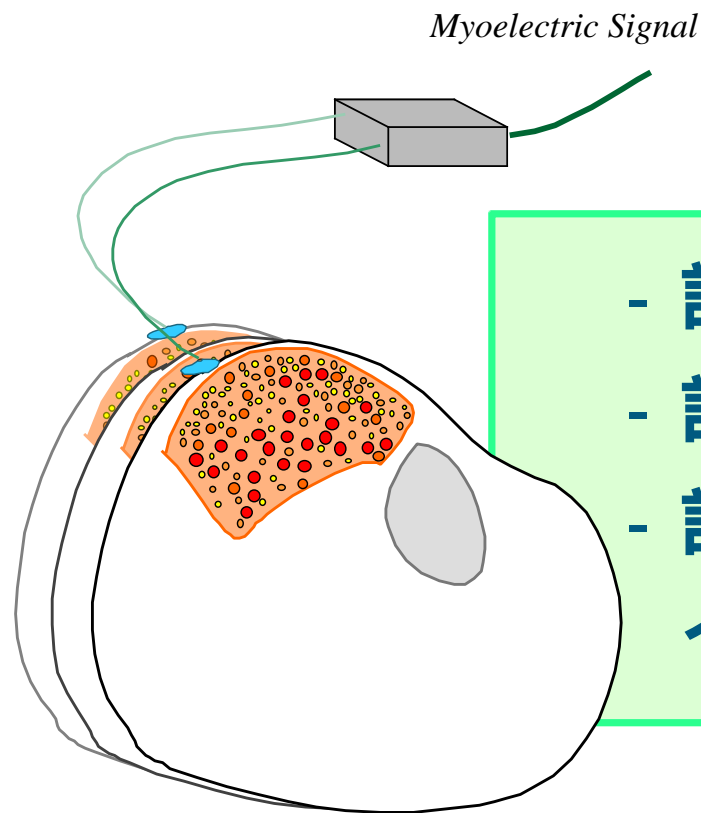


多チャンネルアレイ電極による 表面筋電図の計測と解析

木竜 徹 (新潟大学大学院自然科学研究科)



