

MIT Solve Application 2024

Deadline: April 18, 2024 - 12:00 PM EDT <https://arewemeetingyet.com/UTC/2024-04-18/16:00>

Deadline: TBC extended to April 23, 2024 - 12:00 PM EDT - via email, check accuracy,
<https://arewemeetingyet.com/UTC/2024-04-23/16:00>

-> perhaps best to aim for Apr 18, 2024 - 12:00 PM EDT anyways, if possible

Created: 4 Mar 2024 11:00 , YH

Last updated: 16 Apr 2024 , YH

About the MIT Solve Application

Website: <https://solve.mit.edu/challenges/2024-global-health-challenge>

Previous applications (from OBL/Reclone):

-  MIT Solve : [2020](#), 2022
-  2024_MIT Solve : [2020 \(copy\)](#) (same as above file/link, just copied into current folder),

This application (from Reclone):

-  2024_MIT Solve :  MIT Solve Application 2024.docx (this file)

Aim: for the 2024 MIT Solve Application - intended to be a Reclone project, scope yet undefined, but likely to align with the mission of developing distributed/decentralised Reclone Reagent Hubs around the world, as a replacement/ follow-on project from the FreeGenes Project.

Current Hubs include: Mendoza, Argentina; Accra, Ghana; Manila, Philippines.

Interest from the following to become Hubs: Ottawa, Canada; Brazil; South Africa; India (?); ...

San Juan, Puerto Rico

Santiago, Chile.

Scope/Theme: diagnostics, for resilience and pandemic preparedness; increasing capacity and developing a robust supply chain; developing Reclone Regional Reagent Hubs with technical coordination and training to ensure health equity.

- ☐ YH to provide more details about the scope and timeframe on the project. By Wed 20-Mar-2024.

Application Authors/Contributors

The people involved in this application are listed in the table below. If you would like to be a contributor, please fill in your details here:

Full Name (Initials)	Email Address	Contributions (inc. CRediT*)	Time / Availability
Jenny MOLLOY (JM)	jcm80	Conceptualisation; Writing - review & editing; Supervision;	
Yan Kay HO (YH)	ykh26@cam.ac.uk (first point of contact)	Conceptualisation*; Writing - original draft; Writing - review & editing*; Investigation; Project administration*; Supervision*; ... (*=primary focus/es)	~2 h/w. Next working on this is: Mon 18-Mar-2024 13:00-14:00 UTC.
Cibele Zolnier (CZ)	coordination@reclone.org	? Project administration; ...	
Youzi Bi (YB)	1020705322h@gmail.com	Writing- original draft Writing- review & editing	
Sakti Subramanian	subramaniansakti@gmail.com	Writing - original draft Writing - review & editing	
Fernan Federici	ffederici@bio.puc.cl	Conceptualisation; Writing - original draft Writing - review & editing	2h/week
Adrian F	openbioscience@gmail.com	Writing - original draft Writing - review & editing	2h/w
David J. Castillo	glyxonbiolabs@gmail.com		2h/w
Aaron Macauyag		? Conceptualisation	

* Contributor roles follow the CRediT system: <https://credit.niso.org/> . Anyone making a significant contribution towards a project – whatever the role – should be listed as a co-author.

CRedit contributions that merit authorship are: conceptualisation, investigation, methodology, resources, data curation, formal analysis, validation, software, writing – original draft, writing – review & editing, visualisation, supervision, project administration, and funding acquisition.

Once you have indicated your interest to be an author/contributor, please also self-assign what you plan to work on in the Actions Outstanding section below.

In terms of “significant contributions” towards credit and attributions, YH and JM will have the final word based on what they have seen as support during the completion of this application.

Actions Outstanding

This table lists the actions that need to be completed for the application, the people assigned to the tasks, and a deadline for when actions are due.

-> Ideally, to have at least two (2) Responsible People and one (1) Reviewer per Action Item.

We understand if you cannot always meet the deadlines, but if you realise this may be an issue, please let YH know with as much notice as possible.

ID #	Action	Volunteer/Assignee(s) (Initials)	Due Date/Time (DDD dd-mmm-yyyy hh:mm UTC)
1	- Add in the QUESTIONS from this PDF file that need to be answered as part of the application into this document below. - You do not need to make an account; you can use any one of the “Submitted Solutions” on https://solve.mit.edu/challenges/2024-global-health-challenge/solutions#challenge-subnav as a template for copying the QUESTIONS from the four sections: — Solution Overview & Team Lead Details — More About Your Solution — Your Team — Your Business Model & Funding — And paste into the below document; use Heading 4 formatting for each Question. — To help get started, YH has copied some of the questions for the first section as an example of what to do. — Check with another of the “Submitted Solutions” to make sure all Questions have been copied over.	Responsible person(s): - YB, - ??, - ... Reviewer(s): - YH	Wed 13-Mar-2024 12:00 UTC [DONE]
2	- Call for authors/contributors for the project to add their details to the Authors/Contributors section above.	Responsible person(s): - YH,	Wed 13-Mar-2024 14:00 UTC

