Farmed Animal Funders

FUNDING SCIENTIFIC RESEARCH ON PLANT-BASED ALTERNATIVES

One of the types of research that Farmed Animal Funders completes are 'custom reviews' to help funders with their funding decisions. This piece is one of those custom reviews with some identifying information removed. Depending on the topic and the funder in question, the nature and tone of other reviews may significantly differ from this one. The motivation for this specific review was a funder asking to what extent they should fund open-access technical research for plant-based alternatives. Roughly 40 hours was spent drafting this review.

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MAIN TENTATIVE CONCLUSIONS AND SUGGESTIONS FROM THIS SHALLOW REVIEW

In summary:

- It is tentatively suggested that you [the funder this report was written for] should consider implementing, to a greater extent, a "diversifying approach" to your funding allocation.
- If you were to implement the "diversifying approach" to any significant extent, it seems likely you would allocate significant funding across at least two different general priority areas (e.g., plant-based alternatives and at least one other area) and plant-based alternatives probably wouldn't receive >80% of your annual funding allocation.
- If allocating significant funding to plant-based alternatives (e.g., 80% of your annual funding amount) it is tentatively suggested that it would probably be best to split that across multiple outstanding opportunities within the plant-based alternatives sphere rather than focusing all of it on open-access research to plant-based alternatives.
- If using several to a few million dollars to try and fund the best options within the plant-based alternatives sphere, it is tentatively suggested that the optimal annual allocation is currently unlikely to result in more than ~70% of that funding to open-access research on plant-based alternatives.

SOME INITIAL THINKING ABOUT PRIORITIZING DIFFERENT AREAS

Two key approaches to funding allocation described by the Open Philanthropy Project are:

1. **The "default approach:"**
   A. There is a common "set of criteria and processes" for all your funding,
   B. We can estimate how different funding options perform on that common "set of criteria and processes,"
   C. Then prioritize the funding options that perform best.
2. **The "diversifying approach:"**
   A. There are some different "sets of criteria and processes" that somehow can't be compared on a common metric,
   B. You assign weight to those different "sets of criteria and processes" to varying but significant degrees,
   C. You then reason to allocate funding across those "different sets of criteria and processes,"
   D. Each of those "sets of criteria and processes" then allocates funding to what's best according to them.

A way of thinking about the "**diversifying approach**" that could be helpful is that if you were using this funding approach you would allocate funding to several different buckets, and then each bucket would use its own "set of criteria and processes" to decide how that funding is allocated. "Sets of criteria and processes" is used here in the same way that the Open Philanthropy Project uses "worldviews." Alternatively, a "set of criteria and processes" might also be labelled as some "set of crucial considerations." It could also be helpful to think of different "sets of criteria and processes" as different mindsets or different ways of thinking about how to prioritize between different funding options.

Some general "criteria and processes" (with examples further specified in footnotes)[1] that could differ between the different buckets within Effective Animal Advocacy which you may want to allocate funding across are:

- Different buckets could have different processes for drawing inferences from evidence;[2]

1 Please note that this is some initial thinking about this idea. Examples given in the footnotes below are plausible candidate buckets for splitting funding across rather than those which are recommended, and the percentages assigned to them are for illustrative purposes.

2 A possible example in our context could be that in addition to the primary bucket that could be allocating most of your funding to plant-based alternatives there could be another bucket with, for instance, ~10% of your annual funding. This other bucket requires a relatively large amount of positive evidence about the effectiveness of some funding options before allocating funding to it, and if it can't find such a funding option then it allocates its funding to further research in order to determine those funding opportunities in the future. All other buckets may disagree with that approach to handling uncertainty or evidence and may be more comfortable allocating funds in light of more significant uncertainty about the effectiveness of a funding opportunity.

- Different buckets could have slightly different values that lead to large differences in how they think funding should be allocated;[3]
- Different buckets could have different initial beliefs about the effectiveness of some class of interventions.[4]

A reason for highlighting the difference between this "**default approach**" and the "**diversifying approach**" is that a funding strategy of heavily funding (e.g., ⩾80% of annual funding towards) plant-based alternatives can probably only come about if one is largely using the "**default approach**" and not the "**diversifying approach**." If to a significant extent you think that the optimal funding strategy is the "**diversifying approach**," then this would probably lead to a significantly greater split of funding across different areas within and besides plant-based alternatives.

