Robot / Human Comparisons (how inhumane)

Table I presents some of the elements of robotic and animal movement systems neatly compared for your viewing pleasure.

Table I. Comparison of Movement Control Systems in the Robot and Human

	ROBOT	*HUMAN*
Communication	wires	10^5-10^6 axons
Speed	3 x 10^8 m/sec	10-100 m/sec
Control System	computer	brain/spinal cord
Effectors	motors (linear)	400^+ muscles (non-linear)
Effector Directionality	push or pull	pull only
Transmission	gears/linkages (precise geometry	joints/tendons (nightmare geometry
Degree of Freedom	<10	~100
Control Design	closed loop	closed loop
Transducers	position velocity acceleration	position (Muscle spindle) velocity (Muscle spindle) force (Golgi Tendon Organ)

Table II Motor Unit Properties (adapted from Henneman, 1980).

	Red Muscle Fibers	*White Muscle Fibers*
Number of motor units	many	few
Number of muscle fibers per motor unit	few	many
Axon diameter	small	large
Tetanic tension	small	large
Contraction speed	slow	rapid
Fatigue	slow	rapid
Metabolism	aerobic	anaerobic
Blood supply	rich	sparse