			[DONE]
2.1	- Meet with potential contributors, see https://forum.reclone.org/t/join-the-open-working-session-on-drafting-a-proposal-for-the-mit-solves-global-health-equity-challenge-2024/931	Responsible person(s): - All Contributors Reviewer(s): - YH	Wed 20 March 2024 14:00 UTC Via Zoom: Launch Meeting - Zoom [DONE]
3	- Read guidelines for applying: Before you begin an application, be sure to review the Become a Solver page on our website for details on the types of solutions we accept and the criteria that judges use to score your application.	Responsible person(s): - All Contributors (Add your initials below when you have done this) - YH, - ??, - AF,	Prior to doing Action #4.
4	- Fill in responses for the Questions copied from Action #1 - You can refer to this Reference section for how to fill in, but note that this was for the 2020 application, and the scope of Reclone vision/mission has changed. - Depending on Questions, may have different assignees for each section, this will be noted in () after the assignee's initials.	Responsible person(s): - YH (A-D), - YB (A,C), - ?? (e.g. D), - ... Reviewer(s): - YH	Fri 05-Apr-2024 Anywhere on Earth (UTC-12)
5	- Review Application in this file. - Invite authors/contributors to make final comments.	Responsible person(s): - YH, - ??, - ... Reviewer(s): - YH, JM	Mon 08-Apr-2024 13:00 UTC
6	- Submit Application - Copy responses from this file to the application page.	Responsible person(s): - YH Reviewer(s): - JM	Fri 12-Apr-2024 (17:00 GMT/UTC+1) Final Deadline: Thu 18-Apr-2024 (12:00 EDT /

			16:00 UTC / 17:00 GMT/UTC+1)
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Questions from Potential Contributors?

Should you have any questions/suggestions, feel free to leave them here, and YH will check in periodically to answer. Should you not receive a reply within 48h (and/or if your question is urgent), highlight the question and add in a comment that tags in ykh26@cam.ac.uk.

Associated Question/Suggestion [tags]:

- [Solved] = Question/Suggestion answered / taken into consideration.
- [Open] = Not (fully) answered yet.
- [Duplicate] = Will be integrated together.

1. **[Solved] YH: How do we submit the application?**

YH will use her account to submit the application, using the responses from the [Application Answers below](#).

Plan to review answers on Mon 08-Apr-2024, and submit by Fri 12-Apr-2024 (17:00 GMT/UTC+1).

2. **[Open] Anon: How can I be a named author/contributor for this application? And what would I be expected to do?**

Ideally, you would be able to actively dedicate 1~4 h to help with drafting the application. If the application is successful, we can discuss which aspect of the project/time a contributor can provide to implementing the project.

3. **[Solved] Are there any tips/guidelines for the application?**

Tips for Completing the Application [Info from submission account, via YH]

Once you decide you would like to apply to Solve's 2024 Global Challenges, begin your application as soon as you can. In post-application surveys, most applicants reported that they spent several hours completing the application. Be sure to budget enough time to submit your application before the deadline.

Keep in mind that all answers you submit are visible to the public, unless they are denoted as "Not Publicly Viewable: for internal use only." Please only share information in your application that you are comfortable publicly sharing.

Only some of the questions in the application are required, and they all appear in the Solution Overview section. You must answer all the required questions in order to submit your application. But we strongly encourage you to complete the optional questions too – applicants who answer all or most of the optional questions are more likely to be selected.

Your solution is not saved OR submitted automatically! Follow the directions below to make sure you don't lose your work. If you have an unstable internet connection, you may wish to work offline using this list of questions, then copy-paste your answers into the application.

4. **[Solved] What happens if we get selected?**

<https://solve.mit.edu/become-a-solver>

Solver® teams receive funding, nine months of personalized support and join Solve's community of social impact leaders.

Selected applicants become [Solver](#) teams and:

- Receive a \$10,000 prize from Solve and access to additional funding in the form of grants and investments
- Participate in a 9 month virtual support program including
 - Tailored capacity workshops
 - Leadership coaching
 - Access to in-kind and pro bono resources such as software licenses and legal services
 - Curated opportunities to connect & network with impressive peers that act as a trusted support group, offering inspiration and guidance.
 - Monitoring and evaluation support to build an impact measurement practice
- Join a powerful network of impact-minded leaders across industries and sectors, with dedicated spaces to meet year-round and travel stipends to join [Solve's flagship events](#)
- Gain exposure in the media and at conferences.

Thanks to our partners, to date Solve has mobilized **over \$70 million in funding** for Solver teams and social innovators, in addition to in-kind support.

September 2024: Solve Challenge Finals [Info from submission account, via YH]

If your solution is selected as a Solver team, your solution Team Lead must be available to attend Solve Challenge Finals (a live pitch and networking event) in New York City in September 2024. Travel funding is available. Please note that MIT Solve follows MIT, Massachusetts State, and United States Federal COVID-19 guidelines and policies pertaining to all in-person gatherings and will be in touch should we need to modify our plans.

See also Answer to Q5.

5. **[Solved] What are the Prizes?**

<https://solve.mit.edu/challenges/2024-global-health-challenge/custom/prizes>

There are multiple prizes that can be awarded:

- a. MIT Solve - Solver Award
All Solver teams selected for Solve's Global Challenges and the Indigenous Communities Fellowship will receive a \$10,000 grant funded by Solve.

- b. **The GSR Foundation Prize**
GSR Foundation will award a prize to solutions that use technology in an innovative way to address pressing issues in their communities, which have the potential to scale globally. Preference will be given to solutions that remove barriers to financial inclusion, and that place a strong emphasis on learning. The prize is funded by the GSR Foundation, an independent charity founded by GSR, a leading cryptocurrency trading firm. The Foundation seeks to advance education, promote equality of opportunity, and contribute to a sustainable world, emphasizing blockchain and innovative technology-powered solutions. Up to \$150,000 will be awarded across several Solver teams from any of Solve's 2024 Global Challenges.
- c. **Morgridge Family Foundation AI Innovation Prize**
Solutions that use AI to boldly spark change through innovation, disruption, and transformation are eligible for the Morgridge Family Foundation AI Innovation Prize. The Morgridge Family Foundation invests in leaders and organizations who are reimagining solutions to some of today's biggest challenges. Up to \$50,000 will be granted across up to two Solver teams from Solve's 2024 Global Challenges or from Solve's portfolio of Solver teams.
- d. **The AI for Humanity Prize**
The AI for Humanity Prize is open to solutions leveraging data science, artificial intelligence, and/or machine learning to benefit humanity. The prize is made possible by The Patrick J. McGovern Foundation, a philanthropy committed to advancing AI and data solutions to create a thriving, equitable, and sustainable future for all. Up to \$150,000 will be awarded across several Solver teams from any of the 2024 Global Challenges.