Further, relative to the funding allocations that you [the funder for whom this report was initially written] seem to be considering (i.e., largely prioritizing plant-based alternatives), although I feel uncertain about this, I would tentatively suggest to a greater extent following the "**diversifying approach**." This approach would result in splitting funding across a few different prioritizing buckets to a greater extent, after which each of those buckets would allocate funding according to what seems best to them. Preferring the "**diversifying approach**" could come from greater uncertainty about how to prioritize funding options and/or greater difficulty in comparing priorities suggested by different "sets of criteria and processes." To the degree that you're correctly confident in some specific "set of criteria and processes" for prioritizing funding options, the "default approach" does seem correct and a plausible output of that approach could be to heavily prioritize plant-based alternatives with your funding.

3 A possible example in our context could be that in addition to the primary bucket that could be allocating most of your to plant-based alternatives there could be another bucket with, for instance, ~10% of your annual funding. This other bucket could have values that suggest that most wild animals have lives that are significantly filled with suffering. Those values may then imply that donating to groups that focus on reducing wild-animal suffering is the priority and that bucket allocates its funding to the best funding opportunities in that area. All other buckets may disagree with prioritizing that area.

4 A possible example in our context could be that in addition to the primary bucket that could be allocating most of your funding to plant-based alternatives there could be another bucket with, for instance, ~10% of your annual funding. This other bucket could one bucket that has an overall worldview that suggests that the set of interventions that are say more traditionally associated with social movements (e.g., the set of corporate campaigns, legal initiatives, and veg*n advocacy) as opposed to plant-based alternatives will be the more effective option to fund. This bucket could then attempt to find the very best funding opportunities in that other set of interventions and attempt to fund them. All other buckets could disagree that this set of interventions is going to be the most effective.

SOME INITIAL ANALYSIS REGARDING PRIORITIZING FUNDING OPEN-ACCESS RESEARCH FOR PLANT-BASED ALTERNATIVES

Plant-based options already seem to be:

1. Fairly cost-competitive, through most have significant room for progress (e.g., see the now similar prices for similar quantities of this plant-based burger and this beef burger)
2. Fairly taste-competitive, though most still have significant room for progress (e.g., see professional chefs fail to identify the plant-based burger in this taste test and one report suggesting taste is a top reason why US consumers eat plant-based proteins)
3. Stocked in some large supermarket chains
4. Included in and selling out in(!) some large fast-food chains
5. Comparing fairly well nutritionally to animal based foods
6. Are better for the environment than animal based foods

The plant-based market is now a few billion dollars in size and seems to be growing at a rate of several hundred million annually. For instance, The Plant-Based Food Association's estimate is that the US market is ~$3.3 billion; they estimated ~20% growth between mid-2017 and mid-2018, and the estimates from market reports for the likely growth rate seem to put it between 5 and 10% CAGR[5] in next 5-10 years. Again, according to PBFA's analysis, plant-based milks now account for ~15% of total US milk sales and grew by ~9% in the past 12 months. So, to give a sense of possible scenarios in the future, I very roughly modelled an optimistic scenario of the plant-based foods excluding dairy, assuming that a growth rate of 20% per year until 2030 is maintained. This would bring the plant-based meat market to 10% of the global meat and seafood market if the rest of that market were to grow at 2% per year over that time period.

On the other hand, there's arguably much reason to be skeptical of some reported timelines for cost-competitive cell-based meat. Some reports—such as the Open Philanthropy Project's Animal Product Alternatives report and van der Weele & Tramper (2014)—suggested that it is unlikely that cultured meat will become cost-competitive with conventional meat.[6,7] The relevant groups who are proponents of cell-based products might initially give timelines that are too optimistic and then revise them to be

5 For instance, this estimate of 9.4% CAGR for Asia Pacific region and a 7.7% CAGR for the entire plant-based market. The Asia Pacific market is reportedly less than $1 billion and so growing at perhaps an estimate ~$60-70 million annually.

