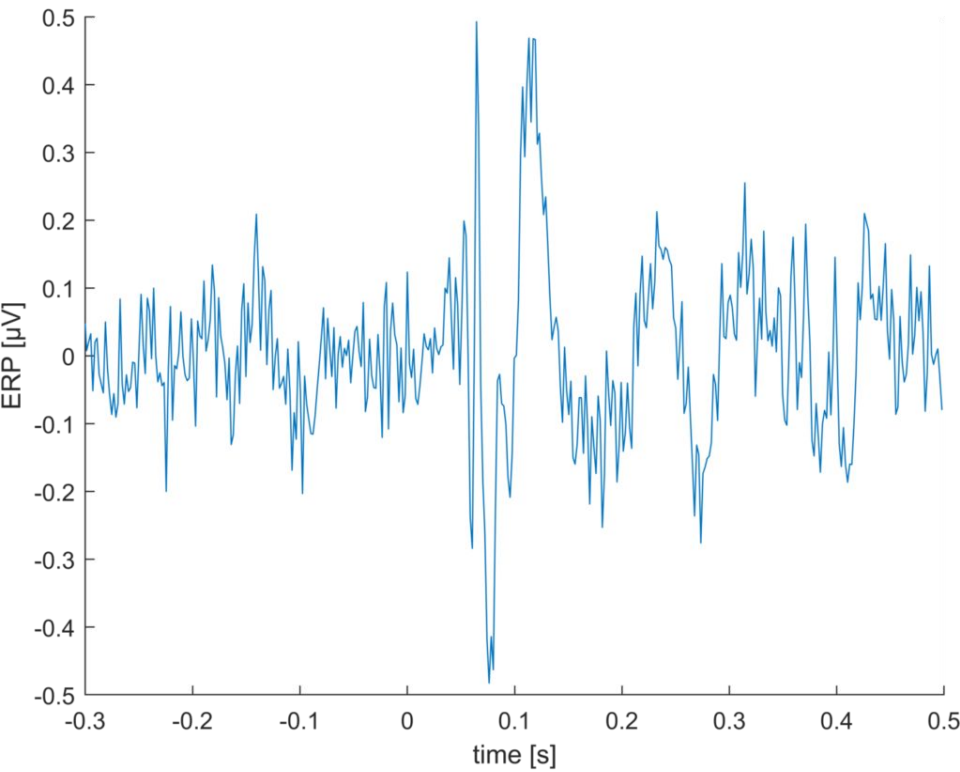


- İç kaynaklar
 - Göz hareketleri
 - Göz kırpmaları
 - Kas gürültüleri
 - Yüz ve çene kasları
 - Şakak kasları
 - Boyun ve beden kasları
 - Elektrot gürültüleri
- Dış kaynaklar
 - Elektromanyetik sinyaller
 - Şehir şebekesi (50-60 Hz)

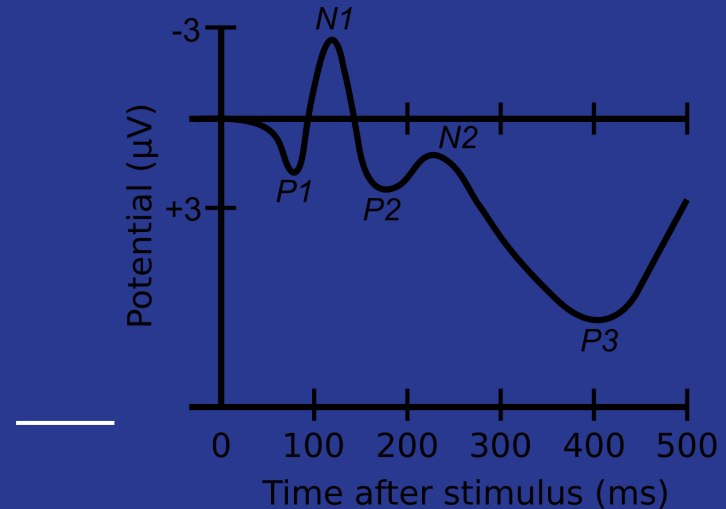
HEOG
VEOG

Help

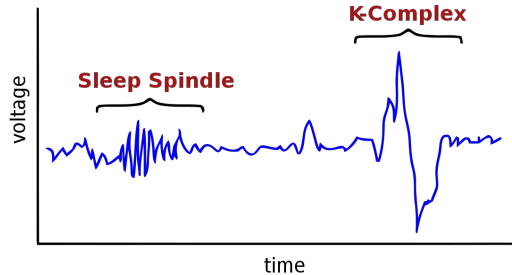
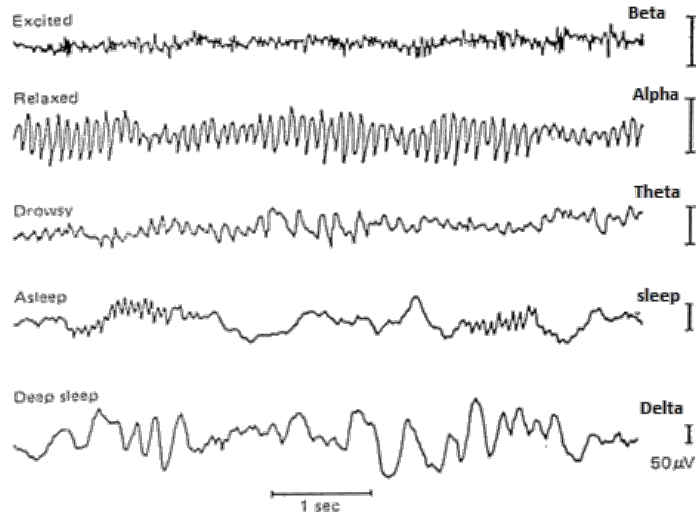




