Supporting Information

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SI Text

Functional Forms. Table S1 shows the different functional forms that were used in the model. Fig. S1 shows velocity fields corresponding to different forms for **f**, and Fig. S2 shows the different clearance functions (d). See Movie S1 for an example of the evolution to steady state according to the "A" functions. $\bar{\tau}$ is the mean age of cells in the population. See *Clearance Function* in *Materials and Methods* for definition of Δ.

Parameter Estimates. We estimated parameters for different functional forms of the deterministic evolution (**f**) and clearance functions (d). The qualitative results are consistent for these three different functional forms, suggesting that our results represent characteristics of in vivo pathophysiology and not overfitting of data. Details of the functional forms are shown in Table S1, and the estimates are shown in boxplots in Figs. S3 and S4.

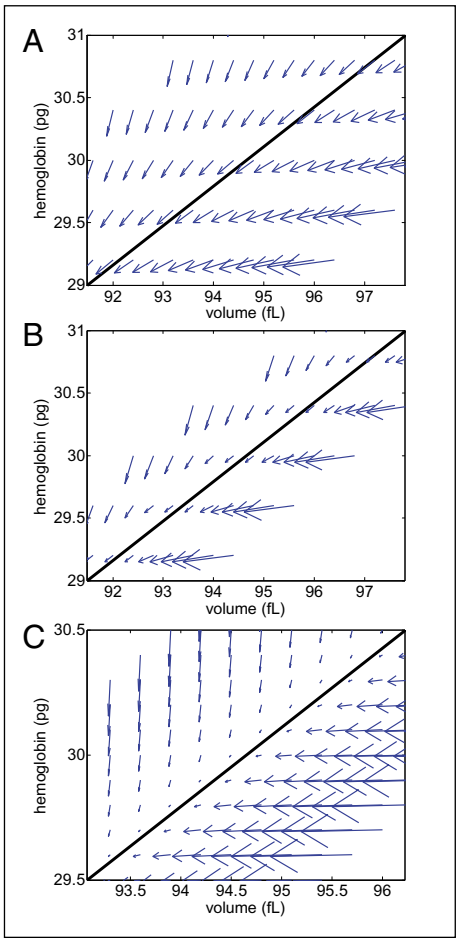


Fig. S1. Velocity fields for different functional forms in Table S1. (*Top*) "A"; (*Middle*) "B"; (*Bottom*) "C." The black diagonal line shows constant hemoglobin concentration equal to MCHC.

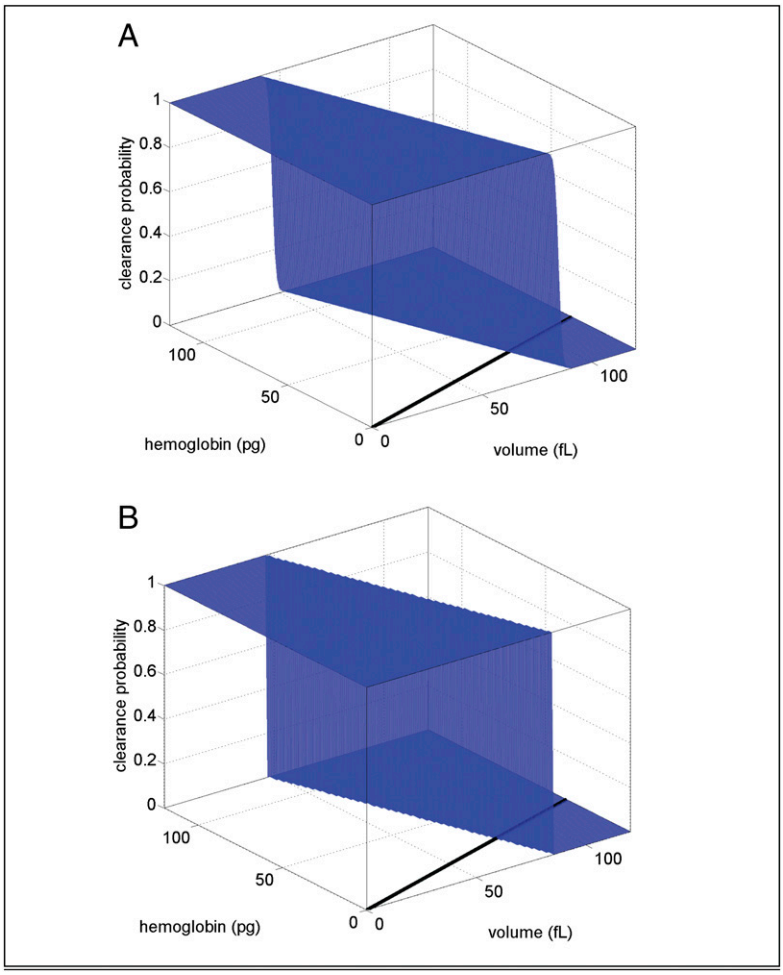


Fig. S2. Clearance probabilities for different clearance functions described in Table S1. (*Upper*) Functional forms A and C; (*Lower*) functional form B. The MCHC line is shown in black.