6 "We are highly uncertain about the eventual cost per kg of cultured meat, and have not closely examined the above cost estimates. However, none of these estimates suggest a cost competitive with that of conventional meat."—The Open Philanthropy Project (2015). Animal Product Alternatives. The Open Philanthropy Project.

7 "From an economic point of view, however, competition with 'normal' meat is a big challenge; production cost emerges as the real problem. For cultured meat to become competitive, the price of conventional meat must increase greatly."—van der Weele, C., & Tramper, J. (2014). Cultured meat: every village its own factory? Trends in Biotechnology, 32(6),294-296.

more realistic as it becomes clearer that those initial timelines were optimistic.[8] The market reports analyzing the cell-based market seem to suggest that this market will likely be much smaller than the plant-based market in the near term (e.g., estimates suggesting that the cell-based market will total a few tens of millions but that the plant-based market will be many times greater than that, at a total closer to $10 billion). For those reasons, favoring the plant-based alternatives over the cell-based alternatives could be justified.

It seems reasonable to believe that one of either plant-based or cell-based alternatives would play a significant part in any longer-term massive decrease in the large-scale suffering from the industrial agriculture of animals. It also seems fair to say that, for now, there is a decent reason to prioritize supporting plant-based alternatives over cell-based alternatives. The availability of taste and cost-competitive plant-based alternatives seems to be at least one of, if not the most likely credible longer-term avenue to massively decreasing farmed animal suffering.

After settling on plant-based alternatives for animal products as a priority area, a case can be quickly made for prioritizing supporting open-access research to plant-based foods. For instance, according to GFI:

> *"The vast majority of commercially available plant-based protein ingredients comes from only 2 percent of the 150 plant species on which today's global food supply depends. A significant pool of potential plant protein sources is thus available for exploration, and this does not even take into account the almost 250,000 additional plant species not used in agriculture today. Innovation opportunities in this area include expanding and diversifying our use of plant protein sources, determining which sources are best suited to particular plant-based meat products, and ensuring that the proteins from these novel sources are optimized specifically for plant-based meat rather than plant-based foods in general."*

That strongly suggests significant knowledge gaps that could be addressed by open-access research. Furthermore, based on preliminary analysis, some of the most significant gains in market share that the plant-based meat market has made, seem to have importantly come from utilizing new processes or bringing different products—not just incrementally different, but quite different products—to market. For instance, one often used explanation for the recent market share gains is:

8 For instance, in January 2016 New Harvest reported that a cellular products would be available within a few years. Now, a few years later, they say they have no formal predictions about when products will become available.

> *"Originating from research in the 1990s, high-moisture cooking extrusion processes have enabled, in one step, the texturing of plant-based proteins into fibrous structures that mimic muscle-meat-like structures, giving them a bite and mouth-feel closer to meat. Perhaps the leading commercial example of this is the company Beyond Meat, whose products are famously said to have fooled the taste buds of Microsoft founder Bill Gates and others, leading to their investment in the company."*[9]

That is, the prevailing interpretation seems to be that some open-access research[10] from the 1990s played an important role in significant advancements in plant-based meats (with this open-access developed process then being used in the Beyond Meat and Impossible Burger) around two decades later. If that is true, that could be significant evidence in favor of a funding strategy that were to prioritize open-access research for plant-based alternatives.

But to what extent are others already addressing the research gaps in plant-based alternatives? Thus far, there seems to have been little interest in open-access research on plant-based alternatives. For instance, it was reported that GFI estimated that only about 0.3% of universities worldwide are doing research in the fields of plant-based and lab-grown meat. There seem to be few programs, labs, or funding bodies that allocate funds to this issue. Based on a very preliminary search, the ones that do include:

- The European Commission's Protein2Food
- The North Carolina Food Innovation Lab
- Plant meat matters
- Earlier this year, it was reported that the Canadian government announced that it will invest "up to nearly $153 million, matched dollar for dollar by the private sector, in the Prairie-based Protein Industries Canada Supercluster."
- Earlier this year, it was reported that Israel announced that they would invest $28 million into a food tech incubator over 8 years.

