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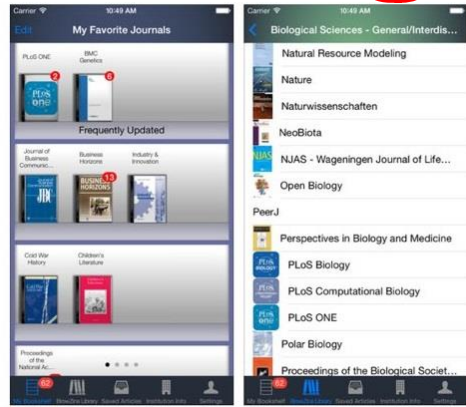


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RESEARCH ARTICLE

Episodic rolling and transient attachments create diversity in sperm swimming behavior

Donner F Babcock^{1,2*}, Petra M Wardenmuth¹ and Günther Wernemuth¹

Abstract
Background: Frequency and asymmetry of the flagellar waveforms of sperm are controlled by cAMP-mediated and Ca²⁺-dependent signaling pathways, but additional mechanisms modulate sperm swimming behavior. Here, high-speed imaging of free-swimming mouse sperm simultaneously reports flagellar waveform, orientation of sperm head, and swimming paths.
Results: We found many sperm roll to rotate around their long axis at intervals closely tied to flagellar beat frequency, allowing an asymmetrical flagellar beat to form linear averaged swimming trajectories. For non-rolling sperm, flagellar waveform asymmetry dictated circular path trajectories. Sperm rolling produced abrupt changes in swimming trajectories. The asymmetric sperm rolling was unaffected by blockade or engagement of cAMP- or Ca²⁺-mediated flagellar responses, but other sperm loosely attached (tethered) to surfaces or other cells. Sperm tethered to each other in duos or trios could have narrowed swimming paths, allowing enhanced progression.
Conclusions: We propose that transient episodes of rolling and reversible attachments are organizing principles that determine diverse swimming behaviors, which may have roles in selection of the fertilizing sperm.
Keywords: Capacitation, CASA, Hyperactivation, Sperm competition, Sperm cooperation, Sperm motility

Background
 Mature mammalian sperm and eggs are produced and released in vastly disproportionate numbers. That disparity is mostly eliminated in the period between mating and fertilization, which prepares and selects the single (or few) fertilizing sperm from the many in the deposited sperm [1]. For example, a recent study in mouse reported 9 × 10¹¹ sperm in the ampulla 4 to 5 h after coitus [2]. Much attention has focused on possible roles of chemotaxis [3], thermotaxis [4], and rheotaxis [2] in guiding kinetics of these few sperm along the female upper reproductive tract to reach the egg. However, the question of how those few sperm are selected has received little attention.
 In past work, we used step-motion imaging the flagellar waveforms of individual mouse [5-14] and man [15] sperm loosely attached (tethered) to surface, as we applied and removed various test

7. Full Text 원문 보기

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depth of field. This combination provided video records of focused images that reported x and y locations for the entire cell, regardless of position in the z plane. Spatial and temporal resolutions (about 1 μm and 3 ms) were high. The recorded flagellar waveforms and swimming paths

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 Lehmann, Tobias; Heß, Martin; Wanner, Gerhard; Melzer, Roland R

Plasticity versus specificity in RTK signalling modalities for distinct biological outcomes in motor neurons
 Caruso, Nathalie; Herberth, Balazs; Lamballe, Fabienne; Arce-Gorvel, Vilma; Maina, Flavio; Helmbacher, Françoise



8. 저장 및 공유 : 이메일, 서지관리 도구로 보내기 등 이용

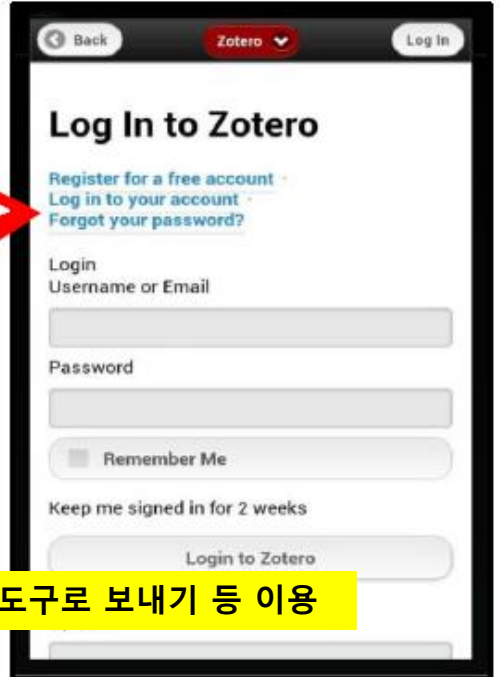


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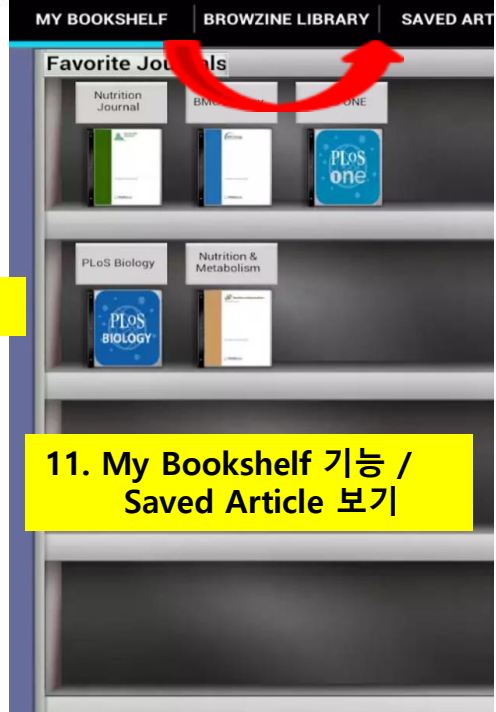
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