

# “Longer” and “Faster” Are Interchangeable Only When the Body Is Treated as One Bag

— In a one-compartment model the fraction removed is  $1 - \exp(-Kt/V)$ , so clearance and time act only through their product, and splitting  $Kt = 48$  four ways gives 0.698805788 every time with difference 0 — the separator is whether one uses one compartment or includes exchange between compartments — [Paper 850]

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## Abstract

When removing waste from the blood, “run it longer” and “run it faster” look like the same thing. This paper counts that this depends on how the model is set up. No new theorem or law is claimed. First, in one compartment clearance and time act only as a product: splitting  $Kt = 48$  four ways gives 0.698805788 each time, a difference of 0 (Section 2). Second, the first half removes more: at  $Kt/V = 1.2$  the first half takes 0.645656 of the total and the second 0.354344 (Section 2). Third, doubling the time does not double the removal: from  $Kt/V = 1.2$  to 2.4 the fraction removed rises by 1.301194 (Section 2). Fourth, and this is the core. With two compartments the same product gives different answers: at  $Kt = 48$  the result spreads from 0.654180349 to 0.494258914, a difference of 0.159921 (Section 3). Fifth, slower and longer wins: clearance 0.2 for 240 minutes removes more than clearance 1.6 for 30 (Section 3). Sixth, the separator is whether one uses one compartment or includes exchange between compartments: interchangeability of “longer” and “faster” is a property of the model, not of the body (Section 4). **Keywords:** dialysis, one-compartment model, two-compartment model, exponential decay, clearance and time, model.

Scope of this paper (scope note): No new theorem or law is claimed: that concentration falls as  $\exp(-Kt/V)$  in a one-compartment model, that dialysis dose is expressed as  $Kt/V$ , and that slow exchange between body compartments lowers removal (two-compartment models), are all known. No medical advice is given: no treatment time or clearance is recommended. No real patient's values are claimed: 40 L of body water, compartments of 15 L and 25 L and an exchange of 0.6 L/min are model values. The membrane is not entered: membrane properties and the size or kind of solute are not treated. Fluid removal is not included: body water is held constant. Relation to earlier papers: Paper 333 showed that the constant ratio of osmotic pressure to freezing-point depression follows from an assumption rather than a measurement, and its scope note left open "biological membranes: the reality of semipermeable membranes and cellular osmoregulation are not entered". This paper sits in that seat; there is no earlier occupant. Paper 300 showed that whether two things share a root is decidable: the one-compartment and two-compartment conclusions are distinct roots by that criterion. What is added is splitting the product four ways and confirming a difference of 0 in one compartment, measuring the first-half and second-half shares, measuring a spread of 0.159921 at the same product in two compartments, and placing the separator on one compartment versus exchange between compartments.

## 1. Notation and the Question

Setting: let  $V$  be body water,  $K$  the clearance and  $t$  the time. Treating the body as one well-mixed bag (one compartment), the fraction left is as follows.

$$\frac{C(t)}{C_0} = \exp\left(-\frac{Kt}{V}\right), \quad \text{fraction removed} = 1 - \exp\left(-\frac{Kt}{V}\right)$$

In two compartments only the outer one (15 L) is cleared, and it exchanges with the inner one (25 L) at 0.6 L/min.

Question: at the same  $Kt$ , does the split between clearance and time not matter?

## 2. In One Compartment, Only the Product Acts

Computation 2.1:  $Kt = 48$  ( $V = 40$  L) was split four ways.

| clearance $K$ (L/min) | time $t$ (min) | fraction removed |
|-----------------------|----------------|------------------|
| 0.2                   | 240            | 0.698805788      |
| 0.4                   | 120            | 0.698805788      |
| 0.8                   | 60             | 0.698805788      |
| 1.6                   | 30             | 0.698805788      |

### Observation 2.2

all four agree, with difference 0.  $K$  and  $t$  enter the formula only as the product  $Kt$ : inside a one-compartment model, “longer” and “faster” say the same thing.

Computation 2.3:  $Kt/V = 1.2$  was split into halves, and  $Kt/V$  was doubled repeatedly.

| quantity                    | value    |
|-----------------------------|----------|
| fraction removed in all     | 0.698806 |
| first half’s share of that  | 0.645656 |
| second half’s share of that | 0.354344 |
| $Kt/V = 0.6$                | 0.451188 |
| $Kt/V = 2.4$                | 0.909282 |
| $Kt/V = 4.8$                | 0.991770 |
| ratio from 1.2 to 2.4       | 1.301194 |

### Observation 2.4

the later half takes less. As concentration falls, the same clearance carries out less: doubling the time raises the fraction removed by only 1.301194.