Through a very quick search for scientific articles completing research on plant-based meats ~7 (see footnote)[11] were identified and it was then a struggle to find more. It seems that very little open-

9 This quote is from here. Another example of this could be found in this article: "'In the last 10-15 years, the quality of the product has improved tremendously.' Much of that improvement can be attributed to his adoption of twin-screw extrusion technology and its ability to align the fibers in plant proteins."

10 This article seems be the one often cited as the research which lead to the advancements.

11 Here are the links:
sciencedirect.com/science/article/pii/S0023643817307041
onlinelibrary.wiley.com/doi/abs/10.1111/jhn.12546
sciencedirect.com/science/article/pii/S0959652618320080

access research for plant-based alternatives occurs. In fact, if giving a few million to this area annually, one might actually double (or more) the amount of open-access research on plant-based alternatives within the next few years. This actually could be a cause for concern that open-access research for plant-based alternatives might not have adequate room for more funding in the near future. The risk is that it might not be able to absorb more than several million in funding without there being significant diminishing marginal returns to allocating further funding to it. At that point some other area within plant-based alternatives or Effective Animal Advocacy could emerge as the new option(s) that you should prioritize.

Though, perhaps a lot of this foundational research is happening within plant-based food companies? Plant-based food companies have received investment from several large funders, ~tens of Venture Capitalist firms, and a number of large corporate partners. Over the past few years these companies seem to have raised several-hundred million dollars in funding. According to Pitchbook Data, US plant-based startups raised $296M in just the last year.[12] For what it is worth, this degree of strong investor interest from others, gives some reason to be skeptical about the counterfactual value added by investing in these companies directly. Investing in plant-based food companies may well crowd out some other investors. This seems suboptimal because most farmed animal advocacy funders otherwise would likely use that funding relatively more productively than other investors.

There's roughly 100 or more plant-based food companies—most of them are small-medium enterprises that most likely aren't really allocating resources to the type of foundational research that you're considering funding. Basically all these small and medium enterprise plant-based food companies probably would not invest much at all in research and development, and if they are, it would likely mainly focus on incremental innovations around existing products and processes.[13] That type of research is likely quite different from open access research on new products and processes.

However, some large companies could be completing their own research and development efforts that would to an extent be duplicated by the open-access funding. For instance, Quorn is reportedly spending millions of pounds on a new research facility and has a research team of more than 35 people. Beyond Meat's research team is reportedly working on new products to follow up on the release their recently released sausage. According to GFI, JUST is now sharing a platform that is a "deep database of sustainable, functional tools from the plant and animal kingdoms" in order to launch a Food Technology Accelerator. I imagine that Impossible Foods would also have significant research plans (e.g., see this report on a new fish product of theirs). Other large food companies probably also have research and development, or product development that could be worth considering. For instance, this FAIRR report profiles 16 of the largest global food companies,

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sciencedirect.com/science/article/pii/S2213329118300911
onlinelibrary.wiley.com/doi/abs/10.1111/ijfs.13847
onlinelibrary.wiley.com/doi/abs/10.1002/jsfa.9438

12 H/t Lewis Bollard who cited this statistic in a 2018 newsletter.

13 For instance, '[t]he food industry is classified as low-tech on the basis of low R&D investment and low levels of human capital. For this reason, it is believed that these firms have low capabilities of innovation and that they mainly focus upon incremental innovations around existing products and processes (Galizzi and Venturini, 1996; Grunert et al, 1997)."
I also found that this 2018 technical report for the European Commission was helpful in forming a rough impression.

each worth billions of dollars, and several companies are referenced as having dedicated internal resources (R&D, product development, procurement) that focus on developing and/or acquiring plant-based products and ingredients. As another example, Tyson has reportedly been formulating vegan protein bowls that are set to hit stores in 2019. Some of these other large food companies could be acquiring twin-screw extruders to advance their own analogue efforts. Nestle has now released an "incredible" burger.

Unfortunately it seems these for-profit companies are incentivized to keep a tight lid on their research and as such, their research is almost always largely siloed within their company. As a result of that, I think it is reasonable to say that open-access research, even if it risks duplicating existing research in large private companies, still has high expected value because others would be able to more quickly build upon it.

To further help think about the degree to fund open-access research on plant-based alternatives, it could be helpful to reason about the extent to which we would expect funding open-access research to push the plant-based alternatives research frontier forward.