6. **[Open] How was the process for the 2020 Solution? And are there previous successes from other applicants?**

7. **[Open] Question ...**

8. **[Open] Suggestion ...**

9. **[Open] Suggestion ...**

10. **[Open] Suggestion ...**

!!! 2024 Application

Sections are grouped into:

- ! = needs action (i.e. to draft and review)
- [WIP] = work in progress, draft needs completing, then reviewing
- [Review] = drafted, and ready for review
- [Done] = ready to submit
- ? = optional action

(A) Solution Overview & Team Lead Details

[Done] Our Organization (Required)

Reclone (The Reagent Collaboration Network - Reclone.org)

JM: does this need to be an actual organisation? If so, probably add University of Cambridge

[Done] What is the name of your solution? (Required) {Character Limit = 30}

Applicants typically use their organization name or the name of their product or service, if different from organization, as their solution name. We recommend a length of 1-4 words. The name you provide will be used to refer to your solution on Solve's website, during the selection process, and, if you are selected, during your participation in Solve. Examples of solution names can be found [here](#).

Reclone: The Reagent Collaboration Network

[Review] Provide a one-line summary of your solution. (Required) {Character Limit = 150}

Describe your solution in 10-20 words. This summary will be used to describe your solution on the Solve website and to refer to it during the selection process. Examples of one-line summaries can be found [here](#) directly under each solution name.

Increasing equitable health security through hubs to access affordable reagents for infectious disease research and surveillance in the global South

[Done] In what city, town, or region is your solution team headquartered? (Required)
Cambridge

[Done] In what country is your solution team headquartered? (Required)
United Kingdom

[Done] What type of organization is your solution team?

Refer to this [link](#) for organization definitions.

- For-profit, including B-Corp or similar models
- Nonprofit
- Hybrid of for-profit and nonprofit
- Not registered as any organization
- Other, including part of a larger organization (please explain below)

[IF OTHER] If you selected Other, please explain here. {Word limit = 100}

For example, if your solution team is part of a larger organization, share the name of the larger organization and describe the relationship between your solution and that organization.

[Done] Other, including part of a larger organization (please explain below) {Word limit = 100}

If you selected Other, please explain here.

Reclone is currently hosted by the University of Cambridge but is a global consortium with distributed leadership, primarily based in the UK, Brazil, and the Philippines.

? Film your elevator pitch.

Provide a Vimeo or YouTube video link pitching your solution (maximum 2-minute video). Your video doesn't need to be fancy—you can simply record yourself speaking into the camera of a smartphone. Though it's not required, a video will help our reviewers understand your solution. If you have a tangible product, we suggest that you demo it in the video. An example of a successful application and its video pitch can be found [here](#). Note: please ensure the video privacy settings are set to public.

[OPTIONAL]

[Review] What specific problem are you solving? (Required) {Word limit = 500}

Describe the specific problem within the Challenge that you are working to solve. What is the scale of the problem in the communities you are working in, and globally? How many people are affected? Which factors contributing to the problem relate to your solution? Include any relevant local or global statistics. If you're not sure where to start, take a look at these resources [here](#) and [here](#). You can also review answers from successful applications, [such as this one](#).

...

Theme: diagnostics, for resilience and pandemic preparedness; increasing capacity and developing a robust supply chain; developing Reclone Regional Reagent Hubs with technical coordination and training to ensure health equity.

Diagnostic testing is essential: in a direct sense to ensure patients get the care they need but also because it is our primary lens onto the emergence and spread of disease.

The global supply chain for diagnostic reagents - the chemicals and materials that enable testing for human disease - is broken. Reagent manufacturing is concentrated in North America, Europe, and specific parts of Asia (China, India, South Korea, Japan), leaving most of Asia, Africa, and Latin America heavily dependent on importation of test components, which are disproportionately expensive compared to their purchasing power and can take months to be delivered. This situation (i) delays research to develop diagnostics that respond to new threats or to local health system requirements; (ii) delays innovation and translation from bench to bedside; and (iii) ultimately delays and decreases reliability of deployment for surveillance and clinical testing, leading to inequitable access to quality care.

COVID-19 demonstrated that when supply chains are under pressure in a global pandemic, the health security of countries with no domestic manufacturing capacity is especially severely impacted. The Director of the Africa CDC John Nkengasong said in 2020 that “a failure of international solidarity [has] shoved Africa out of the diagnostics market. African countries have funds to pay for reagents but cannot buy them”. This problem needs to be addressed to improve health security, resilience and autonomy in low- and middle-income countries (LMICs), which are disproportionately impacted by infectious diseases and other health threats.