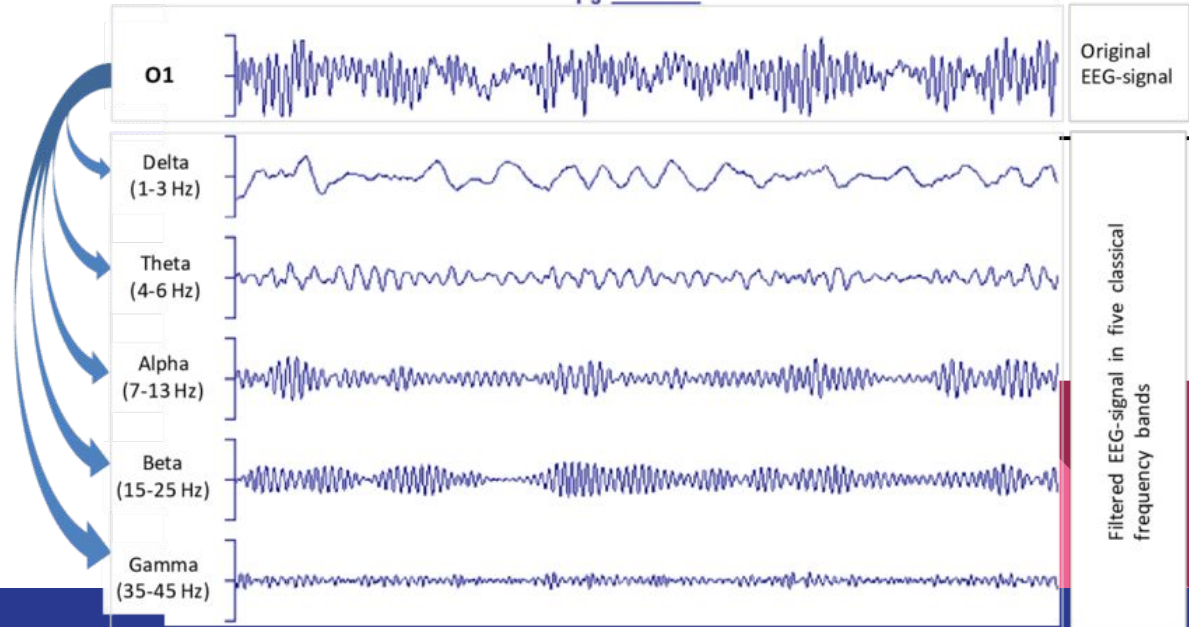
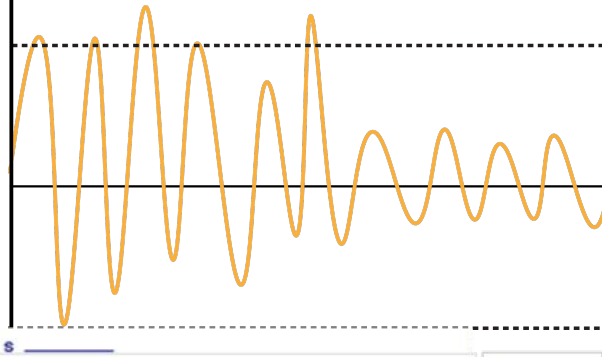
- Event-related potentials (ERP)
Olaya ilişkin potansiyeller
- **Superposition**
- Event-related oscillations (ERO):
Olaya ilişkin salınımlar