The relevant research frontiers here could be usefully described as:

1. **The research frontier for a small to medium sized private enterprise**
2. **The open-access research frontier**
3. **The research frontier for a large sized private enterprise**

Again, small- to medium-sized private enterprises (i.e., less than 50 employees) seemingly do little of their own research. When they do, they mainly focus on incremental innovations around existing products and processes. There seems to be little overlap between that research and the more foundational research that this would be seeking to fund. Funding open-access research seems likely push the foundational research frontier forward for small and medium enterprises. One effect of pushing the research frontier forward for small- and medium-sized private enterprises would be to contribute to their product selection and improve their ability to bring products selected to market. An outcome of funding open-access research could be to improve the ability of small- and medium-sized private enterprises to compete with large-sized private enterprises via making their respective research frontiers closer.

Some examples of funding open-access research are The European Commission, the Canadian government, and the USDA. The total of this other funding and GFI funding might currently total 10 million dollars per year, though government funding has the potential to be much higher in the future. If government funding were much higher in the future, funding open-access research with a few million dollars such that it would only increase the amount of open-access research by <10% each year might be less worthwhile. However, quite significantly contributing to the overall amount of open-access research each year (i.e., >15%) may quite significantly close the distance between different private enterprises' research frontier and cause progress in their research frontier.

But to what extent should we expect that open-access research would cause progress in the research frontier of large sized private enterprises (i.e., an enterprise with more than 50 employees)? Large sized private enterprises in this space each complete at least a million dollars of research annually. A significant portion of this research does seem to focus on fundamental research. One concept that could be helpful to attempt to clarify is the extent to which research progress by one large private enterprise is transferred to other large enterprises. For instance, there would be some slight but significant transfer of progress on the research frontier across the large enterprises that complete research in this space. That is, $1 invested in R&D by large company A could equate to large company B investing something like $0.025-$0.50 into R&D, rather than the equivalent of company B investing $0 dollars into R&D. Since advances made by one large company can allow another large company to have a better idea of what the final chemical profile of a product should be or know that some general process can lead to some type of product so they can then focus incremental research around that process in order to create a product of interest.

To get a sense of the amount of funding large-sized private enterprises could allocate to fundamental research, rough (unpublished) modeling of the size of the plant-based foods market (excluding dairy) was conducted. In that model it was assumed that the plant-based meat market for 2018 was about $1.5 billion and that a growth rate of 10% per year until 2030 is maintained. This would bring the plant-based meat market to ~5% of the global meat and seafood market if the rest of that market were to grow at 2% per year over that time period. Under these assumptions, plant-based meats would have total revenue of ~$37 billion between now and 2030. In comparison to that revenue amount, perhaps the industry would invest a few percentages of that amount into R&D. Though, much of that could be into incremental and process improvements for existing products, rather than fundamental research. Attempting to take this all into account, a very tentative guess would be that something like a few hundred million to several hundred million would be put towards fundamental plant-based alternatives research by large private enterprises in the next decade.

If we assume that amount of research is split across ~20 companies for 10 years then that would come to an average of a few million to several million dollars of fundamental research per year for each of the ~20 large sized private enterprises. Remember, there would probably be some level correlation/overlap in their research agenda and some transfer of independent progress across any of their research frontiers.

At that level of research expenditure, progress in the research frontier of large sized enterprises probably wouldn't so outpace progress in the open-access research frontier and therefore advances in the open-access research frontier could significantly contribute to progress in the research frontier of large sized private enterprises. To be clear, that judgement is informed by an initial inspection/overall and limited understanding of:

A. The amount of funding going into the open access research frontier
B. The amount going to large-sized private enterprise research frontier, and
C. The potential of actors within those research frontiers build on progress made by others

While uncertain, funding open access research on plant-based alternatives could accelerate the release of novel plant-based alternatives and increase competition in the sector via:

- Causing progress in the research frontier of small and medium sized private enterprises.
- Causing progress in the research frontier of small to medium size enterprises to a greater extent than it would cause progress in the research frontier of large size enterprises. This decrease in the difference in research frontiers should increase the competition between i) small and medium sized private enterprises and ii) large sized private enterprises. This, in theory, should increase competition, which, in turn, should lead to faster increases in market share for plant-based alternatives.
- Causing progress in the research frontier of some large size private enterprises, leading them to bring novel alternatives to market sooner than they otherwise would.
- Causing progress in the research frontier of some large enterprises to a greater extent than it would cause progress in the research frontier of other large size enterprises. This decrease in the gap in research frontier should increase the competition between them. This in theory should increase competition which in turn should lead to faster increases in market share for plant-based meats.