The World Health Organization narrowed down specific problems to be solved to increase equitable access to effective, high quality diagnostics in LMICs when they compiled learnings from the COVID-19 pandemic (WHO, [a](#), [b](#), [c](#)), which are also echoed in the 2023 WHO resolution on strengthening diagnostics capacity. Recommendations included: allocating funds to catalyse early-stage research and product development of diagnostics and other medical countermeasures in LMICs, especially those that may be needed for future pandemics or for diseases that disproportionately afflict marginalised populations; developing regional manufacturing capabilities to ensure supply chain diversification and quicker access to resources in an emergency; improving legal and regulatory options for equitable sharing of diagnostics including material transfer agreements and intellectual property waivers. Strengthening international cooperative mechanisms was also recommended - including South-South partnerships and triangular cooperation - for diagnostics research and development, regulation and manufacturing; surveillance and reporting; and supply chain resilience.

Reclone addresses these recommendations through a global collaboration to solve the pragmatic challenges of access to the materials, skills and technical support needed for researchers, innovators and manufacturers in LMICs to produce diagnostic reagents.

[421 of 500 words]

[Review] What is your solution? (Required) {Word limit = 500}

Describe your solution and how it works in simple terms. What is it? What does it do? Briefly describe how it works and what technology it uses. Be sure to use this space to talk about your solution, not the problem you are trying to solve. If relevant, share a link to a video of a product demo.

...

[Theme: diagnostics, for resilience and pandemic preparedness; increasing capacity and developing a robust supply chain; developing Reclone Regional Reagent Hubs with technical coordination and training to ensure health equity.]

The Reagent Collaboration Network (Reclone) is a global coalition of scientists developing and deploying an open-source manufacturing model for local production of biological reagents to international standards that are lower-cost and adapted for use in resource-limited contexts.

Our solution has three main components: (1) curating a community-sourced molecular biology toolkit for producing diagnostic reagents; (2) developing a decentralised network for distributing these toolkits; and (3) building an engaged, responsive community of LMIC researchers, industry partners, entrepreneurs, and other relevant parties with the technical capacity for research, product development and manufacturing of molecular diagnostics, even in low-resource settings.

- 1) **Reclone Research in Diagnostics Toolkit:** We have synthesised an open-source toolkit of DNA that produces diagnostic enzymes and we are developing a Reclone Manufacturing Blueprint (including detailed Standard Operating Procedures and template Quality Assurance documents) to assist local producers to use for both research purposes and to meet international standards for *in vitro* diagnostics manufacture.

This package of technology will rapidly enable production of diagnostic enzymes in the bacteria *Escherichia coli* using tried-and-tested techniques (induction of expression by the chemical IPTG and purification by affinity chromatography using nickel) by a network of public and private partnerships

operating as collaborations between universities, national public health laboratories, and local biotech companies.

- 2) **Reclone Regional Distribution Hubs:** We have currently established three Reclone Regional Distribution Hubs, based in Argentina, Ghana, and the Philippines, who form the initial phase for setting up a decentralised reagent supply network for the DNA toolkit. Partners in Chile, Colombia, Peru, Ethiopia, and Cameroon are all at various stages in the research development and/or manufacturing of the toolkit enzymes, whilst collaborators in Chile, Brazil, Puerto Rico, Canada, South America, and India have expressed interest in becoming Regional Hubs once the initial Hubs are firmly established.
- 3) **Community and Capacity Building:** We have monthly Community Meetings to bring together our global network of researchers and for sharing current research from Reclone members around the world. Via the Reclone Forum (forum.reclone.org) and a WhatsApp Community group, we are able to share knowledge and coordinate Working Groups to develop Open DNA Collections and other ready-to-use toolkits. We have also coordinated training courses and lab exchanges between researchers within Latin America and Africa to provide the practical expertise in using the DNA toolkits.
Building on these existing frameworks would allow for scaling up both the technical expertise of the community and encourage engagement from other parties, commercial and otherwise, who can make good use of the distributed toolkits and apply it to diagnostic manufacturing and testing where it is most needed.

Our approach enables rapid redistribution of material from any Hub and accelerates development through collaboratively sharing know-how through building out connections and collaborations.

[500 of 500 words]

[WIP] Who does your solution serve, and in what ways will the solution impact their lives? (Required) {Word limit = 500}

Describe the target population whose lives you are working to directly and meaningfully improve. Who are they, and in what ways are they currently underserved? How will the solution address their needs?

...

Our solution directly serves diagnostic researchers, innovators, and manufacturers in LMICs, with the ultimate beneficiaries being We aim to increase the technological autonomy of LMICs by reducing distribution time and overall costs of reagents by up to 90%.

...

[WIP] How are you and your team well-positioned to deliver this solution? (Required)
{Word limit = 500}

Explain why you and your team are the right people to design and deliver this solution to the target population. We aren't looking for your academic or professional credentials here; we would like to understand your proximity to the communities you are serving. In particular, how is the Team Lead and the team representative of these communities? How is the design and implementation of your solution meaningfully guided by the communities' input, ideas, and agendas?

...

Our team has a deep understanding of the challenges faced by LMIC researchers, innovators and manufacturers in accessing reagents because we are that target group. With a coordination team and community fellows based in the UK, Brazil, Argentina, Ghana and the Philippines, many of our team also have lived experience of the impact that limited access to infectious disease research, surveillance and diagnostics has on the lives of their family, friends and local communities.

Our Team Lead Dr Jenny Molloy has been working in biotechnology for global health and exploring the role of open and collaborative technology development for over a decade, and the active volunteers within the community comprise senior and early career researchers, community lab members and community managers from over 20 countries.