- 計測対象の物理的・生理的特性
- 計測装置の振幅・周波数特性
- 計測対象と計測装置との
インタフェース

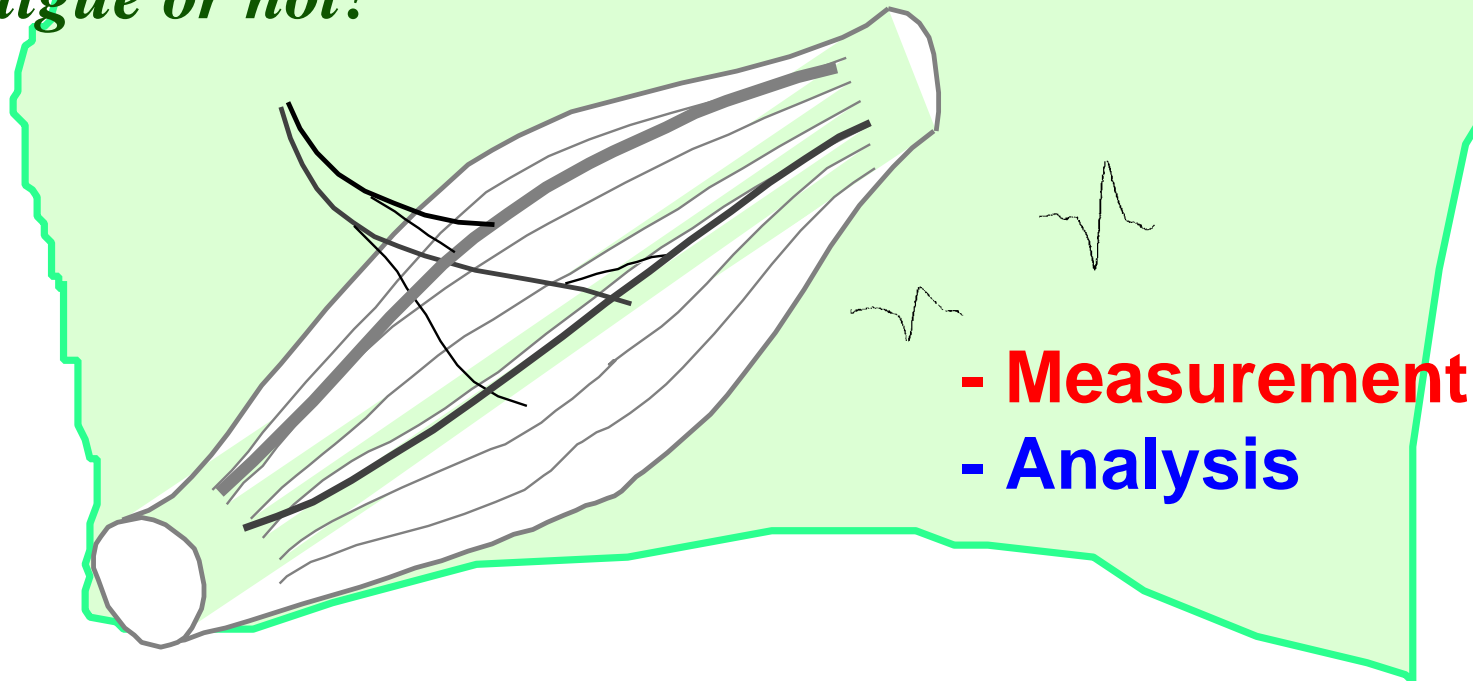
tibialis anterior muscle

筋活動様式をとらえる計測

Which types of MUs are activated as the function of time?

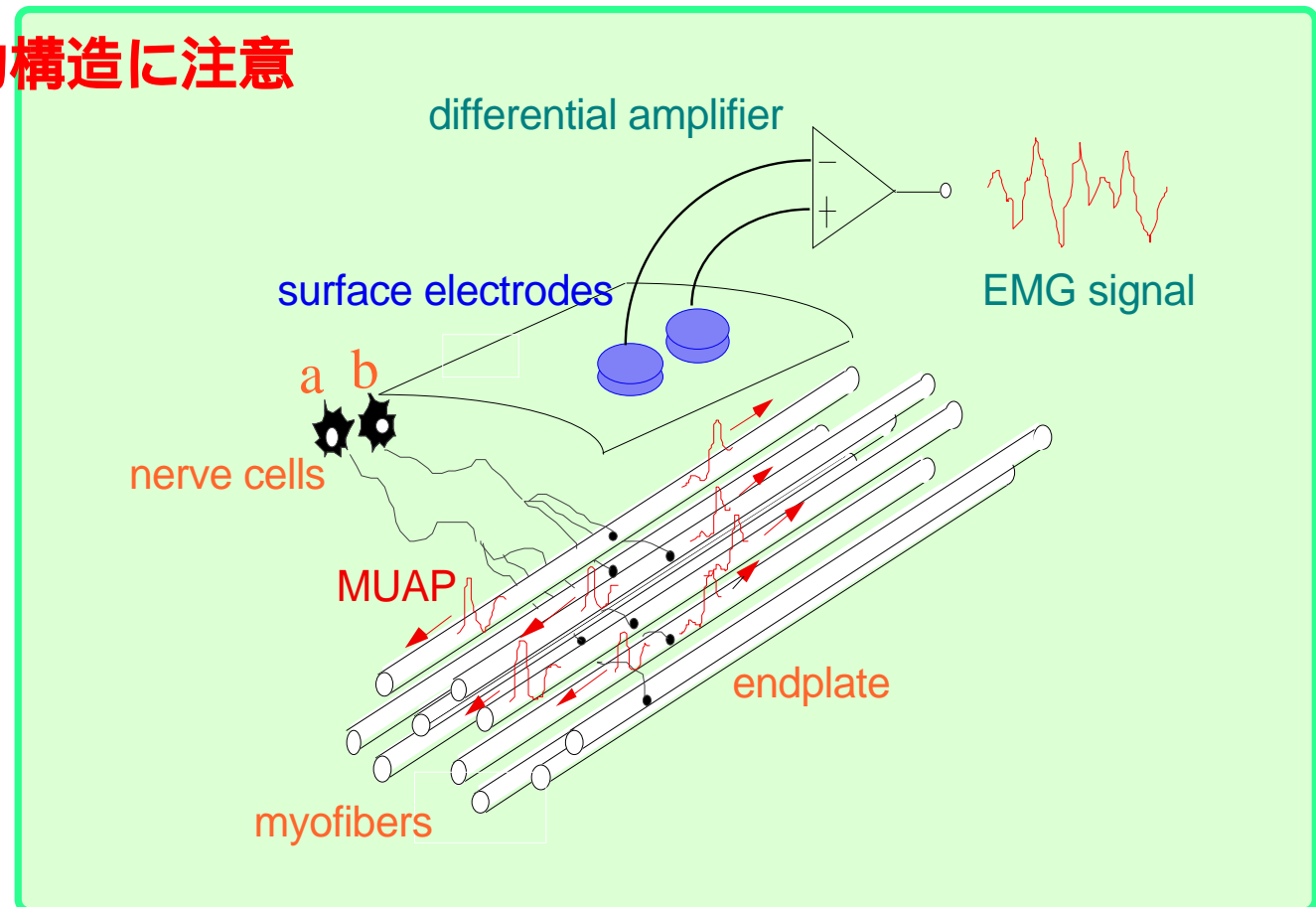
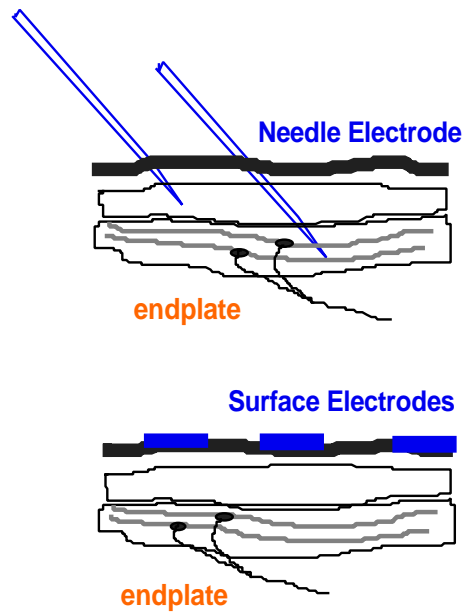
Which muscles are active?