The extent to which funding open-access research on plant-based alternatives would accelerate the research frontiers or increase competition within the sector seems to depend on:

- How much each large sized private enterprise allocates to fundamental research
- To what extent there would be overlap within research agendas of large sized enterprises
- To what extent should we expect there to be a transfer of any progress across the research frontiers of large-sized private enterprises
- To what extent would there be overlap between the open-access research agenda and the overall research agenda across all large sized private enterprises

A deeper analysis of whether or not to prioritize this area would:

- Look in more detail into where would be best to allocate funding to open-access alternatives.
    - For instance, deciding what research to fund is very important. We would emphasise the need to be aware that at times there could be a large disconnect between what academics want to study and what would be useful for actually furthering the plant-based food market. For this reason it seems like a good idea to have GFI or other people with enough domain expertise involved in funding allocation. They would be able to tell when this seems to be particularly likely, in which case they could decide not to allocate funding to those proposals. However, I think that in addition to domain experts reviewing applications, what could be particularly useful is helping to set the priorities of any research fund; for example, ensuring that research would apply to the most numerous and neglected farmed animals.
- Continue to examine the potential for open-access to research to cause gains in market share for plant-based alternatives.

- Consider how these two possibly significant recent updates inform the analysis:
    1. Motif Ingredients raised $90 million. Food companies may now be able to outsource the R&D process to Motif Ingredients. I would expect that Motif Ingredients alone could be doing tens of millions of dollars of research each year.
    2. Beyond Meat had quite a successful IPO. According to their use of proceeds clause, we might expect more than 10 million dollars to go into their research and development.

INITIAL BROAD OVERALL VIEWS OF PRIORITIES WITHIN PLANT-BASED ALTERNATIVES

Further analysis of the potential of open-access research to plant-based alternatives has not been completed because it seems unlikely to significantly change one's overall views of how to best allocate funding within plant-based alternatives. It seems that there are a number of potential priority areas within plant-based alternatives, with the initial list as something like:

Possible Priority Area	A Preliminary List of Possible Funding Options
Completing Open-Access Development Research	GFI and Food HQ?
Providing Strategic Support for Companies or the Industry (e.g., fostering start-ups and helping them acquire funding)	GFI, PBFA, Proveg International, Lever Foundation, The Modern Agriculture Foundation, The Protein Cluster, Future Food Institute, Food Frontier, Danish Food Cluster, HSUS FAPC, Proteines France, Terres Univia, Eating Better, University of California at Berkeley, and possibly incubators?
Completing Publicly Available Consumer Acceptance Research	Faunalytics and Animal Charity Evaluators.
Preventing Unfavorable Regulation of Alternatives	GFI, PBFA, Animal Legal Defense Fund, and The European Vegetarian Union.
Campaigning to Stock Plant-Based Options in Accessible Fashion at Major Selling Points	GFI, PBFA, Proveg International, Animal Equality, Green Monday, Mercy For Animals, HSUS FAPC, and The Albert Schweitzer Foundation.
Attempting to Fund Plant-Based Entrepreneurship Programs at North American Universities that Prima Facie Seem Promising	Stanford, MIT, Harvard, University of Pennsylvania, and UC Berkeley[14]
Promising Options in Important Low or Middle Income Countries.	Possibly Green Monday, ProVeg International, and the Lever Foundation might be good funding opportunities.