Our wider community is convened at bimonthly community meetings with 15-25 participants, via an online forum and in bilateral calls to co-design the distribution hub model, co-author policy briefs, curate enzymes that should be included in our open source enzyme expression toolkits, write open protocols and generate other Reclone assets and initiatives. There are over four South-South and trilateral research collaborations ongoing within the community on rapid molecular tests for COVID, typhoid and other diseases of concern in LMICs, where the research agenda is led by researchers in the global South, informed by local community challenges.

[Done] Which dimension of the Challenge does your solution most closely address?
(Required)

Select the dimension to which your solution is most aligned. If your solution is not aligned to any of the listed dimensions, select Other.

Global Health Challenge	• Ensure health-related data is collected ethically and effectively, and that AI and other insights are accurate, targeted, and actionable. • Increase capacity and resilience of health systems, including workforce, supply chains, and other infrastructure. • Increase access to and quality of health services for medically underserved groups around the world (such as refugees and other displaced people, women and children, older adults, and LGBTQ+ individuals). • Other
Global Learning Challenge	• Ensure that all children are learning in good educational environments, particularly those affected by poverty or displacement. • Use inclusive design to ensure engagement and better outcomes for learners with disabilities and neurodivergent learners, while benefiting all learners. • Provide the skills that people need to thrive in both their community and a complex world, including social-emotional competencies, problem-solving, and literacy around new technologies such as AI. • Other
Global Climate Challenge	• Adapt cities to more extreme weather, including through climate-smart buildings, incorporating climate risk in infrastructure planning, and restoring regional ecosystems. • Enable a low-carbon and nutritious global food system, across large and small-scale producers plus supply chains that reduce food loss. • Strengthen coastal and marine ecosystems and communities through the broader blue economy, including fisheries, clean energy, and monitoring, reporting, and verification. • Other
2024 Indigenous Communities Fellowship	• Strengthen sustainable energy sovereignty and support climate resilience initiatives by and for Indigenous peoples. • Drive positive outcomes for Indigenous learners of any age and context through culturally grounded educational opportunities. • Promote culturally informed mental and physical health and wellness services for Indigenous community members.

[Done] Which of the UN Sustainable Development Goals does your solution address?

Select all that apply. You can read more about the 17 UN Sustainable Development Goals and how progress toward them is measured here. (Required)

1. No Poverty
2. Zero Hunger
- 3. Good Health and Well-Being**
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
- 9. Industry, Innovation, and Infrastructure**
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life On Land
16. Peace, Justice, and Strong Institutions
- 17. Partnerships for the Goals**

You'll be asked this version of the question if you are an applicant for the ~~Global Economic Prosperity Challenge~~, **Global Health Challenge**, ~~Global Learning Challenge~~, or ~~Global Climate Challenge~~.

[Review] What is your solution's stage of development? (Required)

Review the definitions below and select the most appropriate stage for your solution. Though you are able submit a solution at Concept-stage, please note that MIT Solve is not able to support Concept-stage solutions, and therefore Concept-stage solutions will not be reviewed or selected as Solver teams. We also hope that you will apply to a future Challenge when your solution is further developed. Be honest about your stage - we accept solutions across stages, including prototypes and pilots; exaggerating your progress can affect your chances of selection.

- • Concept: An idea being explored and researched for its feasibility to build a product, service, or business model, including prototypes under development. Until the solution has a functioning prototype, we would still consider it a Concept.
- • Prototype: An initial working version of a solution that may be in the process of getting initial feedback or testing with users (i.e. running a pilot). If for-profit, a solution that has raised little or no investment capital. Until the solution transitions from testing to consistent availability, we would still consider it a Prototype. (Often 0 users/direct beneficiaries)
- • Pilot: The solution has been launched in at least one community, but is still iterating on design or business model. If for-profit, is generally working to gain traction and may have completed a fundraising round with investment capital. (Often 10+ users/direct beneficiaries)

- • Growth: An established solution available in one or more communities with a consistent design and approach, ready for further growth in multiple communities or countries. If for-profit, has generally completed at least one formal investment round (Seed stage or later). If nonprofit, has an established set of donors and/or revenue streams.
- • Scale: A standard solution operating in many communities or multiple countries and is prepared to scale significantly by improving efficiency. If for-profit, has likely raised at least a Series A investment round.

[WIP] Please share details about why you selected the stage above. (Required)

What have you built and tested so far? How many customers or beneficiaries have you served? Please focus this answer on what you've accomplished so far, not what you plan to do.

Reclone Research in Diagnostics Toolkit: We synthesised the Reclone Research in Diagnostics toolkit, an open-source toolkit of DNA for producing diagnostic enzymes and we are in the process of developing a Reclone Manufacturing Blueprint to assist local producers to use the toolkit for both research purposes and for *in vitro* diagnostics manufacture.

The toolkit has been distributed to over 100 labs via the Free Genes project at Stanford and Reclone members, of which approximately half were beneficiaries in the Global South.

Reclone Regional Distribution Hubs: We have now established partnerships with academic researchers at the Universidad Nacional de Cuyo (UNCUYO) in Argentina, Ashesi University in Ghana, and the Ateneo Research Institute of Science and Engineering (ARISE) in the Philippines, as they act as the Regional Hubs.

Currently, each Hub has stored a selection of enzymes from the Research in Diagnostics Toolkit, and the intention is for a larger set of the toolkits to be sent out from the University of Cambridge to these pilot Hubs, to enable a larger collection of the toolkits to be shared. Partners in Chile, Colombia, Peru, Ethiopia, and Cameroon are all at various stages in the research development and/or manufacturing of the toolkit enzymes, whilst collaborators in Chile, Brazil, Puerto Rico, Canada, South America, and India have expressed interest in becoming Regional Hubs once the initial Hubs are firmly established.

