



SDI Review Form 1.6

Journal Name:	<u>British Journal of Mathematics & Computer Science</u>
Manuscript Number:	2015_BJMCS_17290
Title of the Manuscript:	Fluid dynamics of flow driven by nodal cilia processing non-circular cones
Type of the Article	Original Research Article

General guideline for Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty**', provided the manuscript is scientifically robust and technically sound.

To know the complete guideline for Peer Review process, reviewers are requested to visit this link:

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PART 1: Review Comments

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)
<u>Compulsory</u> REVISION comments		Thanks the reviewer for the constructive comments.



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Minor REVISION comments

There is no doubt that this paper provides very important understanding towards the basic nature of the physics of momentum and swimming. It is worth publishing. This article has future potentials and is worth publishing if the authors could answer some of these comments in the paper would be worth. This research article is very well written & can be published if the authors could

A thorough check has been carried out to fix grammatical errors.

(i) The flow is in the half infinite space. In the far field, the flow induced by the cilia is very slow. Adding a gap junction would be interested to the author, but need figure out exactly how to do it and will not be included in this study.

(ii) Force that a cilium exerted to the flow equals to hydrodynamics force that the flow exerted to a cilium. As this force of the cilium exerted to the flow is the sum of the pointed distributed along the centerline of the cilium, this has been computed when solve the flow field. A plot has been added to the paper for force distribution at a location and the total force during one period of the motion.

(iii) The fluid in biology system is the non-Newtonian fluid as the reviewer pointed out, it is our goal to build a mathematical model to study such flows in the future.

(iv) The tilt of cilia towards the wall, which breaks the symmetry of the flow, does play an important role to the directional flow in the system. This has been address in the summer as our future work.



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	address the following questions or answer the comments. <u>Questions/comments:</u> There are few spelling mistakes please correct them. 2. “Authors wrote section 3.3: “.....”As the elliptical cone has an orientation based on its major axis and minor axis, we check the trajectory for a fluid trace with a different orientation of the elliptical cones. Figure 22-27 show trajectories of a fluid tracer when two cilia sweep elliptical cones, whose major axis are perpendicular to each other. For the green cilium (on the left), $a = 2b =$	
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	1. For the black cilium (on the right), $2a = b = 1$. For these three pairs of view, the phase differences are 0, $\pi/2$ and π, respectively. These phase differences can be checked from two views of the cilia. These figures illustrate that the phase difference affects more on the shape of epicycles than the shape of long-time orbits”. Comment (i) . I would imagine the viscosity of the fluid very large, subsequently the length- scale of the flow are very small for such creeping flow, usually it is a sort of boundary lubrication scenario. Above statement or the observation is rather interesting using the mathematical formulation, but I was wondering if they could	
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	further <u>add a gap junction</u> between the elliptical cilia & experiment computationally to see whether that has any effect in the L-R symmetry breaking mechanisms. Comment (ii): Is it possible to compute the drag force on these cillias. It would be interesting to get a plot of drag force at varying velocity. Authors Comment (iii): Cillia rotation & tumbling in a highly viscous fluid (which is viscoelastic in nature) experiences the shear thinning phenomena which means the infinite viscosity of the fluid need to be considered. Hence the reviewer may suggest that authors take a hard look at the non-Newtonian fluid flow rather than Stokeslet solution of the linearized Navier –Stokes	
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	equation. Comment (iv): Due to lack of time dependence in the fluid flow cilia, which are incapable of producing sufficient wave form, instead they break the symmetry by tilting their rotational axis in the direction of flow, which in turn influences the hydrodynamic interaction of cell wall, which further create a stroke asymmetry. This may be due the presence rigid boundary near the Stokeslet flow.	
<u>Optional/General</u> comments		