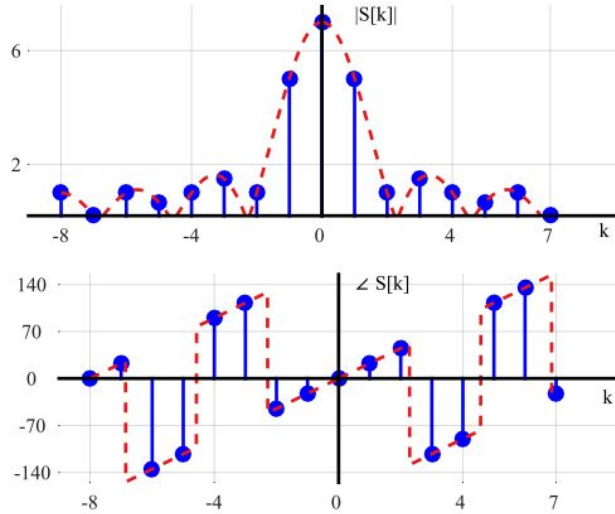
Klinik & Deney



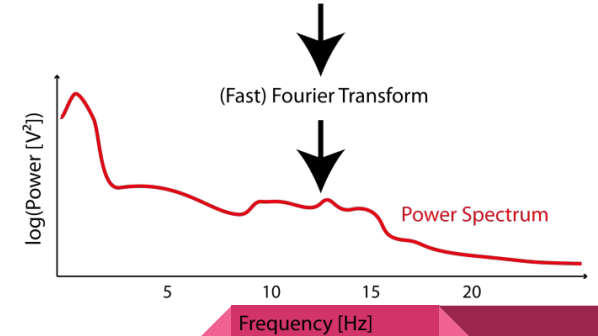
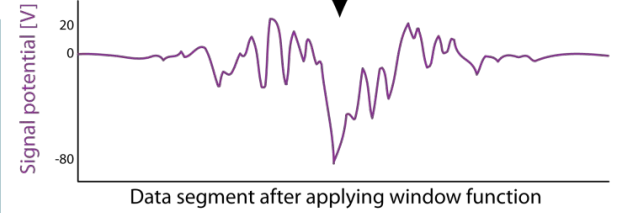
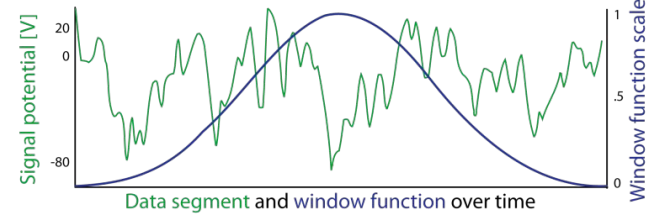
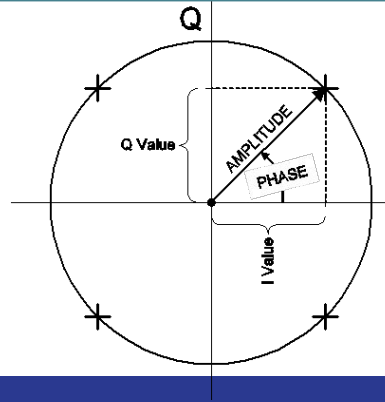
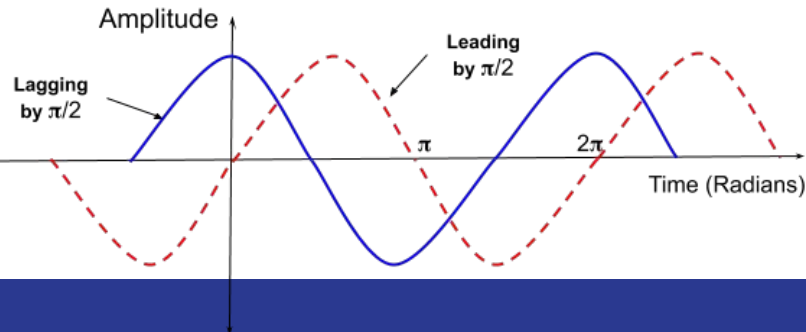
Desynchronized Alpha Wave Activity



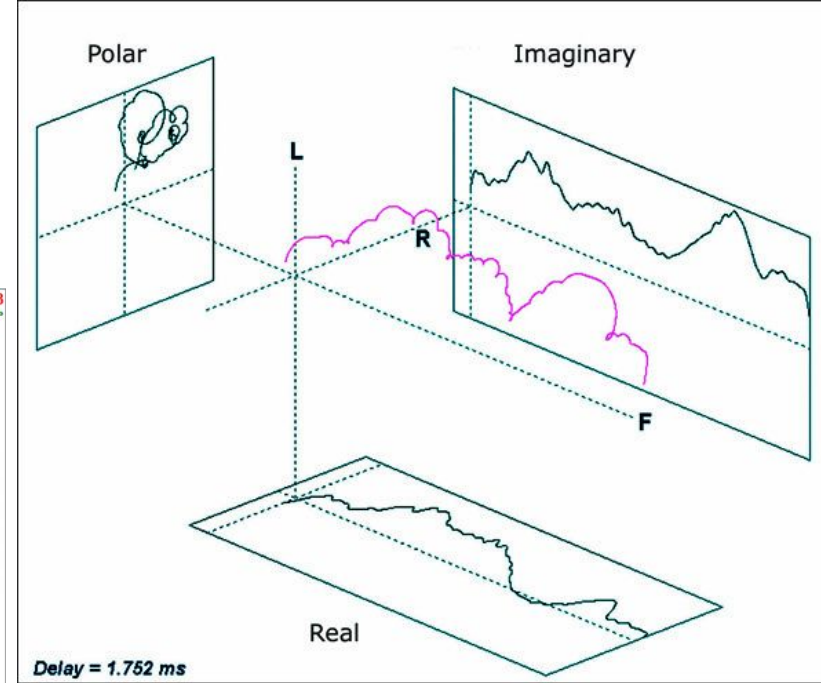
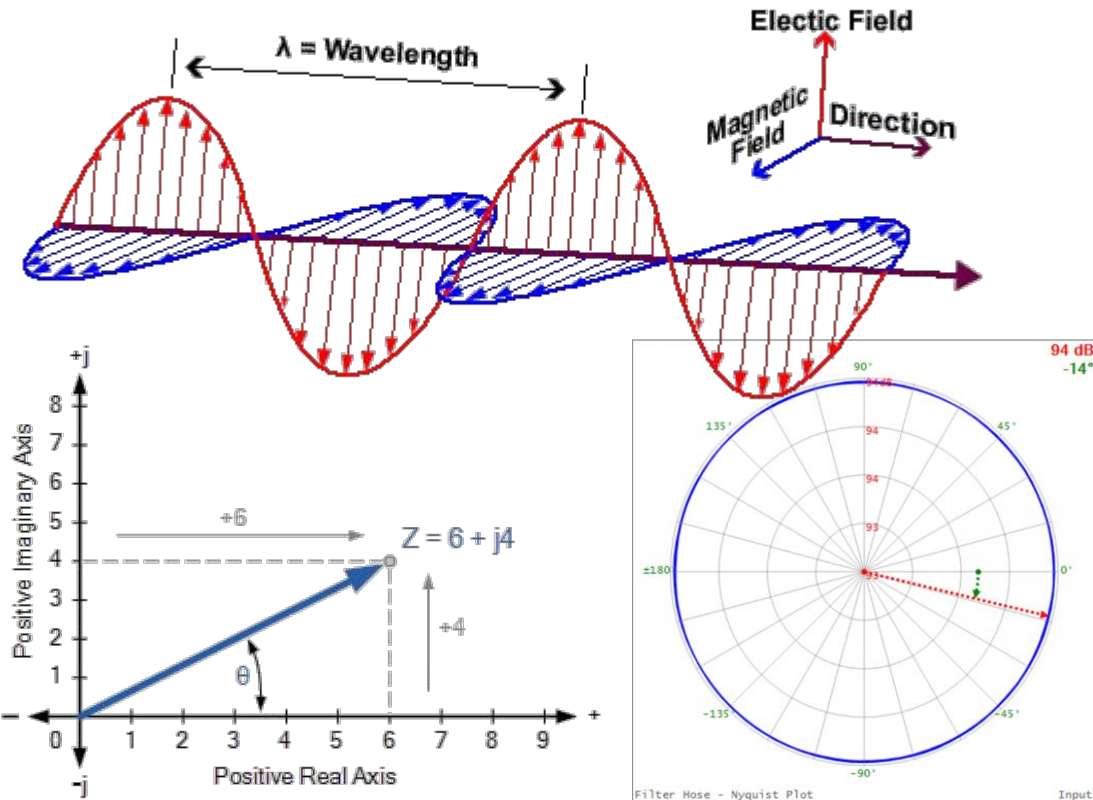
Zaman alanı & Sıklık alanı



