Fast Twitch and Slow Twitch

Cat Soleus:
Mostly slow twitch

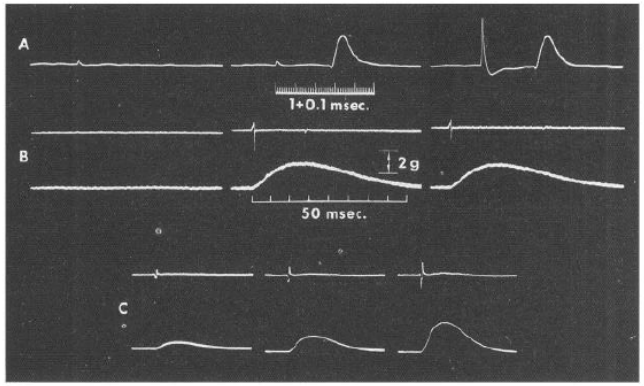


FIG. 2. Criteria for selection of motor units. *A:* all-or-none action potentials recorded antidromically from ventral root filament in response to electrical stimulation of muscle nerve. Stimulus intensities from left to right were 0.17 V. (just below threshold), 0.18 V. (threshold) and 2.0 V. *B:* all-or-none electromyographic (upper) and twitch (lower) responses of same unit to stimulation of VR filament at subthreshold, threshold, and suprathreshold intensities. Calibration of myograph =2 g. *C:* obvious grading of electromyographic and twitch responses due to progressive stimulation of a VR filament containing several soleus axons.

McPhedran A. M., R.B. Wuerker, and E. Henneman, *J. Neurophysiol.* 1965 (28) 71-84.

Cat Gastrocnemius:
Mostly fast twitch

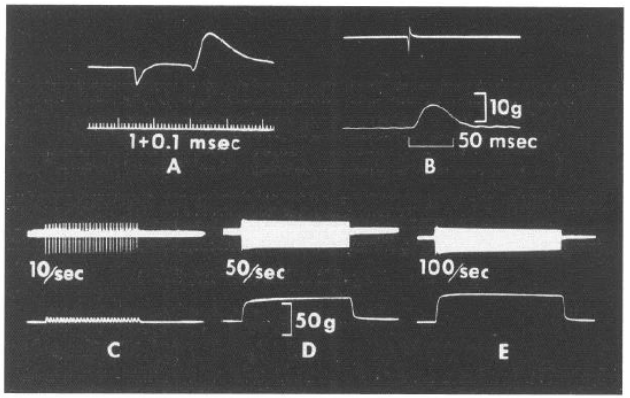


FIG. 1. Oscillographic records from a single motor unit. *A:* measurement of the conduction latency of the antidromic nerve action potential. *B:* single twitch recorded on lower beam; EMG on upper beam. *C*, *D*, and *E:* tetanic tensions at stimulus rates of 10, 50, and 100/sec. (lower traces), with accompanying EMGs.

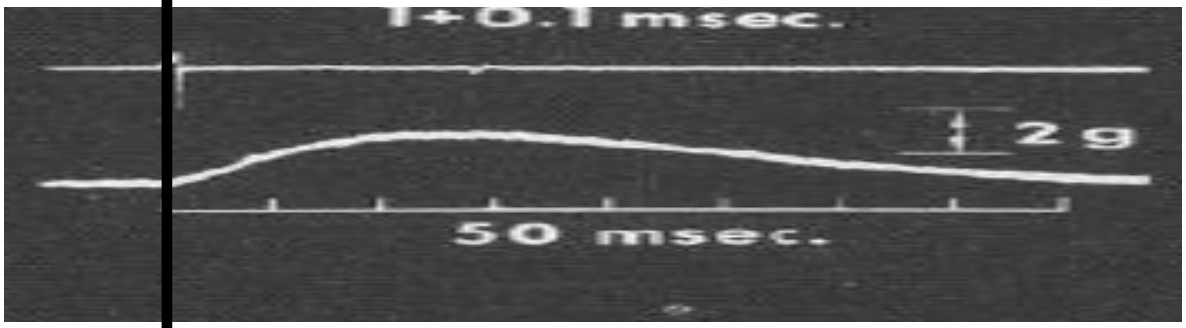
Wuerker R.B., A. M. McPhedran, and E. Henneman, *J. Neurophysiol* 1965 (28) 85-99