Fatigue or not?

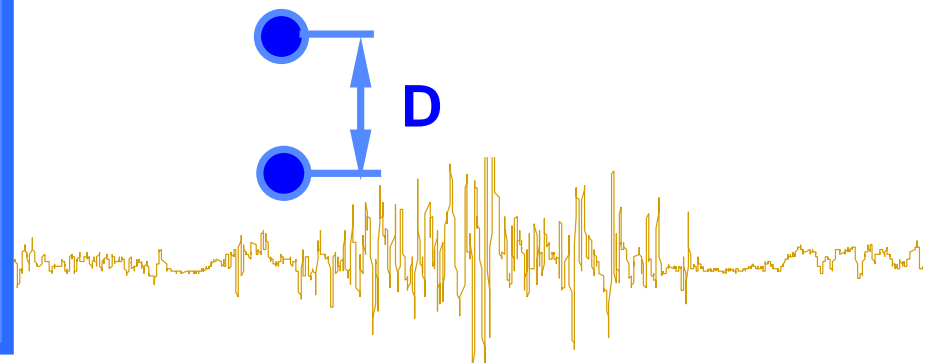
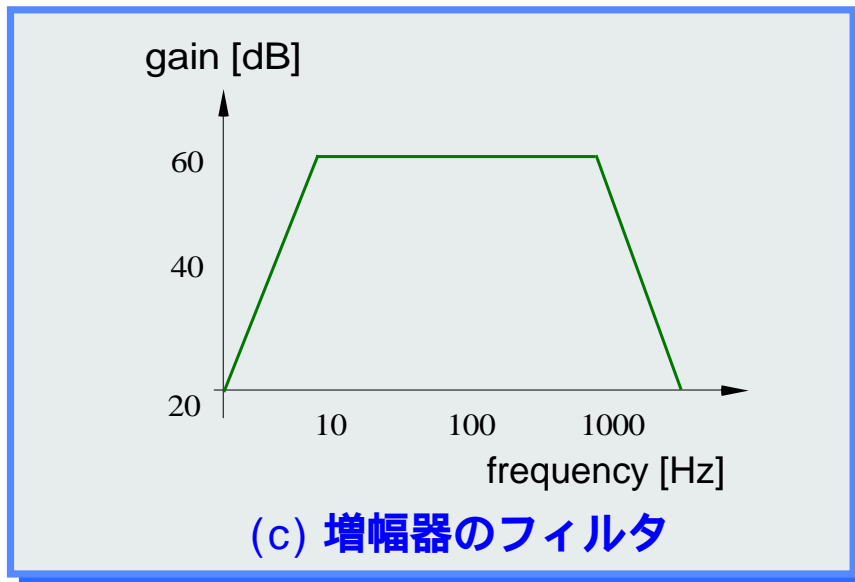
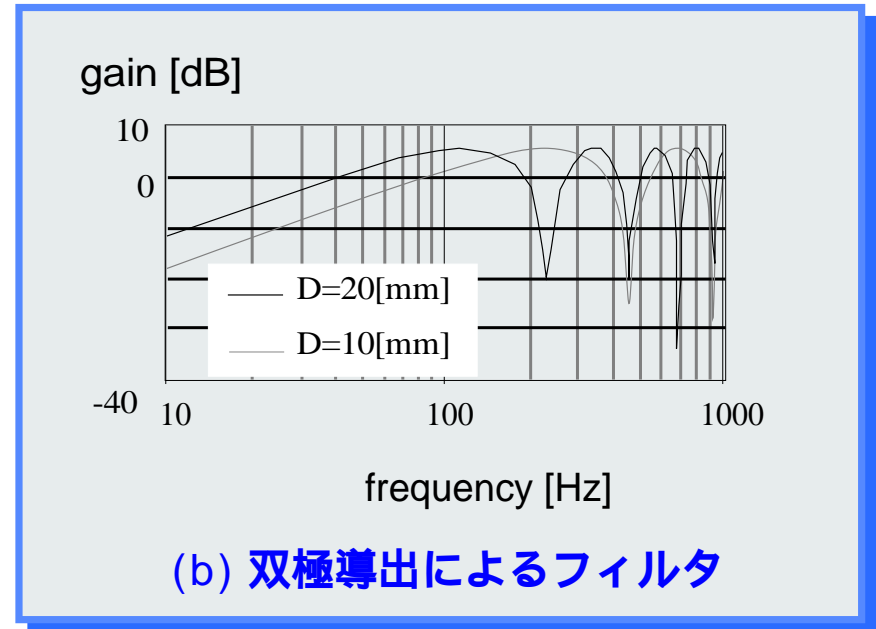
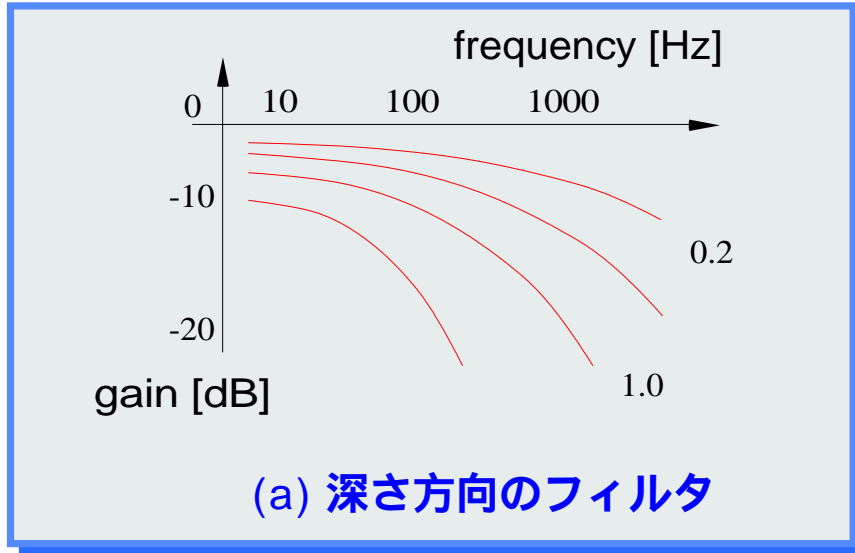