- **Genlik/Güç (Amplitüd, mV)**
 - Ne kadar güçlü?
- **Sıklık (Frekans, Hz)**
 - Ne kadar hızlı?
- **Faz (Evre, radian)**
 - Ne zaman?



Karmaşık düzlem (Gerçek & Sanal)



Matematiği

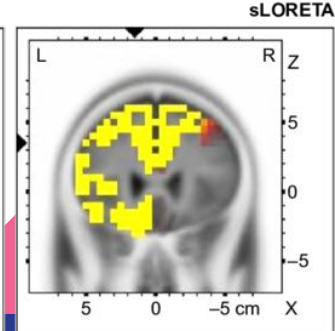
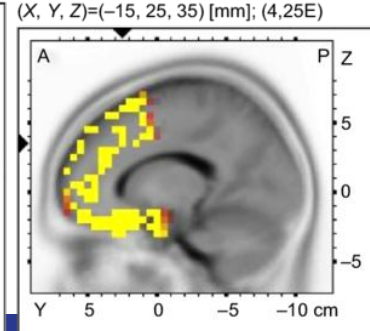
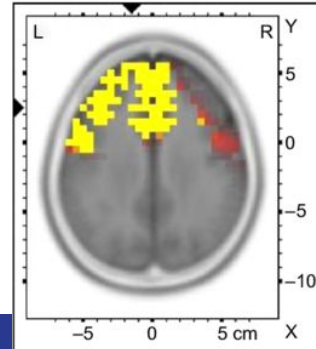
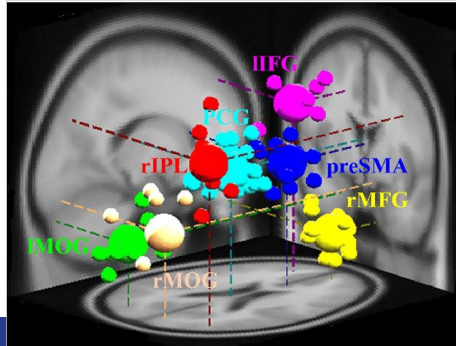
- **Sinüs dalgası:** Sinyal, Gaussian
- **Trigonometri** (Sinüs, kosinüs, radyan): Sinüs teoremi (Law of sines)
- **Karmaşık sayılar:** Euler formülü, Karmaşık düzlem ve Karmaşık fonksiyonlar
- **Matrisler:** Sayıl çarpım (Nokta/skaler çarpım)
 - **Matris dönüşümleri:** Fourier dönüşümü (FFT) ve Wavelet dönüşümü
 - **Diferansiyel denklemler** (Laplacian dönüşüm)



Yorumlanması

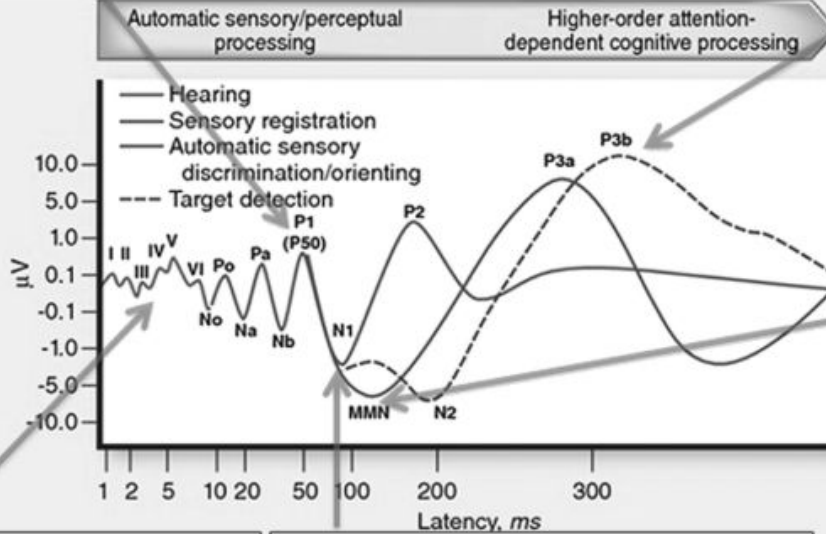
- Olaya ilişkin potansiyeller
 - Genlik
 - Gecikme, faz
- Olaya ilişkin salınımlar
 - Güç
 - Frekans
 - Faz

