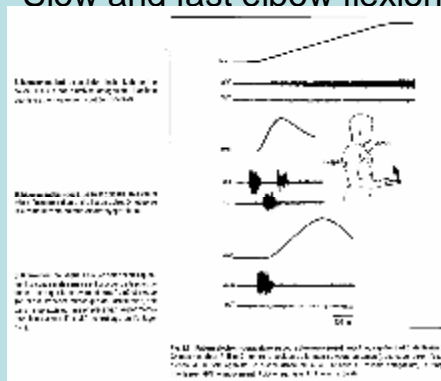


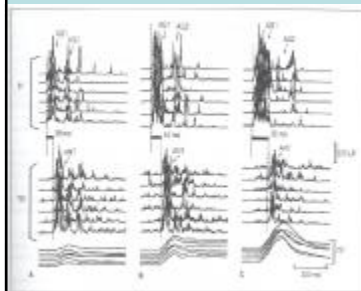
EMG in upper limb movements – part 2

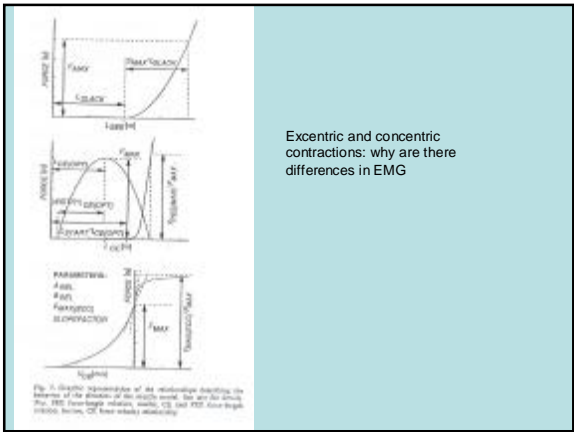
Dr Ana Bengoetxea
LNMB - ULB

Slow and fast elbow flexion

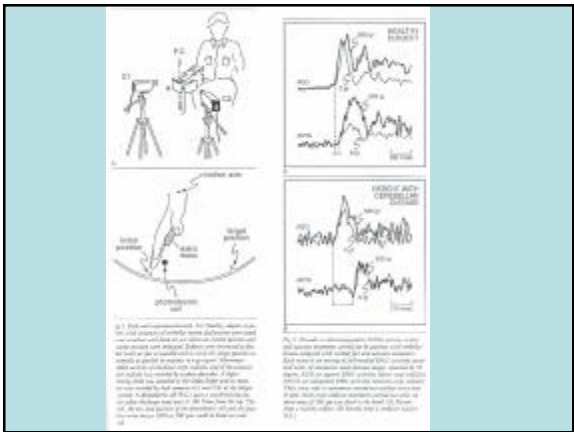


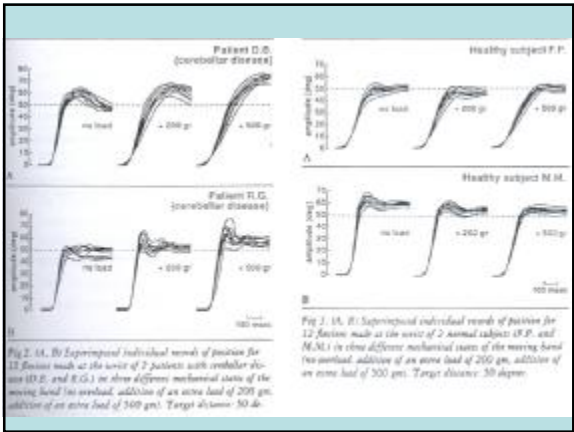
Different amplitudes in fast flexion of the elbow





Excentric and concentric contractions: why are there differences in EMG





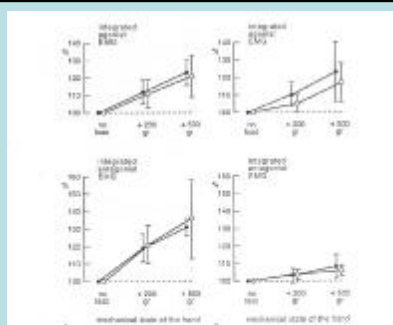


Fig. 6. Integrated surface electromyographic (EMG) activity over the distribution plane of the shoulder and upper arm against EMG activity from the distribution plane of the forearm against with fast and constant forces of the upper arm and forearm against the forearm and shoulder. The number of subjects in the EMG activity was not recorded in the last 100 and 200 N.

Mean \pm SD, $n = 10$, $p < 0.05$.



Fig. 1. The task. Subjects or patients with Parkinson's disease were seated on a chair and faced a target button, while their dominant hand moved on a lever located at their side. When the target button was lit up, they had to switch it off by pushing it with their index finger as fast as possible. Electromyographic activity of the anterior deltoid, biceps, anterior index, and triceps muscles was recorded with surface electrodes. A light-emitting diode (LED) was attached to the index finger and its movement was recorded by the two cameras of the Subject II system.