表面電極で計測すると . . .

解剖学的構造に注意

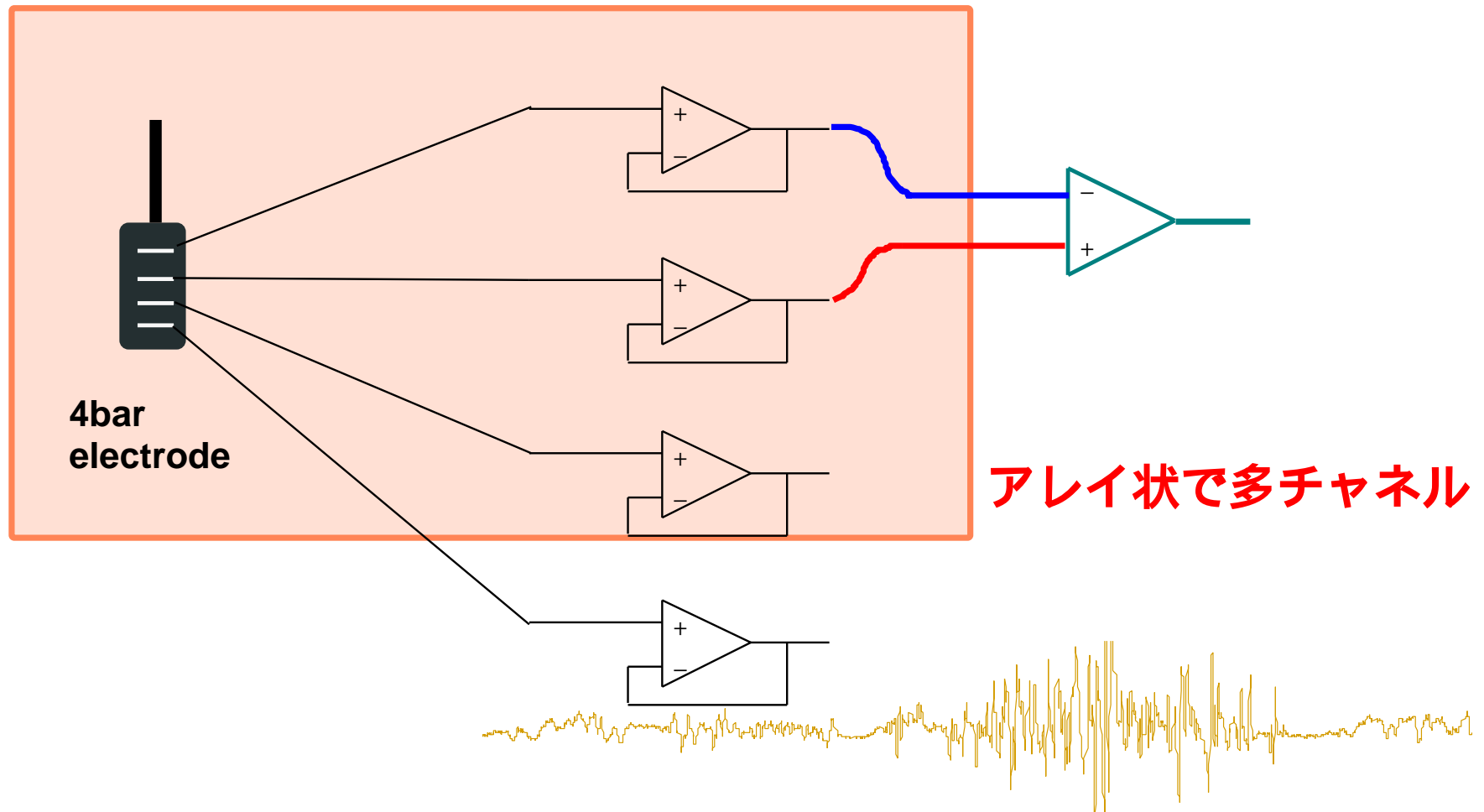


様々なフィルタ特性

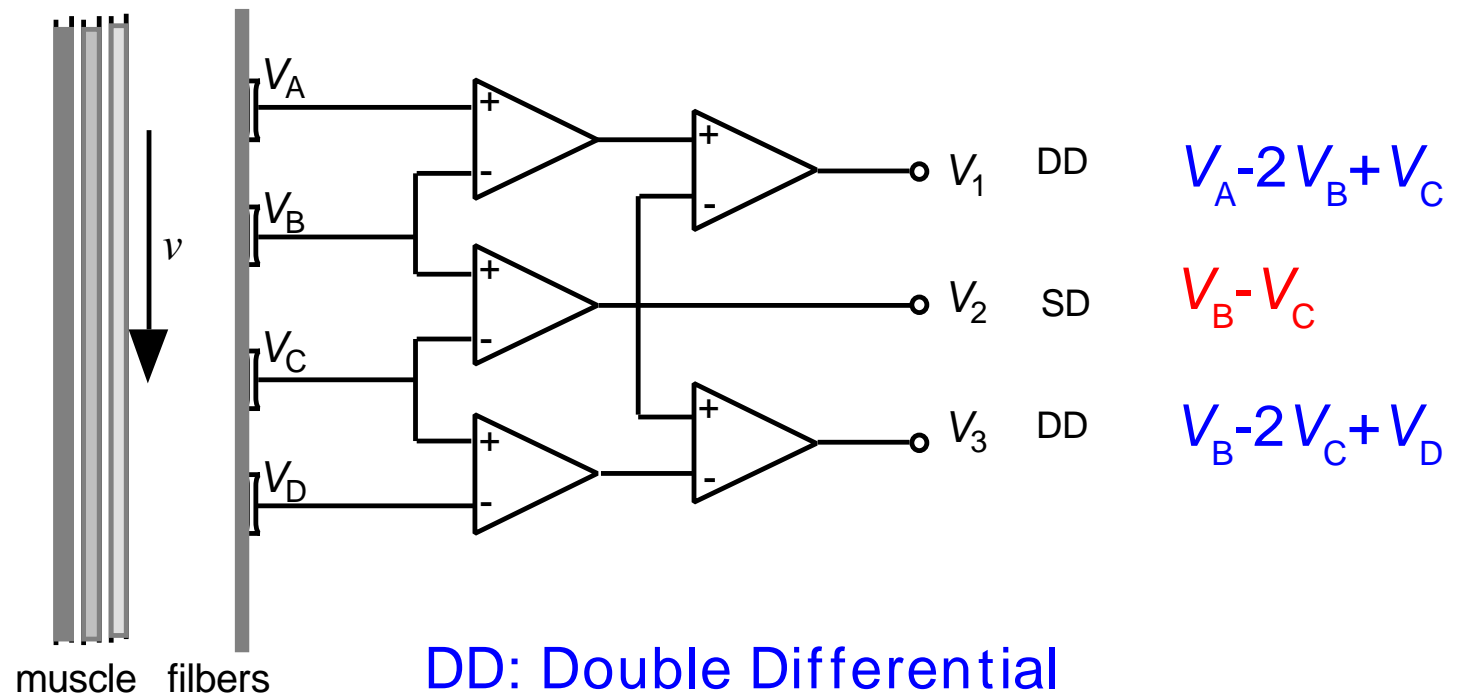


多チャンネルアクティブ アレイ電極

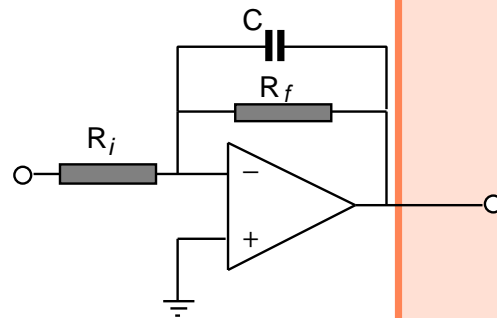