Community and Capacity Building: we have convened over 20 community meetings and six symposia (see 44 videos on youtube https://www.youtube.com/@reclone_org/videos) which have showcased relevant work on access to reagents, with a focus on health research and diagnostics in the global South. We have trained over 250 researchers from ten LMICs in molecular diagnostic techniques and/or reagent manufacturing, published >10 protocols on protocols.io and hosted four early career Fellows.

[WIP] Why are you applying to Solve? (Required) {Word limit = 500}

What specific financial, technical, legal, cultural, or market barriers that you face do you hope Solve can help you overcome, and how? Keep in mind: Solve aims to connect all Solver teams with partners who can help advance their solutions through monetary and/or non-monetary support. If your only goal in applying to Solve is to raise funds, Solve is not the right program for you! Review the [Become a Solver page](#) ("What will I get if my solution is selected?") for more information about what selected Solver teams receive.

...

We would like to tap into the Solve network to help work on the following bottlenecks:

- 1) Distribution and logistics: One of the larger technical and legal issues for distributing the DNA toolkits (classed as nucleic acids) is with shipping logistics to numerous countries, each of which have different regulations in terms of import duties, taxes, and permits. With complex documentation requirements for requests from some countries, and with limited personnel with experience in such processes, has led to long delays in distributing and receiving the reagents. We believe that other Solver teams will have encountered related challenges, or may have supply chain solutions which can help us.
- 2) Communications and marketing: we want to showcase the work and success stories of the amazing researchers in the Reclone community who are addressing health equity in terms of access to diagnostics in the global South at the research, surveillance and clinical level. We also want to learn from Solve's experience with developing case studies that highlight both the people and technology, such that we can create a portfolio of use cases and build a network of Reclone collection users that can inspire new users to the benefits, problems, and lessons learnt with using our open-source DNA toolkits.
- 3)

Finally, financial support is ... open source projects tend to be an afterthought... which means that there needs to be incentive for users to want to develop the toolkits and produce these case studies on top of their BAU. For most, the provision of some stipend can provide the stimulus to dedicate time and research efforts towards these directions.

[Review] In which of the following areas do you most need partners or support?

Please select the most relevant areas in which you seek advice, mentorship, or partners to support your work.

- Business Model (e.g. product-market fit, strategy & development)
- Financial (e.g. accounting practices, pitching to investors)
- Human Capital (e.g. sourcing talent, board development)
- Legal or Regulatory Matters
- **Monitoring & Evaluation (e.g. collecting/using data, measuring impact)**
- **Product / Service Distribution (e.g. delivery, logistics, expanding client base)**
- **Public Relations (e.g. branding/marketing strategy, social and global media)**

- Technology (e.g. software or hardware, web development/design)

[Done] Who is the Team Lead for your solution? (Required)

The person you identify should be the CEO or Executive Director of the solution organization. (In some special cases, the Team Lead may be another member of the executive team.) They should be the person who is responsible for the strategic direction of the solution. If your solution is selected as a Finalist, this person will be expected to pitch the solution and interview with judges in July over Zoom. If your solution is selected as a Solver, this person will be expected to attend Solve Challenge Finals in New York City in September, and to be the lead participant in the Solver program.

...

Jenny Molloy

~~You'll be asked this only for the Indigenous Communities Fellowship.~~

~~Please indicate the tribal affiliation of your Team Lead.~~

~~How is your Team Lead connected to the community or communities in which your project is based? (Required)~~

[Done] Is the Team Lead a resident of the United States? (Required) [Not Publicly Viewable: for internal use only]

We ask this and the following questions about your Team Lead to help our staff use the most respectful language when addressing or referring to them, to better understand our applicant pool, and to fulfill some of our grant reporting requirements.

- Yes
- **No**
- Prefer not to answer

[IF YES] What is the Team Lead's race or ethnic group? Mark all that apply. (Required) [Not Publicly Viewable: for internal use only]

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Hispanic or Latino
- ☐ Native Hawaiian or other Pacific Islander
- ☐ White
- ☐ Prefer not to answer

You'll be asked this version of the question if you are an applicant for the ~~Global Economic~~

~~Prosperity Challenge, Global Health Challenge, Global Learning Challenge, or Global Climate Challenge.~~

[IF YES] Would you like to be considered for the Black & Brown Innovators in the US Program? (Required) [Not Publicly Viewable: for internal use only]

In recognition of racial disparities among US communities, we will select solutions from across our 2024 Global Challenges that are focused on driving positive impact in Black and Brown communities in the US. If you select Yes for this question, you will be automatically considered – no additional application questions are required. Applicants who emphasize how they're thinking about racial equity in their work (for example, in application questions about who the solution serves or why the team is well-positioned to deliver the solution) are more likely to be selected. If you are selected, you will receive additional coaching, resources, and partnership support. Learn more about the program [here](#), and read more about our next Summit [here](#).

- Yes
- No

[Done] What is the Team Lead's gender? (Required) [Not Publicly Viewable: for internal use only]

- Agender
- Genderqueer/Gender Fluid/Non-Binary
- Man
- Unsure/Questioning
- **Woman**
- Prefer Not to Answer
- Prefer to write in:

[Done] Is the Team Lead transgender? (Required) [FOR SOLVE USE ONLY]

- Yes
- **No**
- Unsure/Questioning
- Prefer Not to Answer

[Done] Have you or someone else from your organization ever been selected as a Solver for an MIT Solve Global Challenge or for the Indigenous Communities Fellowship? (Required) [Not Publicly Viewable: for internal use only]

- Yes
- **No**

[Done] Is your solution an active or past participant in another entrepreneurship network? (Required) [Not Publicly Viewable: for internal use only]

Entrepreneurship networks are business incubators, accelerators, venture capital programs, or fellowship programs that aim to help you grow your solution. This has no impact on the evaluation of your solution.