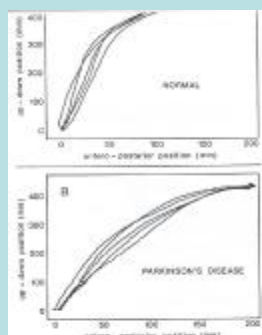


Fig. 4. Display of the path followed in five successive trials, and reach by the index finger of the a healthy subject and by that of (B) a patient with Parkinson's disease. The spin-axis displacement was plotted as a function of consecutive displacement.

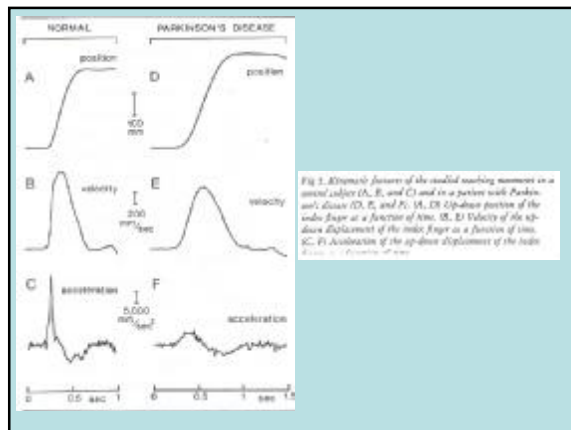


Fig. 1. Kinematic features of the studied reaching movement in a normal subject (A, B, and C) and in a patient with Parkinson's disease (D, E, and F). A, B. Displacement of the index finger as a function of time. C, E. Velocity of the index finger as a function of time. D, F. Acceleration of the index finger as a function of time.

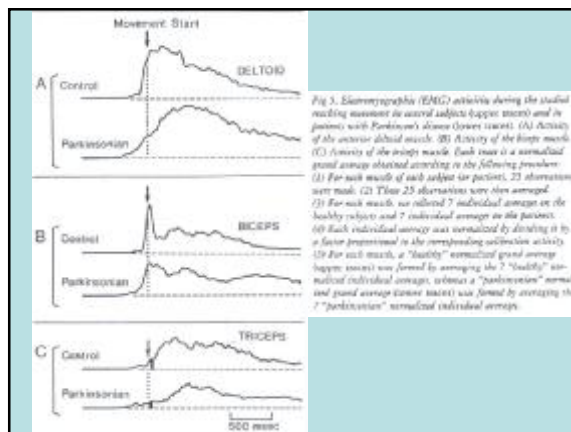


Fig. 2. Electromyography (EMG) activity during the studied reaching movement in normal subjects (upper traces) and in patients with Parkinson's disease (lower traces). (A) Activity of the anterior deltoid muscle. (B) Activity of the biceps muscle. (C) Activity of the triceps muscle. Each trace is a normalized grand average obtained according to the following procedure: (1) For each muscle of each subject (six patients), 25 observations were made. (2) These 25 observations were then averaged. (3) For each muscle, we selected 7 individual averages on the healthy subjects and 7 individual averages on the patients. (4) Each individual average was normalized by dividing it by a factor proportional to the corresponding activation activity. (5) For each muscle, a "healthy" normalized grand average (average trace) was formed by averaging the 7 "healthy" normalized individual averages, whereas a "parkinsonian" normalized grand average (average trace) was formed by averaging the 7 "parkinsonian" normalized individual averages.

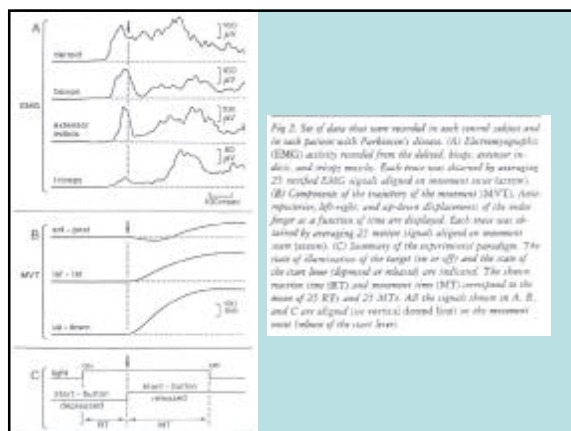


Fig. 3. Set of data that were recorded in each normal subject and in each patient with Parkinson's disease. (A) Electromyographic (EMG) activity recorded from the deltoid, biceps, anterior deltoid, and triceps muscles. Each trace was obtained by averaging 25 recorded EMG signals aligned on movement onset (arrow). (B) Components of the trajectory of the movement (MVT). Anterior-posterior, left-right, and up-down displacements of the index finger as a function of time are displayed. Each trace was obtained by averaging 25 motion signals aligned on movement onset (arrow). (C) Summary of the experimental paradigm. The time of observation of the target (on or off) and the state of the start lever (displaced or released) are indicated. The observation time (OVT) and movement time (MT) are indicated in the mean of 25 RTs and 25 MVTs. All the signals shown in A, B, and C are aligned (see vertical dashed line) on the movement onset (before of the start lever).