- Aktivite (Spontan EEG)
- Yanıt (Uyaran/Olay)
- Yerelleştirme (Üreticisi)
- Bağlantısallık (İletişim)



Olaya İlişkin Potansiyeller

- N170
- P300 (P3a, P3b)



Middle latency responses
Generator: Primary auditory cortex.
Function: They reflect early auditory processing.
Hallucinations: Reduction of P1 suggests hallucinations interfere with hearing external sounds.

P3a and P3b
Generators: Frontal and parietal lobes, respectively.
Function: They reflect the allocation of attention, elicited passively or effortfully.
Hallucinations: Reduction of P3a suggests hallucinations affect the registration of salience of external events, and reduction of P3b suggests an inability to attend to task relevant events.

Brain stem responses
Generators: 8th nerve through brainstem.
Function: They reflect the integrity of the early auditory system.
Hallucinations: There are no reports of brain stem responses being affected by hallucinations.

N1
Generators: primary and secondary auditory cortex, but influenced by frontal lobe activity.
Function: N1 reflects hearing levels and auditory perception.
Hallucinations: Reduction of N1 suggests hallucinations interfere with higher level auditory processing.

MMN
Generators: Secondary auditory cortex, and frontal lobes.
Function: It reflects automatic registration of auditory sensory memory.
Hallucinations: Reduction of MMN suggests hallucinations affect early sensory memory for auditory events.

Olaya İlişkin Osilasyonlar

- **Örnek çalışma:** Aktürk, T., Işoğlu-Alkaç, Ü., Hanoğlu, L., Güntekin, B., 2019. Age related differences in the recognition of facial expression: Evidence from EEG event-related brain oscillations. Int. J. Psychophysiol. <https://doi.org/10.1016/j.ijpsycho.2019.11.013>
- **Frekans bantları:**
 - Yavaş: **Delta** (0,5 - 3,5 Hz), **Teta** (4 - 7 Hz), **Alfa** (8 - 13 Hz ve *Mu*)
 - Hızlı: **Beta** (13 - 30 Hz), **Gama** (30 + Hz ve *Ripple* (~200))
- **Evoked** yanıt - **Induced** yanıt
- **Genlik ve Güç:**
 - **Total power:** Ortalama alındıktan sonra güce bakılır.
 - **Evoked power:** Her bir süpürümün gücünün ortalaması alınır.
 - **Induced power:** Total'den evoked çıkarılır.
- **Faz:** 0 - 1 arasında değer alır.
 -

Yüz ifadelerinde osilasyonlar

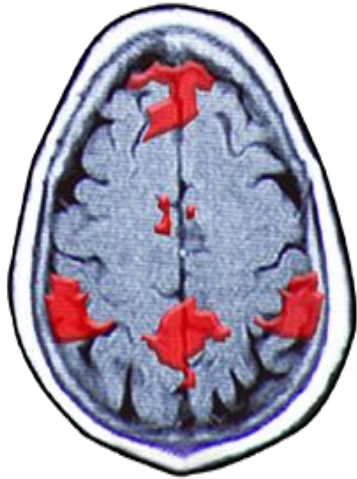
- **Örnek çalışma:** Güntekin, B., Başar, E., 2014. A review of brain oscillations in perception of faces and emotional pictures. *Neuropsychologia* 58, 33–51.
<https://doi.org/10.1016/j.neuropsychologia.2014.03.014>

Gamma	
Modality	Face > Non Face
	Upright Faces > Inverted Faces
	Known Faces > Unknown faces
Face Expression	Angry Face Expression > Neutral Face Expression
	Fearful Face Expression > Neutral Face Expression
	Unpleasant Stimuli > Neutral stimuli



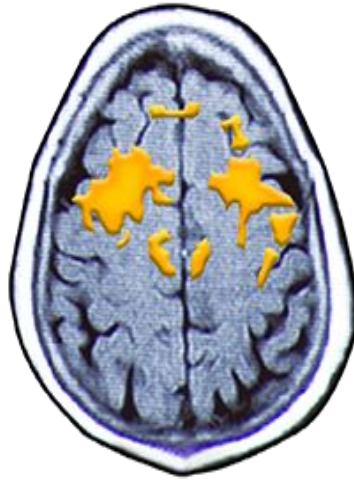
Ağlar (network)

Olağan Durum Ağı



Activates when not performing a task;
daydreaming, mind wandering and
thinking about others.

Dikkat Değiştirme Ağı



Switching between the
Default Mode Network and the
Central Executive Network.

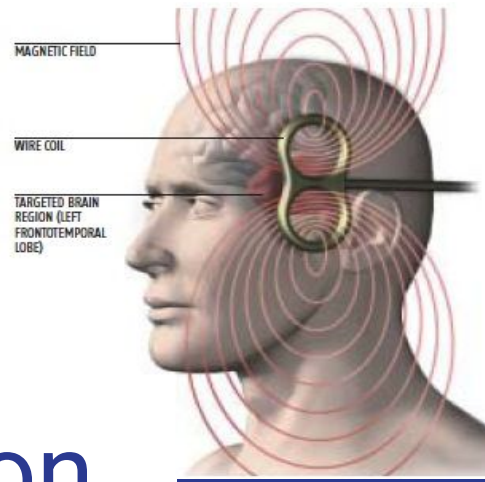
+%5

Merkezi Yürütücü Ağ



Engages your conscious brain
to think and maintains attention
on a prioritized task.