Fast Twitch and Slow Twitch

(same data as previous page, plotted on same scale)

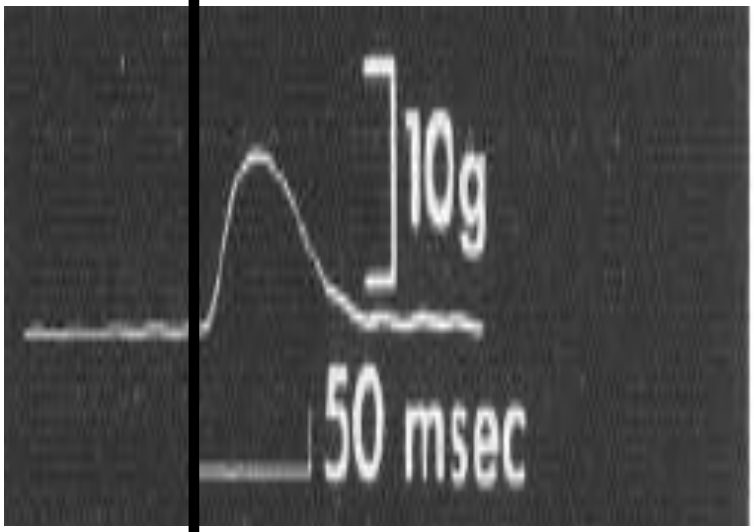
Soleus motor unit

McPhedran A. M., R.B. Wuerker, and E. Henneman, *J. Neurophysiol.* 1965 (28) 71-84.



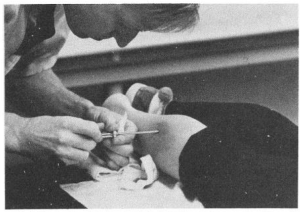
Gastrocnemius motor unit

Wuerker R.B., A. M. McPhedran, and E. Henneman, *J. Neurophysiol* 1965 (28) 85-99



Fast twitch motor units generate more force, and reach maximum force more quickly, than slow twitch motor units.

Fast twitch motor units relax more quickly than slow twitch motor units.



Elite Track Athletes Vs. Ordinary People

Sprinters: mostly fast twitch

Distance runners: mostly slow twitch

Everyone else:
no clear preponderance

Note: muscle fibers in humans are more heterogenous than muscle fibers in cats.

MUSCLE FIBER COMPOSITION AND ENZYMES IN TRACK ATHLETES

TABLE 2. *Fiber distribution, size, and relative areas of all groups studied*

Subj	Sex	No.	% ST Fibers	ST Fiber Area, μm^2	FT Fiber Area, μm^2	% Area ST Fibers	ST/FT Area
Sprint runners	F	2	27.4 (26.6–28.2)	3,752 (3,540–3,964)	3,930 (3,366–4,495)	26.8 (23.6–29.9)	0.99 (0.79–1.18)
	M	2	24.0 (21.0–27.0)	5,878 (3,975–7,782)	6,034 (5,877–6,192)	23.5 (15.3–31.8)	0.98 (0.64–1.32)
Middle-distance runners	F	7	60.6 (44.0–73.3)	6,069 (3,076–9,952)	5,642 (4,012–7,500)	60.4 (41.2–78.5)	1.05 (0.68–1.40)
	M	7	51.9 (40.5–69.4)	6,099 (4,551–8,447)	7,117 (4,889–9,212)	46.5 (31.2–62.1)	0.87 (0.67–1.08)
Distance runners	M	5	69.4 (63.4–73.8)	6,613 (3,644–10,111)	7,627 (4,729–11,330)	62.3 (51.0–75.9)	0.90 (0.72–1.24)
Long-high jumpers	F	3	48.7 (38.6–61.2)	4,163 (3,502–5,078)	5,113 (4,354–6,623)	44.0 (33.6–54.7)	0.83 (0.77–0.90)
	M	2	46.7 (44.0–49.3)	4,718 (4,475–4,961)	6,523 (6,301–6,745)	38.8 (35.8–41.7)	0.72 (0.71–0.74)
Javelin throwers	F	3	41.6 (41.2–42.0)	4,864 (4,264–5,464)	4,569 (4,272–4,866)	42.9 (40.9–44.9)	1.06 (1.00–1.12)
	M	3	50.4 (46.5–56.2)	5,585 (2,567–8,254)	5,771 (4,205–7,607)	47.7 (34.6–67.7)	0.92 (0.61–1.08)
Shot-put, discus throwers	F	2	51.2 (48.3–54.0)	5,192 (3,295–7,088)	5,851 (4,766–6,935)	46.9 (39.2–54.5)	0.86 (0.69–1.02)
	M	4	37.7 (13.0–52.0)	7,702 (5,037–10,345)	9,483 (9,131–9,718)	34.0 (7.6–50.0)	0.81 (0.55–1.08)
Untrained	F	10	51.0 (27.4–72.0)	3,875 (2,548–5,043)	4,193 (2,565–6,159)	48.8 (27.7–76.0)	0.98 (0.60–1.82)
	M	11	52.6 (38.0–73.2)	5,699 (3,402–8,721)	4,965 (3,881–6,855)	56.0 (34.9–77.7)	1.15 (0.88–1.27)