## 3. In Two Compartments, the Split Matters

Computation 3.1: the same four splits of  $Kt = 48$  were run through the two-compartment model.

| clearance $K$ (L/min) | time $t$ (min) | fraction removed |
|-----------------------|----------------|------------------|
| 0.2                   | 240            | 0.654180349      |
| 0.4                   | 120            | 0.615841087      |
| 0.8                   | 60             | 0.558647412      |
| 1.6                   | 30             | 0.494258914      |

### Observation 3.2

this is the core. The same product gives different answers. Largest and smallest differ by 0.159921, clearly unlike the 0 of one compartment: running fast thins the outer compartment first, leaving nothing to carry out before the inner one can supply it.

### Observation 3.3

slower and longer wins. Clearance 0.2 for 240 minutes gives 0.654180349; clearance 1.6 for 30 minutes gives 0.494258914: the more time is handed to the exchange, the more of the inner store is reached.

## 4. The Separator

### Observation 4.1

the separator is whether one uses one compartment or includes exchange between compartments. In the first, clearance and time act only as a product; in the second, the split moves the answer by 0.159921: interchangeability of “longer” and “faster” is a property of the model, not of the body.

#### Observation 4.2

sitting in the seat of Paper 333.333 showed that a constant ratio followed from an assumption rather than a measurement, and its scope note left biological membranes open. There constancy came from an assumption; here interchangeability comes from the one-compartment assumption. The same pattern, counted on the other side of the membrane. Paper 300 showed that whether two things share a root is decidable: the two conclusions are distinct roots by that criterion.

#### Observation 4.3

what is not said. Treatment times and clearances, real patients, membrane properties and fluid removal are not treated. What is shown is that “only the product matters” rests on the one-compartment assumption.

### 5. Census and Closing

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1. one compartment: **0.698805788** four times (Computation 2.1): **difference 0**.
2.  $K$  and  $t$  enter only as a product (Observation 2.2): **longer equals faster**.
3. first half's share **0.645656** (Computation 2.3): **second half 0.354344**.
4. double the time, **1.301194** (Computation 2.3): **not double**.
5. two compartments: from **0.654180349** (Computation 3.1): **slow and long**.
6. to **0.494258914** (Computation 3.1): **fast and short**.
7. difference **0.159921** (Observation 3.2): **the core**.
8. nothing left before the inner store arrives (Observation 3.2): **the cost of speed**.
9. time given to exchange reaches further (Observation 3.3): **the direction**.
10. one compartment, or exchange (Observation 4.1): **the separator; Papers 333, 300**.

Closing: “Longer” and “faster” are interchangeable only when the body is treated as one bag. In a one-compartment model the fraction removed is  $1 - \exp(-Kt/V)$ ; splitting  $Kt = 48$  four ways gives 0.698805788 each time with difference 0, and doubling the time raises removal by only 1.301194, because clearance and time enter only as a product, and falling concentration carries out less. But with an outer compartment that is cleared and an inner one behind it, the same  $Kt$  spreads from 0.654180349 to 0.494258914, a difference of 0.159921, and slower-and-longer removes more, because running fast thins the outer compartment before the inner store can reach it. Whether they can be traded is a property of the model, not of the body. Placed among the earlier papers: sitting in the biological-

membrane seat Paper 333 left open, counting its “constancy follows from an assumption” on the other side of the membrane, and treating the two conclusions as distinct roots by the criterion of Paper 300. To be honest: body water, compartment sizes and the exchange rate are model values and correspond to no real patient.

## References

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1. Gotch, F. A., & Sargent, J. A. (1985). A mechanistic analysis of the National Cooperative Dialysis Study (NCDS). *Kidney International*.

2. Yamagishi, Y. (2026). *The Three Hundredth Census: Whether Two Things Share a Root Is Decidable* [Paper 300]. YOI: <https://www.yamagishiyuuki.com/yoi/300>; DOI: 10.5281/zenodo.22171914

3. Yamagishi, Y. (2026). *That the Ratio of Osmotic Pressure to Freezing-Point Depression Is Constant Follows from an Assumption, Not from a Measurement* [Paper 333]. YOI: <https://www.yamagishiyuuki.com/yoi/333>; DOI: 10.5281/zenodo.22681740

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