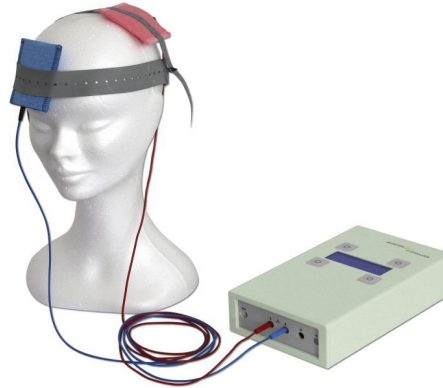
Nöromodülasyon: **tACS**



Nöromodülasyon

- tES (**tACS**, tDCS, tRCS), EKT
- TMS
- tFUS

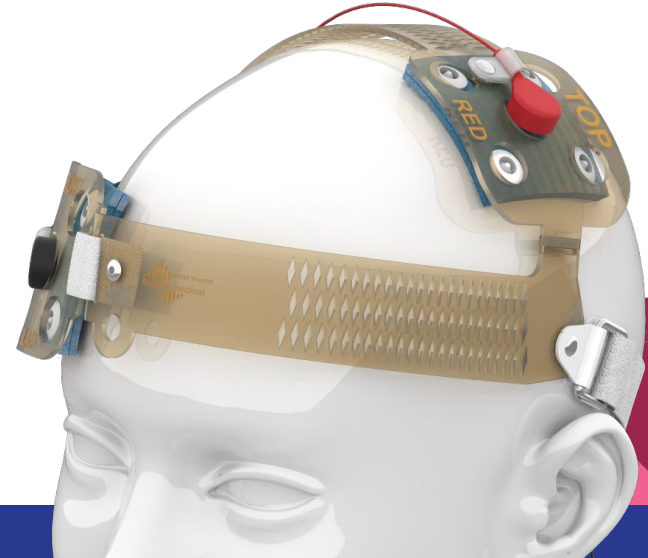
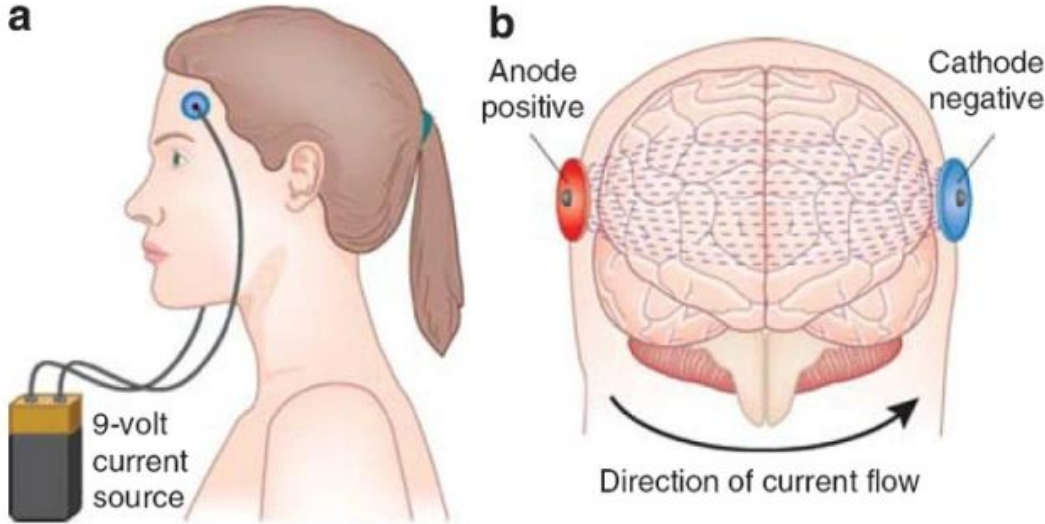
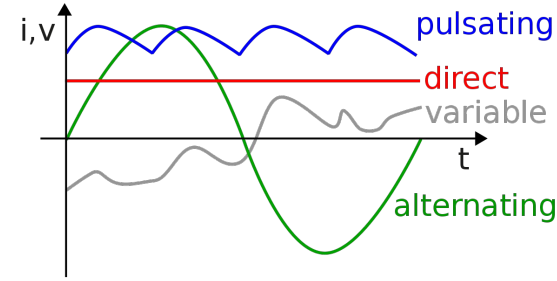
*ve güvenlik



Akım uyarımı (Doğru/Almaşık)

Doğru akım: **Anot**'tan (+), **katot**'a (-) akan akım.