Values are means with ranges in parentheses.

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Costill et al. *J. Appl. Physiol., 1976* (40) 149-154

Power Lifters Vs. Ordinary People

Power Lifters generate more force:

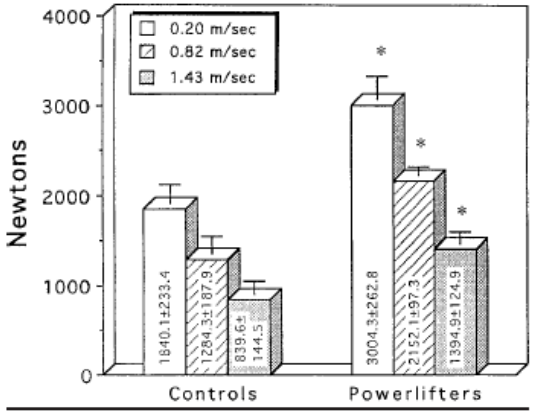

Figure 1. Absolute (*N*) isokinetic squat force (*$p < 0.05$).

Power Lifters generate more power:

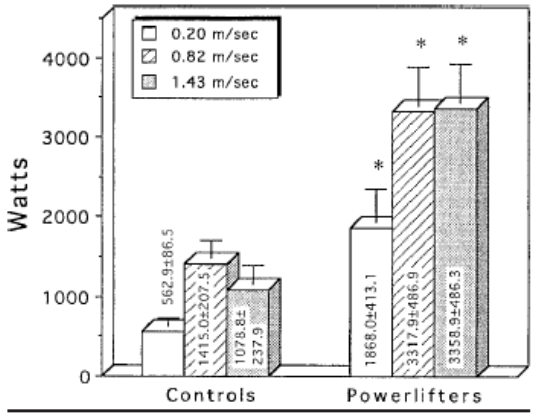

Figure 3. Absolute (W) isokinetic squat power (*$p < 0.05$).

Power Lifters and ordinary people have the same fraction of "slow twitch" (=Type 1) fibers (almost 50%):

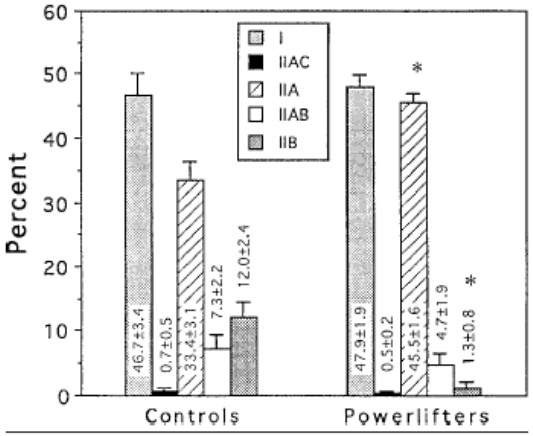

Figure 7. Percent mATPase fiber types (*$p < 0.05$).

Fry et al. *J. Strength Cond. Res.*, *2003*(17) 402-410

Conclusion

Since successful sprinters have a preponderance of fast twitch fibers, while successful power lifters do not, conclude that fast twitch fibers are an advantage for high angular velocity activities—those in which contraction must very rapidly be followed by relaxation. The specific advantage of fast-twitch over slow-twitch fibers is that fast-twitch fibers relax more quickly.