バッファアンプを内蔵



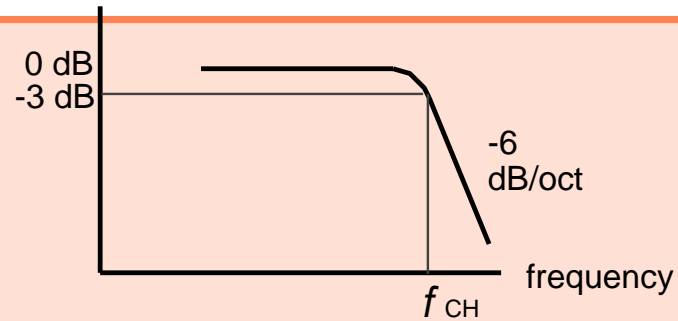
誘導方法



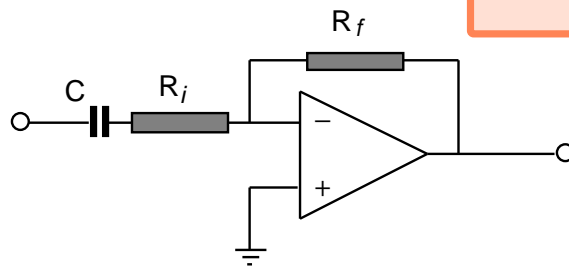
計測用フィルタ



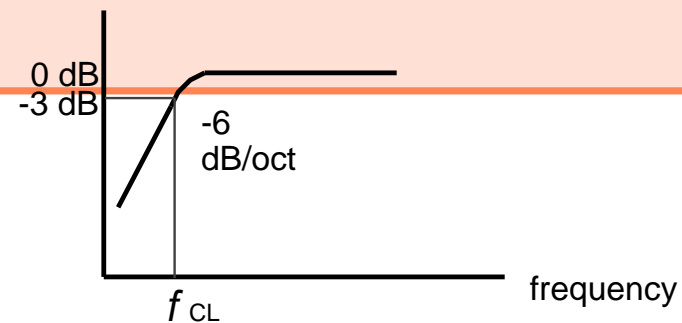