- Yes, this solution is already (or has been in the past) a part of other networks
- No, Solve is the first network joined

[IF YES] Please share the names of the other entrepreneurship networks. [Not Publicly Viewable: for internal use only]

Did you take the MITx course “Business and Impact Planning for Social Enterprises?” (Required) [Not Publicly Viewable: for internal use only]

You do not need to take the MITx course to apply to Solve. This question helps us understand whether the course is a useful resource for applicants.

- Yes, I completed the entire course
- Yes, I completed part of the course
- No, I didn't take the course

[Done] How did you first hear about Solve? [Not Publicly Viewable: for internal use only]

We are asking this question to help grow the Solve community.

- Word of mouth
- Google or other search engine
- Email from Solve
- Email from your network
- Solve event
- Solve's MITx course “Business and Impact Planning for Social Enterprises”
- Facebook
- Instagram
- TikTok
- LinkedIn
- Email from Sloan Indigenous Graduate Partnership
- Other (please specify)

Tell us more about how you found out about Solve's 2024 Global Challenges. {Word limit = 100} [Not Publicly Viewable: for internal use only]

Please specify the event where you heard about Solve, the network through which you received

an email, or any other details that can help us reach applicants like you in the future.

Your contact information

If you are selected as a Finalist, we will contact you to confirm that you wish to continue moving forward in the competition. Because the timeline for confirmation is very short, please provide your contact details here to ensure that we can reach you or someone else on your team. Be sure to watch your email for a message from us between July 18 - July 23, 2024.

Primary Contact: Name (Required) [Not Publicly Viewable: for internal use only]

Jenny Molloy

Primary Contact: Email Address (Required) [Not Publicly Viewable: for internal use only]

jcm80@cam.ac.uk

Primary Contact: Phone Number (including country code) (Required) [Not Publicly

...

Viewable: for internal use only]

...

Backup Contact: Name [Not Publicly Viewable: for internal use only]

Yan-Kay Ho

Backup Contact: Email Address [Not Publicly Viewable: for internal use only]

ykh26@cam.ac.uk

Backup Contact: Phone Number (including country code) [Not Publicly Viewable: for internal use only]

...

(B) More About Your Solution

[WIP] What makes your solution innovative? {Word limit = 500}

Describe how your solution approaches the problem in a new or significantly improved way. How could it catalyze broader positive impacts from others in this space? How could it change the market/landscape?

...

Our approach of sharing reagent manufacturing toolkits and know-how as an open source project, and establishing a decentralised network of distribution and manufacturing nodes is, as far as we know, a unique solution.

Our technological solution is also innovative for the following reasons:

1. Our Research in Diagnostics DNA toolkit and Reclone Manufacturing Blueprint combine technologies that take a great deal of effort to synthesise (from the scientific literature, patents, biological databases, biorepositories and labs) into a well-documented and tested package enabling transfer of know-how to new locations.
2. The Manufacturing Blueprint focuses on the needs of resource-constrained labs in developing and emerging economies, which is unique to our knowledge.
3. While the Research in Diagnostics Toolkit contains "ready to use" modules with tried and tested technology, we considered user innovation as a built in feature of the system. The DNA toolkit is designed to be modular and interchangeable using approaches from synthetic biology. Moreover, enzymes that the user needs to "hack the kit" and exchange modules e.g. to use an enzyme purification matrix that is easier for them to obtain or to produce a new enzyme that we didn't think of; are also available in the kit. A hardware analogy is the RepRap 3D printer which "prints itself".

Describe in simple terms how and why you expect your solution to have an impact on the problem {Word limit = 500}

This is called a theory of change or logical framework, and it should link your activities to immediate outputs and longer-term outcomes for your target population. In addition to illustrating logical links between activities, outputs, and outcomes, a strong theory of change provides evidence to support the existence and strength of those links, such as third-party research, findings from a process or impact evaluation, data from interviews with your target population, etc. If you're unsure how to answer this question, start by following [these guidelines](#) or [enroll in our online course](#).

...

What are your impact goals for your solution and how are you measuring your progress towards them? {Word limit = 500}

Impact goals are concise statements of the specific external impact you wish to create through your solution. Your impact goals are what orient all aspects of your work. We look for solutions that will have a transformational impact on people's lives. Use this space to describe your impact goals and how you are measuring your progress towards them. Share a few specific indicators you are using to measure your progress. These may be indicators you are already collecting and using to talk about your solution's progress and impact. Or, if you need ideas, you may wish to draw from the list of indicators associated with the [UN Sustainable Development Goals](#) that align with your solution. You can view the list of indicators by clicking "More Info" for your goal, then "Targets and Indicators," and finally "Indicators" under each target.

...

[WIP] Describe the core technology that powers your solution. {Word limit = 500}

We define technology broadly as the application of science and evidence-based knowledge to the practical aims of human life. For MIT Solve and our mission to drive innovation to solve world challenges, it's important that your solution uses technology to solve a problem facing your community and/or the world, and that it seeks to benefit people and the planet. We welcome solutions that are using apps, SMS technology, software, AI, robots, drones, blockchain, and virtual reality, and what you might commonly think of as technology in this modern era! We also welcome solutions that are leveraging traditional, ancestral and natural technologies, and knowledge systems. That could be using centuries-old irrigation or building techniques, plant-based solutions that can reduce the effects of climate change, biodegradable sanitary pads, and so much more.