Postscript

Whatever fiber type you have: Warm up!

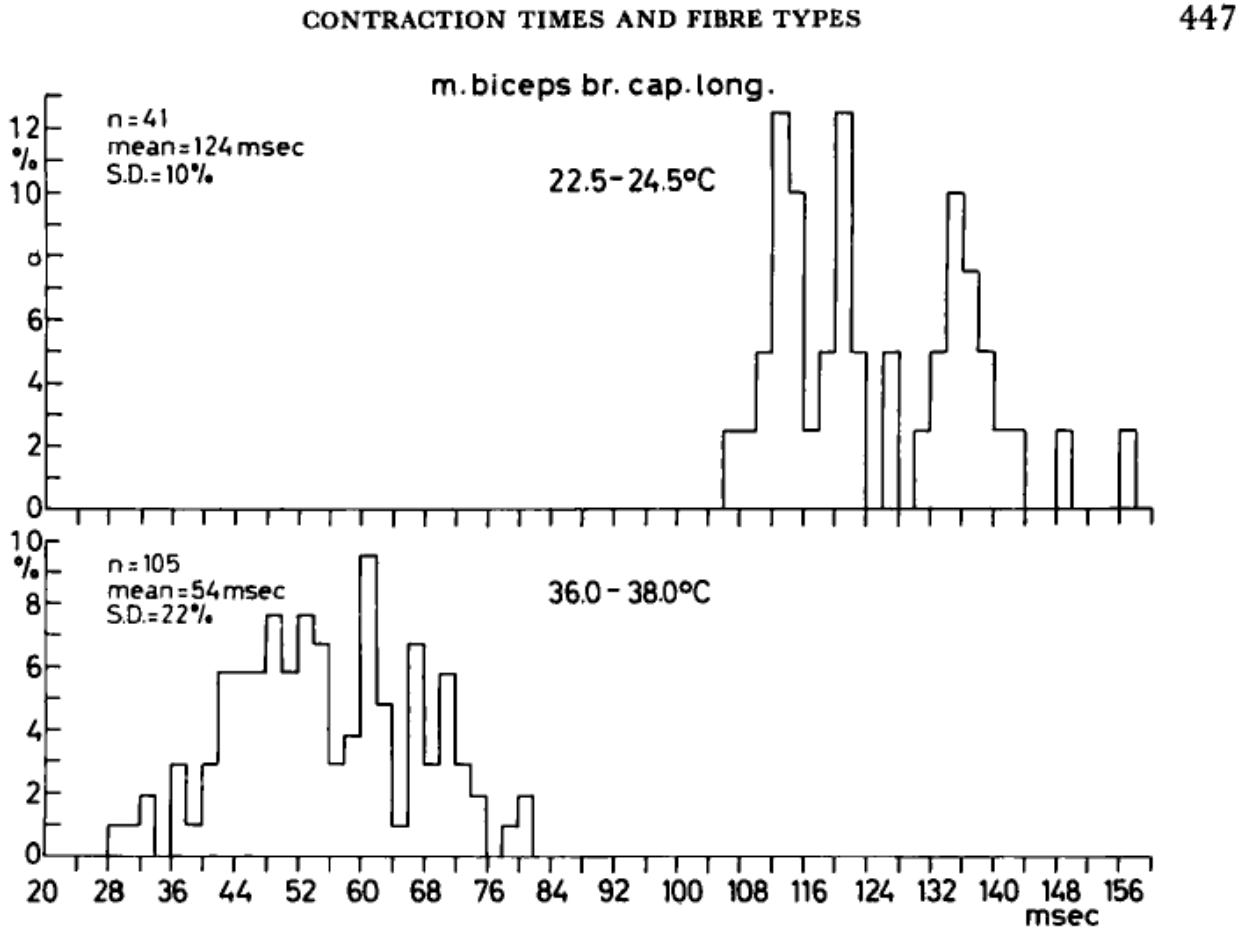

Fig. 11. Spectra of contraction times at low (above) and at normal temperature (below) (2 subjects). n denotes the number of bundles. Note that the relative standard deviation was halved in the spectrum at low temperature.

Buchthal F. and Schmalbruch H., Acta physiol. Scand. 1970 (79) 435-452