Low Pass Filter



$$H(j) = -\frac{R_f}{R_i} \left(\frac{1}{1 + j \omega C R_f} \right)$$

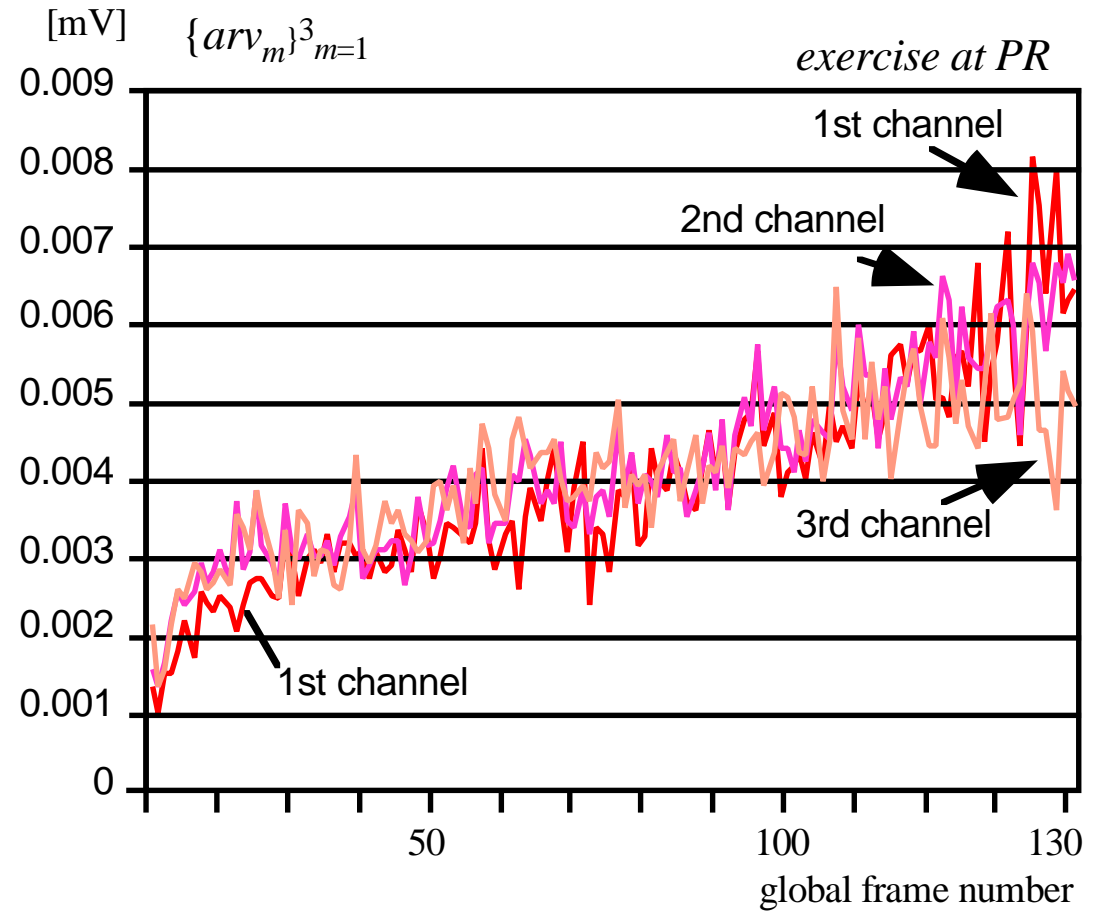
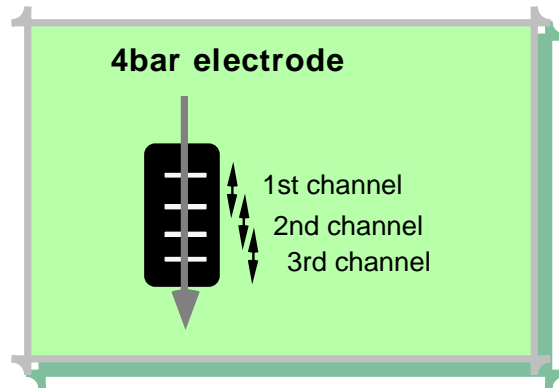