Plausibly, in addition to funding open-access research of plant-based alternatives, other areas that could be particularly promising are (with reasons for most indented):

- Providing strategic support for companies or the industry:
  - E.g., GFI reports they aided in launching Good Dot and DAO Foods International. In addition to GFI, a number of other non-profits are also looking to expand into this space and offer strategic support for plant-based alternative companies. See Proveg Incubator

14 See previous shallow review on Sutardja Center for some further reasoning about why to prioritize these universities and specifically the program at Berkeley.

and Food Frontiers as examples. This type of work could include helping raise funds for start-ups, connecting co-founders, and consulting on marketing practices.
    - Trade associations could also meaningfully support the entire industry.
- Preventing unfavorable regulation of alternatives:
    - See this lawsuit from several groups, including GFI and the Animal Legal Defense Fund countering the first US law (in Missouri) legislating that plant-based products cannot be called meat. The Plant Based Food Association (PBFA), for instance, is also looking to scale up in this area.
- Supporting plant-based alternatives in important lower and middle income countries:
    - The Asia-Pacific region has created few plant-based companies, but this is where the market is predicted to have the greatest relative growth in the near term.
    - The animal product alternatives landscape in these in lower- and middle-income countries is much more neglected and less developed than it is in high-income countries.
- Further consumer acceptance research:
    - E.g., further exploring how plant-based alternatives could be best marketed in different Asian countries.
- Campaigning to stock plant-based options in accessible fashion at major selling points

The current situation of choosing which general areas to prioritize in plant-based alternatives could be described as:

1. There are a number of (i.e., > 10) possible general areas that could be prioritized
2. There is much uncertainty about those general areas
3. Based on some initial analysis some of the general areas, in expectation, appear much better than some other general areas
4. Within those general areas (i.e., those that seem better than some other general areas and are listed in the above bullets), one cannot say with high confidence which area is best

There do not seem to be strong reasons to now think that, in general, supporting one of those areas with several hundred thousand dollars or more annually is better than supporting another with an equal amount. With the current information, one can only lean towards some areas as being more effective than other areas in general. That is, if comparing any two options from that bullet listed above perhaps one cannot currently assign more than, say, a 65% probability that funding one of those options with several hundred thousand dollars annually for the next 2 years is more effective than funding another option with that amount of money over the same time period.

It seems reasonable to say that funding open-access research to plant-based alternatives could be the top priority area within plant-based alternatives, but that it doesn't seem clearly better than the other options. Furthermore, something that could make selecting which general areas to prioritize complicated is that the variance within any of the bulleted possible priority areas could be much greater than the variance between them. So, for instance, some of the less-than-average funding

options within the area that seems most promising can be less promising than some of the greater-than-average funding options in some other area.

Tentatively, I would propose that supporting promising campaigns to stock plant-based options in accessible fashion at major selling points, or supporting plant-based alternatives in important LMIC are areas that could be the most likely to outperform open-access research to plant-based alternatives. Moreover, there would be different ways of supporting those general areas which are less promising than the better ways of supporting a number of other promising general areas within plant-based alternatives.

The variance in the relevant areas seems to imply that if you are wanting to fund the most promising options within plant-based alternatives, then rather than heavily allocating funding to one specific area such as open access research on plant-based alternatives, it seems that a better approach could be to fund the outstanding opportunities from a few different priority areas. If allocating a few million dollars to several million dollars per year to plant-based alternatives, I think that at this point and into the near future, it would be unlikely that the optimal allocation would be more than, ~70% to open-access scientific research on developing plant-based alternatives.

MAIN TENTATIVE CONCLUSIONS AND SUGGESTIONS FROM THIS SHALLOW REVIEW

To recap:

- It is tentatively suggested that you should consider implementing, to a greater extent, a "**diversifying approach**" to your funding allocation.
- If the funder were to implement the "**diversifying approach**" to any significant extent, it seems likely they would allocate significant funding across at least two different general priority areas (e.g., plant-based alternatives and at least one other area) and plant-based alternatives probably wouldn't receive >80% of your annual funding allocation.
- If allocating significant funding to plant-based alternatives (e.g., 80% of your annual funding amount) it is tentatively suggested that it would probably be best to split that across multiple outstanding opportunities within the plant-based alternatives sphere rather than focusing all of it on open-access research to plant-based alternatives.
- If using several to a few million dollars to try and fund the best options within the plant-based alternatives sphere, it is tentatively suggested that the optimal annual allocation is currently unlikely to result in more than ~70% of that funding to open-access research on plant-based alternatives.

Please contact
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