This is a competent and useful study on how scaling of biomechanical and morphological variables may affect olfactory performance. The question is well motivated in light of current knowledge. The data is collected properly, the mathematical analysis, although simple, mostly captures the relevant details and is mostly is appropriate for analyzing the question. The results provide some interesting potential insights on both terrestrial and aquatic crustaceans.

There are a number of problems with some aspects of the presentation, particularly concerning how to contrast the observed allometric scaling with isometry. The authors also occasionally are not precise enough in their language, and miss some important points. This is particularly problematic in the discussion, where both the language and the lack of some relevant literature makes the ms less useful then it should otherwise be. There also is at least one fairly important issue with how the calculations are done, and correcting this probably will change the story somewhat, although I think the major messages will still be similar to what they are now. These, and a host of minor formatting/style issues need to be corrected.

Specific comments.

Major:

1) The discussion could be a little more focused in the following ways.
    a. The results show that the negative allometry, relative to isometry, enhances odorant delivery more for smaller animals. This effect is greater for situations where the diffusion coefficients are smaller. The second is expected because larger coefficients reduce the effects of diffusion limitations. It's important to note that this means that the negative allometric relationships are less of a constraint (relative to isometry) both for small molecules but also, in air. In fact, even given the roughly 10-fold increase in viscosity, the roughly 10^4 increase in diffusion constants in air substantially mitigates the effects of negative allometry in larger animals. The authors ignore this last point, but it seems potentially important; it may be that terrestrial crabs are balancing decreased water loss via the antennules with diminished odorant access, but the latter problem is not so serious as it otherwise appears because of the vastly larger D of odorants in air, and because water vapor has a D around 10^{-6}, lower than some other volatiles, but the discussion is somewhat muddled here (L262). Note also that diffusion will be strongly affected by the concentration (humidity) gradient for water, but the gradients for many volatiles will be much larger.
    b. The following statement is problematic, and is the result of incautious use of "*benefit*": (l255-256) "These results suggest that allometric growth results in disproportionately greater delivery of large molecules, while providing little benefit to smaller molecules." All that is known is that the negative allometric growth reduces l_a/l_i in adults if the molecules are small (high D). This actually may be an advantage for the animal. There are other similar places where this sort of imprecision occurs, and the authors need to be more careful in not using language that unintentionally involves a value judgment. This is not appropriate since the real constraints or selective pressures are unknown.
    c. It would be valuable to compare kinematics to other cases where it is known (e.g stomatopods, crabs) to see if the scaling is the same. This might indicate other sorts of constraints, either due to phylogeny (e.g. is the Re of the land crabs the same as aquatic

crustaceans), or alternately, show that land crabs may be using different kinematics as a result of different fluid (or other properties). The simplest assumption is that the kinematics of land crabs are changed in such a way to preserve the same Re as in water, which might say something important about flicking. Either way, this is a very important area the authors ignore.

2) L186. The expectation that aesthetasc number should increase with L^2 is questionable, since aesthetascs are confined to specific areas on the lateral flagellum. Indeed, in some species (e.g crayfish) there are relatively fixed numbers of them in each antennular segment. One could easily make the argument that the "expected" number therefore scales with L because of the necessary constraint of keeping them where odor can be intercepted during flicking. One way around this would be to compute the aggregate aesthetasc area. The argument that this should increase with L^2 makes more sense. The data indicate this does not happen because: A) individual aesthetasc area does not scale with L^2; and B) Aesthetasc number is (likely) constrained to increase with L.

3) Re: Eq 9: Only the aesthetascs themselves are permeable to odorants, so that delivery to the antennule vs. the flux of odorant to the animal is not the same. Given that the allometric relationships are different for antennules vs aesthetascs, it is not clear to me that one can use dimensions of the former to understand the latter. It is not clear how this will change the data, because the scaling relationships are different, but I think the current way of doing things is not defensible. One could use the aggregate area calculation suggested in (2). Also, the sentence here should read: "To measure odorant capture performance.." (Delete the repetition)

4) L151. The way that isometry is derived seems precisely backwards from the way it should be. If allometry is change in size of a given structure relative to body growth, doesn't it make more sense to use the smallest animal to provide the expectation, rather than the largest? This needs to be defended better, either logically or with reference to existing literature. It doesn't actually materially affect the conclusions, but it seems illogical. If the current calculation is kept, please explain that this forces the ratio of l_a/l_i to be one at the largest size, and results in negative allometric relationships (e.g. larger relative structure sizes and small body sizes) to have ratios > 1. Otherwise the audience might be confused as I initially was. Probably best to do this in methods and remind people in results when the trends are discussed.

5) L45 The choice of length scale here is very odd. It's derived from a flat plate, but this is not appropriate to describe Re around the aesthetasc or antennule. The calculation of Re in Figure 4 uses flagellum width, which is appropriate. The example should match the geometry of the situation modeled in the paper.

6) L74. Using Sc to examine scaling is fine, but many other authors have used Pe, which is a little bit better since it explicitly incorporates the object's length scale (e.g. Moore, Webster and Weissburg). Obviously the argument doesn't change, and it might be more productive to relate this work to existing literature. You could still use Sc in Eq 7.

Minor concerns

Is *terrestrialized* a word? Sounds like jargon. *Terrestrial* would do just as well

L31: Olfactory bulb normally refers to vertebrates. Olfactory lobe is the correct term for invertebrates. See work by Sandeman, Derby, M. Schmidt, Ache etc.

Line 46. Viscosity describes momentum diffusion generally, not just from a moving fluid to a still BL. Please be more accurate.

Line 67. The sentence would be stronger by reversing the clauses to put the subject first, and deleting the comma.

L88: "which integrates both changes in body size and .."

L97: How much of the range from newly metamorphosed juvenile to max adult size in encompassed by the range reported here? This information conflicts with that given on L163. It seems that morphological vs kinematic measurements are not take over the same size range. Please make this clear in methods.

L154. Allometry is defined as the relationship of growth of a particular structure or region relative to the change in body size. Isometry is a specific form of allometry, so the sentence should read "..one based on *observed* allometry *of the antennules* and one based on isometric growth.." There are numerous places in the text where the word allometry is mistakenly used to indicate that a given structure does not increase directly in proportion to body size (e.g. L174 225, 252). That is most accurately referred to as negative allometry, and the text should be revised to make this explicit, or use a term like "observed allometry".

L215. I don't think it is legitimate to use a flat plate calculation to estimate boundary layer thickness around the antennule. Too many geometric differences, and this is not essential to the argument.

L226. The results should clearly relate l_a/l_i to the allometry of morphometric and kinematic parameters. This currently is stated somewhat elliptically

L259: Info on D being characteristic of air or water should be in the figure legend also.

Figure 3. I'd have only the units in parenthesis here.

Table 1. The p-value tests whether B is different from B_0. This is confusingly stated in the present tables.

Refs: Please check them all. Nearly all of the taxonomic names are not capitalized or italicized. There also are numerous places where there are unnecessary hyphens.