High Pass Filter

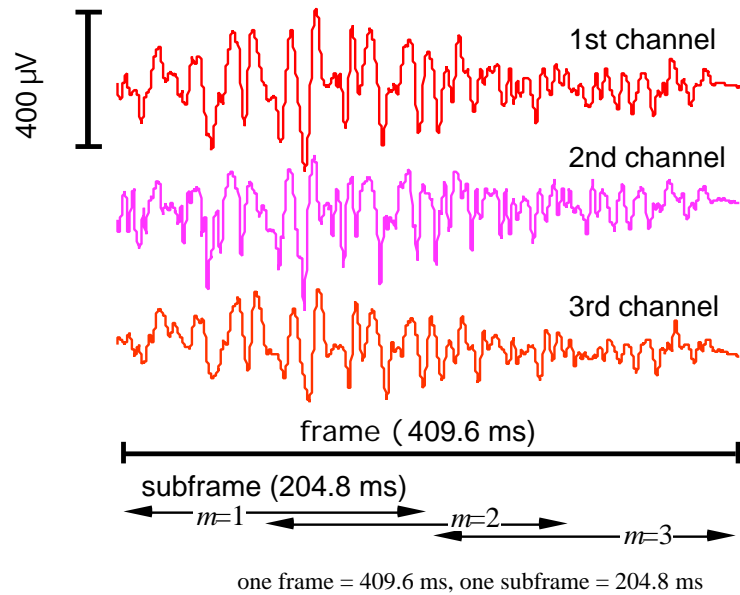


$$H(j) = -\left(\frac{j \omega C R_f}{1 + j \omega C R_f} \right)$$

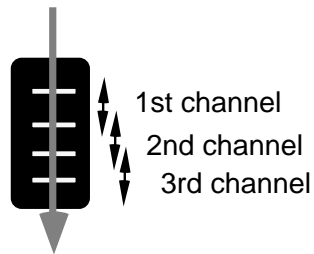
マルチアレイ電極による計測



評価指標毎のチャンネルの選択



4bar electrode



Estimation of ARV & MPF at time n

$$arv_m = \max \left\{ arv_m^{(ch)} \right\}_{ch=1}^{ch=3}$$

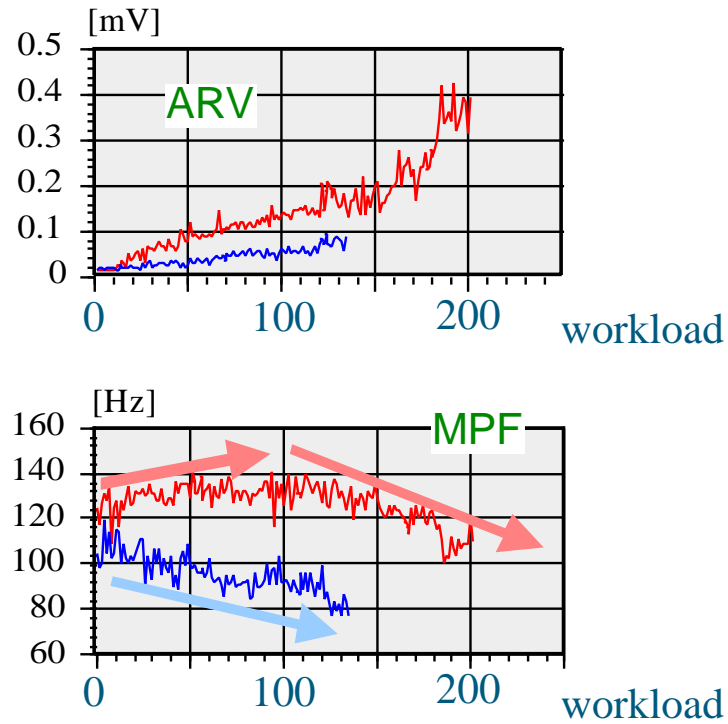
$$arv_n = \frac{1}{3} \sum_{m=1}^3 arv_m$$