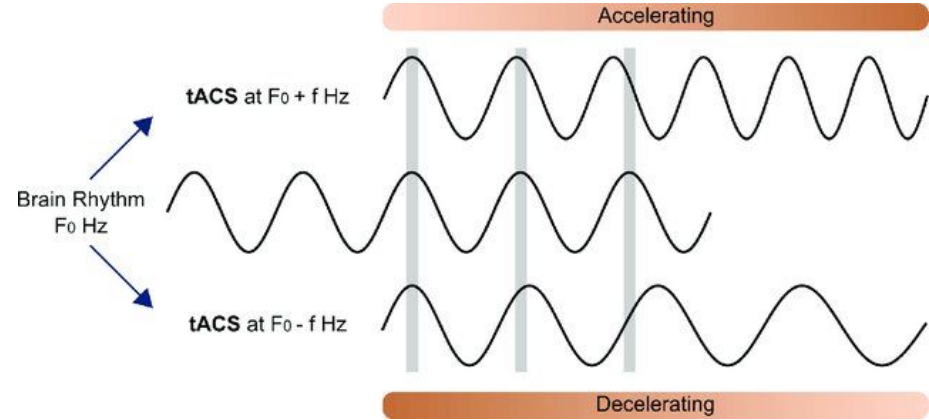
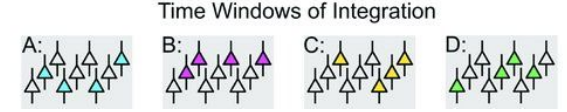
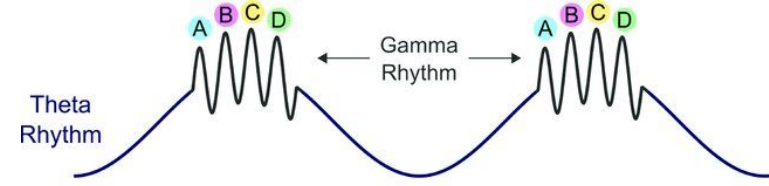
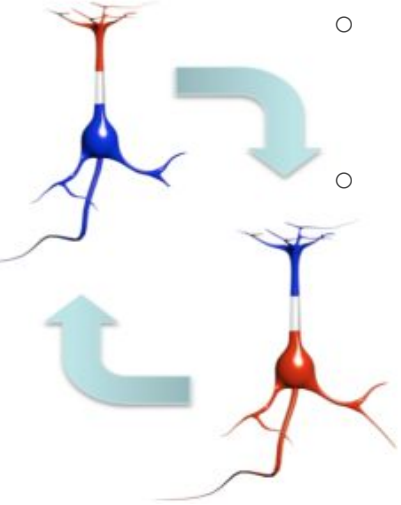
Alternatif (Almaşık) akım: Uçlar arasında salınan akım.



Uyarım (Uyarma & ketleme)

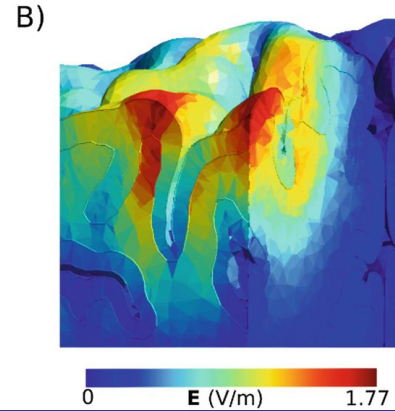
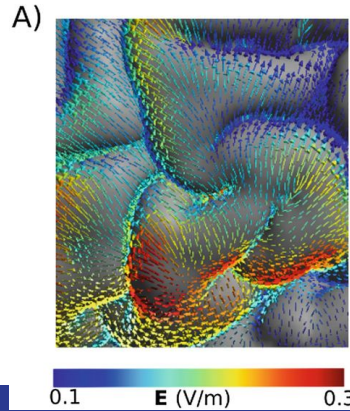
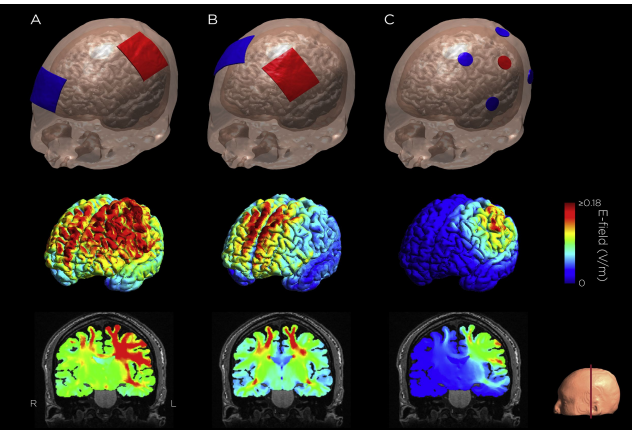
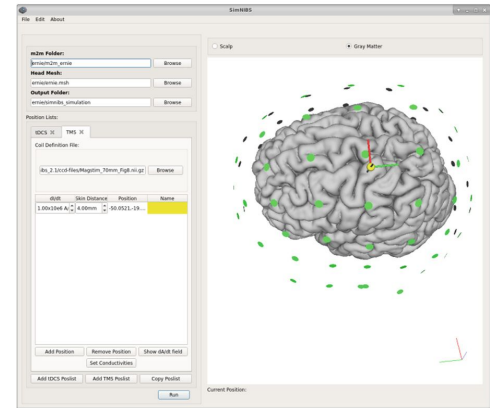
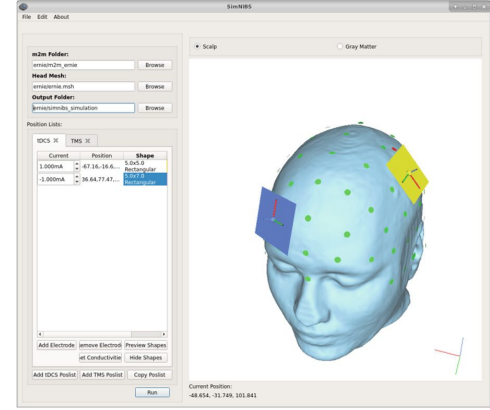
Akson, demet yönü ve aksiyon potansiyeli

- Doğrusal uyarım (ör. TMS)
- Dolaylı uyarım (ör. tES)
 - Polarizasyon (tDCS)
 - Depolarizasyon: Eksitasyon
 - Hiperpolarizasyon: İnhibisyon
 - Sürüklenme (Entrainment, tACS)
 - Hızlandırma
 - Yavaşlatma
 - Faz Resetleme
 - Coupling



Akım yoğunluğu

- Doku yalıtkanlığı
 - Saçlı deri!
 - Kafatası
- Doku iletkenliği
 - Deri (Bridge)
 - BOS



Değişkenler

Hedef: 0 bölgedeki akım yoğunluğu...