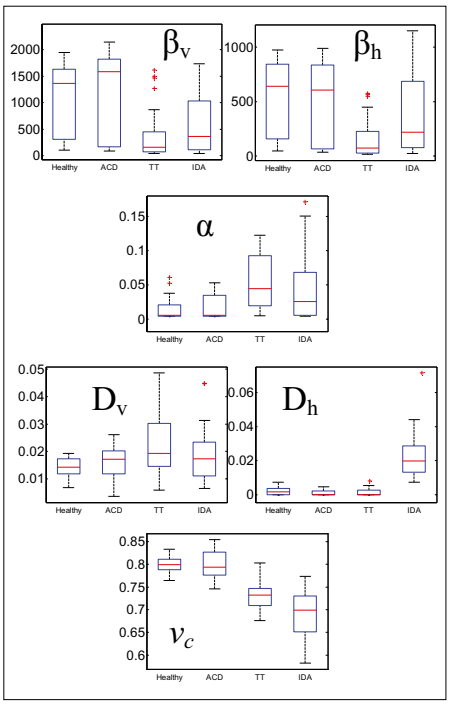


Fig. S3. Boxplots of model parameters based on functional form B from Table S1 for 20 healthy individuals and how they change for patients with three forms of mild anemia: 11 with anemia of chronic disease (ACD), 33 with thalassemia trait, and 27 with iron deficiency anemia. The upper and lower edges of each box are located at the 75th and 25th percentiles. The median is indicated by a horizontal red line. Vertical lines extend to data points that are within 1.5 times the interquartile distance from the box. More extreme data points are shown as red plus (+) symbols. The fast dynamics are characterized by β, the slow by α, random fluctuations by *D*, and the clearance threshold by v_c.

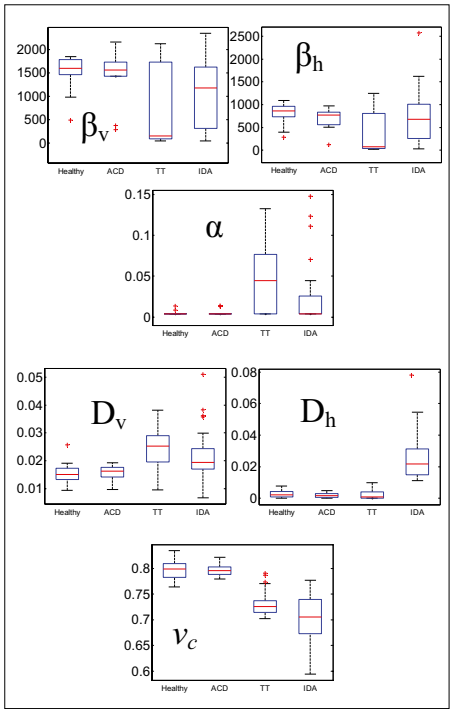
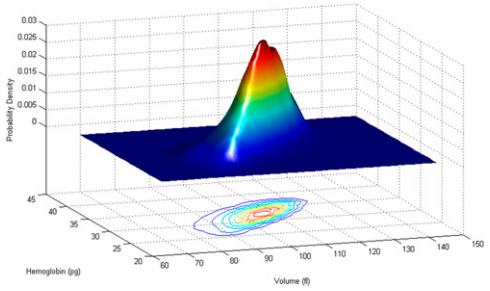


Fig. S4. Boxplots of model parameters based on functional form C from Table S1 for 20 healthy individuals and how they change for patients with three forms of mild anemia: 11 with anemia of chronic disease (ACD), 33 with thalassemia trait, and 27 with iron deficiency anemia. The upper and lower edges of each box are located at the 75th and 25th percentiles. The median is indicated by a horizontal red line. Vertical lines extend to data points that are within 1.5 times the interquartile distance from the box. More extreme data points are shown as red plus (+) symbols. The fast dynamics are characterized by β, the slow by α, random fluctuations by *D*, and the clearance threshold by v_c.

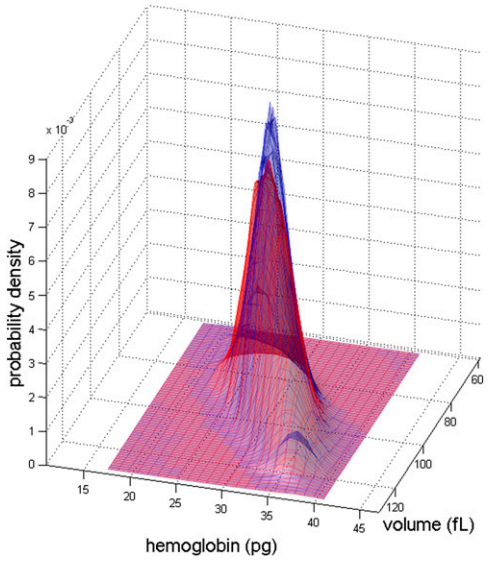
Table S1. Functional forms

	f	d
A	$f_v = \alpha \cdot e^{\beta_v (v-h)}$ $f_h = \alpha \cdot e^{\beta_h (h-v)}$	$d(v,h) = \frac{1}{1+e^{\Delta}}$
B	$f_v = \alpha \cdot \max\{\beta_v (v-h), 1\}$ $f_h = \alpha \cdot \max\{(\beta_h (h-v), 1\}$	$d(v,h) = \begin{Bmatrix} 1 & \Delta \leq 0 \\ 0 & \Delta > 0 \end{Bmatrix}$
C	$f_v = \alpha \cdot v \cdot \max\{\beta_v (v-h), 1\}$ $f_h = \alpha \cdot h \cdot \max\{\beta_h (h-v), 1\}$	$d(v,h) = \frac{1}{1+e^{\Delta}}$



Movie S1. Evolution to steady state: the measured reticulocyte distribution from a healthy individual and how this distribution evolves to steady state according to Eq. **2**, with boundary conditions of vanishing probability at volumes and hemoglobin contents outside the pathophysiological range.

Movie S1



Movie S2. Comparison of modeled and empirical distributions: the empirical (blue) distribution and the best-fit simulated (red) distribution shown in Fig. 6.

Movie S2