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# WO LIEGT DIE URSACHE FÜR MUSKELKRÄMPFE?

## Flüssigkeit und Elektrolyte oder Nervensystem?

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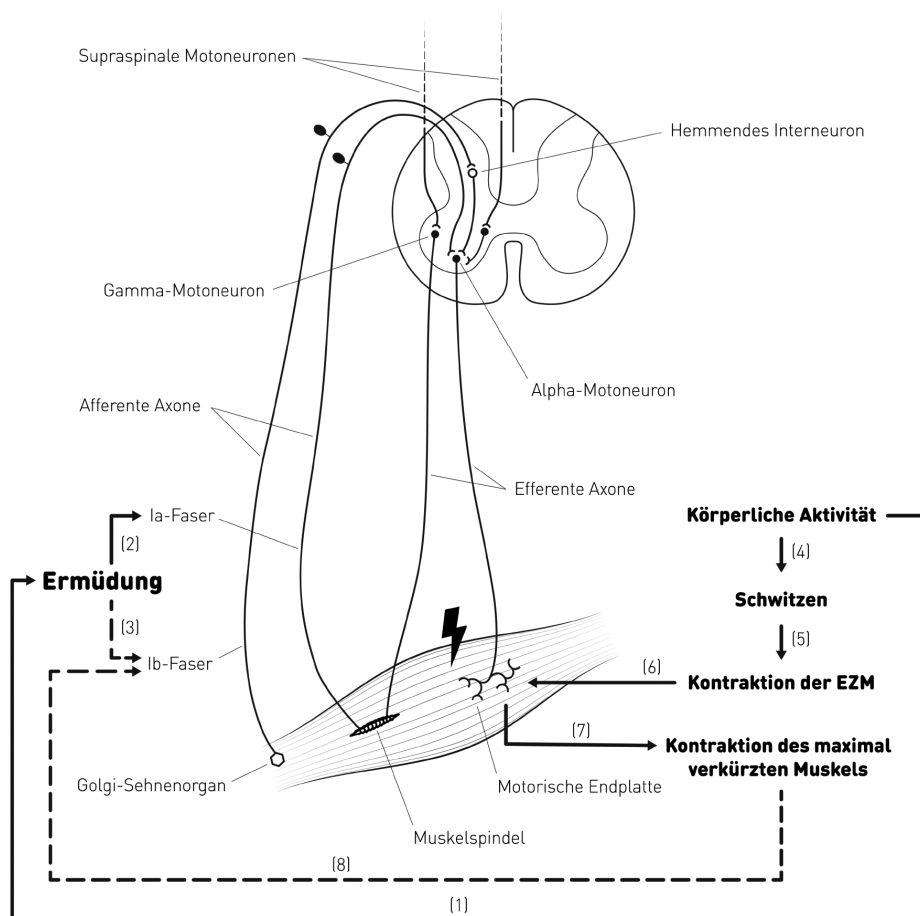
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**Liebe Leserinnen, liebe Leser!**

In der Printausgabe (*Leistungssport*, 1/2018, Seite 36) war die Abbildung 1 des Beitrags versehentlich am unteren Rand beschnitten, sodass eine Verbindungslinie nicht vollständig abgedruckt worden war. Wir bitten um Entschuldigung.

Verlag und Redaktion



**Abbildung 1: Potenzielle Interaktion der „Elektrolytdefizit- und Dehydratations“-Theorie und der Theorie der „veränderten neuromuskulären Kontrolle“**

Fett gedruckte Pfeile kennzeichnen Einflussfaktoren auf neuromuskuläre Funktionen, die zur Entstehung von Muskelkrämpfen bei körperlicher Aktivität führen können. (1) Sowohl muskuläre (Todd et al., 2005) als auch zentrale (Del Coso et al., 2008; Périard et al., 2011) Ermüdung treten durch körperliche Aktivität bei hoher Umgebungstemperatur und hoher Luftfeuchtigkeit früher ein als unter neutralen Bedingungen. (2) Ermüdung erhöht erregende Signale der Ia-Afferenzen der Muskelspindeln (Nelson & Hutton, 1985) und (3) verringert hemmende Signale der Ib-Afferenzen der Golgi-Sehnenorgane (Hutton & Nelson, 1986). (4) Gleichzeitig kommt es bei körperlicher Aktivität bei hoher Umgebungstemperatur und hoher Luftfeuchtigkeit zu früher eintretendem und verstärktem Schwitzen (Bowtell et al., 2013). (5) Das Schwitzen führt zur Kontraktion der extrazellulären Matrix (EZM) (Costill et al., 1976), messbar durch eine Reduktion des Muskelvolumens (Hackney et al., 2012). (6) Diese mechanische Deformierung der Nervenendigungen erhöht die Erregung an der motorischen Endplatte des arbeitenden Muskels (Bowtell et al., 2013; Layzer, 1994) und sorgt damit für eine periphere Verkürzung des Muskels (Layzer, 1994). (7) Wenn dieser bereits verkürzte Muskel weitere erregende Signale vom Alpha-Motoneuron erhält, wird der Muskel anfälliger, sich maximal zu verkürzen. Eine Kontraktion des maximal verkürzten Muskels sorgt für eine weitere Reduktion hemmender Signale der Ib-Afferenzen (Schweltnus et al., 1997). Schlussendlich ist das Übergewicht der erregenden Einflüsse auf das Alpha-Motoneuron zu groß, sodass ab einem bestimmten Zeitpunkt der Ermüdung bzw. Aktivitätsdauer sehr wahrscheinlich ein Muskelkrampf auftreten wird. Zeitlich versetzt kann es auf diese Weise auch unter normalen Umweltbedingungen zu Muskelkrämpfen kommen. (Grafik: Maximilian Milkereit)