Konum: Uyarım ve referans elektrotları

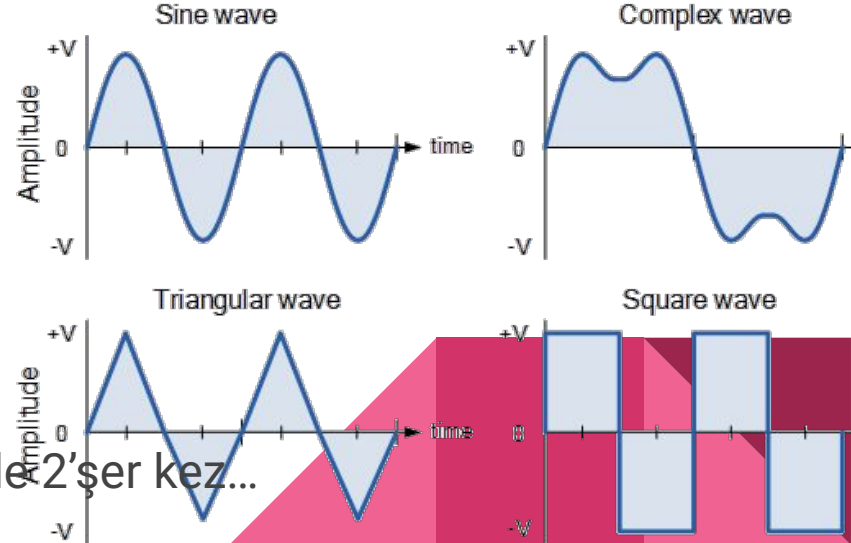
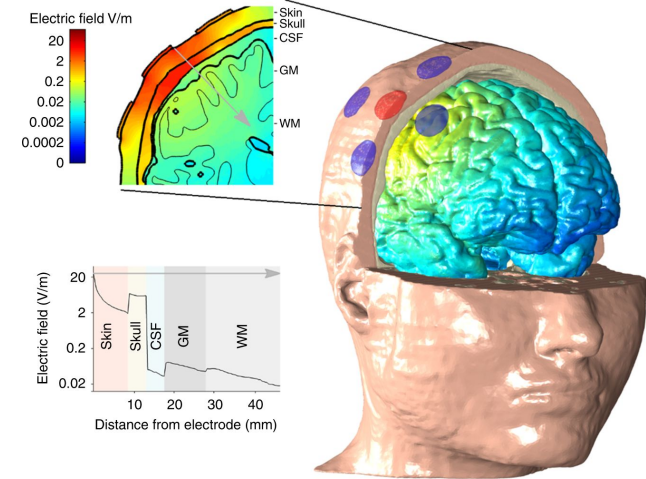
Elektrot boyutu: 5x5 cm, 7x5 cm...

Akım yoğunluğu: 0.1 (Sham) - 2 mA...

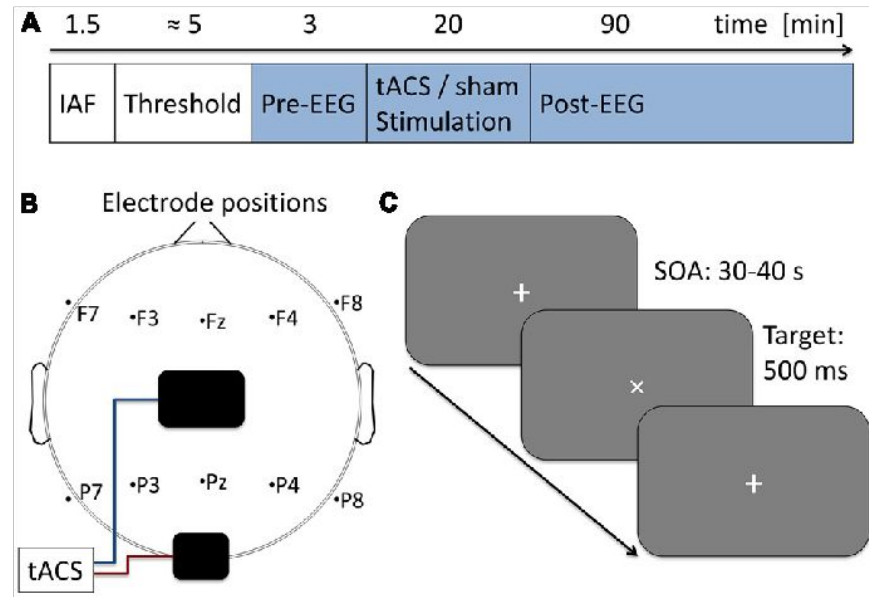
Süre: 5 - 40 dk...

Dalga formu: Sinüs, kare...

Oturum sayısı ve sıklığı: 2 hafta boyunca günde 2'ser kez...



Örnek



Dinlediğiniz için sağ olun.

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