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Erratum

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Lactate After Exercise in Man: III. Properties of the Compartment Model

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Due to a deplorable mishap the formulas 46 and 47 on page 153 were not published correctly. Please find the correct version on the reverse.

to those of $L_M(t)$ and $L_S(t)$, respectively. The sum $[\Phi_{mM}(t) + \Phi_{mS}(t)]$ which estimates the instantaneous lactate utilization rate for the whole body also has a bi-exponential time evolution.

c) The Time Course of the Net Exchange Rate Between (M) and (S). Relationships 5, 29, 35, 36, 39, and 40 give:

$$\Phi_{MS}(t) = \mu + (\gamma_1 - d_2) \cdot V_S \cdot \mathscr{D}_1 \cdot e^{-\gamma_1 t} + (\gamma_2 - d_2) \cdot V_S \cdot \mathscr{D}_2 \cdot e^{-\gamma_2 t}. \tag{46}$$

The discussion of the coefficients $\alpha_1 = (\gamma_1 - d_2) \cdot V_S \cdot \mathscr{D}_1$ and $\alpha_2 = (\gamma_2 - d_2) \cdot V_S \cdot \mathscr{D}_2$ in this expression in (F_1) and (F_2) shows that $\Phi_{MS}(t)$ can reduce to zero none, one, or two times at the most, i.e., it denotes the properties (P_1), (P_2), or (P_3). Thus, it is an important consequence that according to equation 5, the arterial-venous lactate difference can become zero none, one or two times at the most, and the predicted net lactate exchange flow between (M) and (S) during recovery may be sometimes a net muscular release or a net muscular uptake.

More specifically, using (AS4) and the results reported elsewhere [4, 5] gives ($\mathscr{D}_1 > 0$; $\mathscr{D}_2 < 0$). Then (F_1), in which $d_2 < \gamma_2$, provides for $\Phi_{MS}(t)$ "B-curves" which can be consistent with graphs of observed $L_a(t)$ and $L_V(t)$ that denote either no common point, or tangency, or two common points. On the other hand, (F_2) in which $d_2 > \gamma_2$, supplies "A-curves": the corresponding evolutions of $L_a(t)$ and $L_V(t)$ may have a single common point without tangency.

All these theoretical possibilities are qualitatively consistent with the arterio-venous lactate differences observed by Pernow et al. [11] Hermansen et al. [7] and Hermansen and Vaage [8].

d) The Integrals of Lactate Fluxes. The time integrals of $\Phi_{mM}(t)$, $\Phi_{mS}(t)$, and $\Phi_{MS}(t)$ also have bi-exponential forms. These quantities give the amounts of lactate utilized in and exchanged between (M) and (S) and allow one to display the progress of recovery in the previously working muscles and in the whole body.

Representation of the Mathematical Solution

1. A Possible Strategy in Using the Formulae

Since the model expresses the relationships between several parameters and consequent time dependencies of lactate concentrations and flow rates, various choices of application are open to the user.

For instance, knowing $\Phi_{MS}(t)$ at the instants $t = \theta$, $t = \theta'$, and $t \to \infty$, equations 2 and 5 lead to the expressions:

$$d_2 = \frac{\Phi_{MS}(\theta) - \Phi_{MS}(\theta') - V_S\left[\left(\frac{dL_S}{dt}\right)_\theta - \left(\frac{dL_S}{dt}\right)_{\theta'}\right]}{V_S[L_S(\theta) - L_S(\theta')]}, \tag{47}$$

$$\mu = \Phi_{MS}(\theta) - V_S \cdot d_2\,[L_S(\theta) - L_S(\infty)] - V_S\left(\frac{dL_S}{dt}\right)_\theta, \tag{48}$$