$$mpf_m = \min \left\{ mpf_m^{(ch)} \right\}_{ch=1}^{ch=3}$$

$$mpf_n = \frac{1}{3} \sum_{m=1}^3 mpf_m$$

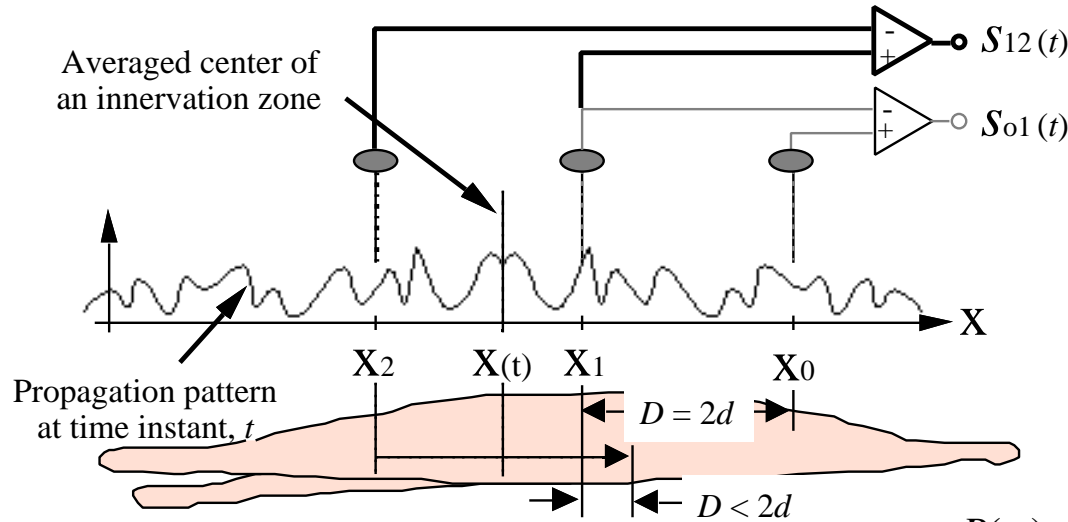
arv: average rectified value
mpf: mean power frequency

ダイナミックな運動時に 筋疲労を探る



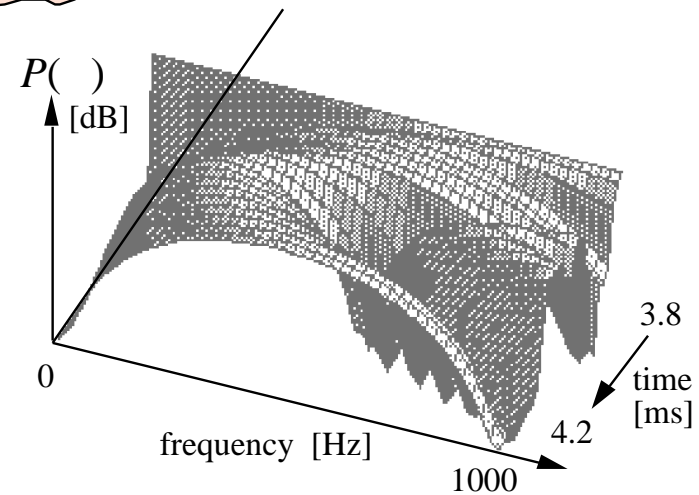
ARV-MPF

神経支配帯位置の影響

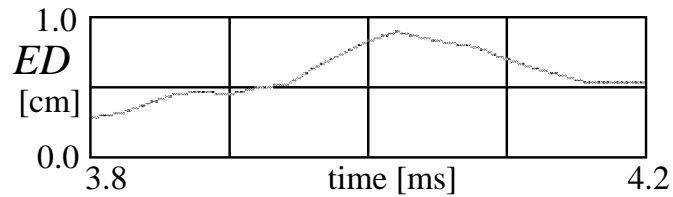


$$P(\omega) = 4 \sin^2\left(\frac{D}{2v}\omega\right) |E(\omega)|^2$$

- Frequency characteristic of time-varying bipolar filter



- Calculation of an effective distance



- 多チャンネルアレイ電極のメリット

- 電極間隔，電極配置を自由に代えられる
- 雑音の影響を受けていないチャンネルが選べる
- 筋疲労や動作識別での解析が正しく行える



**ダイナミックな運動時での筋活動の計測と解析には，
多チャンネルアレイ電極が欠かせない**