...

Our technology focuses on enzymes, which are foundational technologies for molecular diagnostic test. The Relcone DNA Toolkit collection includes

- ready-to-use expression cassettes to produce essential enzymes used in diagnostic among which RT, Bst-LF, RPA enzymes, RNA inhibitors.
- A set of DNA constructs for the production of Sars-CoV-2 RNA positive and negative controls to enable validation of diagnostic tests for COVID-19;
- DNA modules to build up DNA expression cassettes tailored to each lab's resources with a choice between 20 genes, 6 promoters, 10 purification tags (including purification using low cost materials such as silica, chitosan, cellulose etc) and 6 cleavage sites among others. The DNA modules are compatible with many common DNA assembly techniques including MoClo, SEVA, Loop, CIDAR assembly compatible.

In addition we will include enzymes used to manipulate the Toolkit and reassemble the parts, giving researchers and enzyme manufacturers over 200 possible combinations.

[Review] Which of the following categories best describes your solution?

A new technology

A new application of an existing technology

A new business model or process that relies on technology to be successful

[WIP] [IF A NEW TECHNOLOGY] How do you know that this technology works? {Word limit = 500}

Since you have developed a new technology, please provide evidence that it works. Consider providing a link to an academic paper or some other form of publicly available Evidence.

...

Production of enzymes is widely undertaken in the biotechnology industry but typically at quite large scale in facilities with high-cost capital infrastructure.

Our ready-to-use expression cassettes and associated protocols that are suited to small- to mid-scale expression in resource constrained labs are considered ready-to-use because they use tried and tested methods that we validated through literature review of papers and patents or in our own labs. In particular, the Reclone Network node at the University of Cambridge [documented a literature review](#) on each enzyme and how to express it and the broader Reclone Network is sharing validated protocols.

Control materials for SARS-CoV2 were selected based on literature reviews and work by other labs.

DNA modules were chosen from literature reviews so each module has been shown to work in a particular context but the goal for the network is to validate different combinations through distributed experiments that can then feed back into new "ready to use" blocks.

[Done] Please select the technologies currently used in your solution:

- Ancestral Technology & Practices
- Artificial Intelligence / Machine Learning
- Audiovisual Media
- Behavioral Technology
- Big Data
- Biomimicry
- **Biotechnology / Bioengineering**
- Blockchain
- Crowd Sourced Service / Social Networks
- GIS and Geospatial Technology
- Imaging and Sensor Technology
- Internet of Things
- **Manufacturing Technology**
- Materials Science
- Robotics and Drones

- Software and Mobile Applications
- Virtual Reality / Augmented Reality

[Done] If your solution has a website, app, or social media handle, provide the link(s) here:

...

<https://reclone.org/>

<https://forum.reclone.org/>

<https://www.linkedin.com/company/reclone/>

https://twitter.com/reclone_org/

https://www.youtube.com/@reclone_org

You'll be asked this version of the question if you are an applicant for the ~~Global Economic Prosperity Challenge~~, **Global Health Challenge**, ~~Global Learning Challenge~~, or ~~Global Climate Challenge~~.

[Review] In which countries do you currently operate?

Please select from the picklist. The list in the dropdown menu is sourced from the [World Bank's list of Country and Lending Groups](#). Per the World Bank, note that the term country, as used for purposes of this list, "does not imply political independence but refers to any territory for which authorities report separate social or economic statistics."

...

UK, Brazil, Argentina, Ghana, Philippines.

Reclone is currently hosted by the University of Cambridge, UK but is a global consortium with distributed leadership, primarily based in UK, Brazil, and the Philippines.

We also have fellows/collaborators in Argentina, Ghana, and the Philippines who are setting up the initial Reclone Regional Distribution Hubs. Partners in Chile, Colombia, Peru, Ethiopia, and Cameroon are all at various stages in the research development and/or manufacturing of the toolkit enzymes, whilst collaborators in Chile, Brazil, Puerto Rico, Canada, South America, and India have expressed interest in becoming Regional Hubs once the initial Hubs are firmly established.

[Review] Which, if any, additional countries will you be operating in within the next year?

You do not need to re-list the countries where you are currently operating. You'll be asked the following questions if you are an Indigenous Communities Fellowship Applicant.

...

Chile, Colombia, Peru, Ethiopia, and Cameroon.

Puerto Rico, Canada, India.

~~You'll be asked this version of the question if you are an Indigenous Communities Fellowship applicant.~~

[Review] In which parts of the US and/or Canada do you currently operate?

...

Collaborators in San Francisco, Vancouver, Ottawa.

[Review] Which, if any, additional parts of the US or Canada will you be operating in within the next year?

You do not need to re-list the parts of the US and Canada where you are currently operating.

N/A

(C) Your Team

How many people work on your solution team? {Word limit = 100}

Please provide separate numbers for full-time staff, part-time staff, and contractors or other Workers.

...

How long have you been working on your solution? {Word limit = 100}

Please provide the number of years you, your team, or your organization have been working on your solution.

...

Reclone was established in 2020

What is your approach to incorporating diversity, equity, and inclusivity into your work? {Word limit = 500}

Use this space to share about the diversity of your leadership team, your team's goals for becoming more diverse, equitable, and inclusive, and/or actions you've taken to achieve those goals. For more about MIT Solve's commitment to diversity, equity, and inclusion, refer to our [Diversity, Equity, and Inclusion Statement](#). You may also find it useful to read MIT's definitions of diversity, equity, and inclusion: diversity is the social, cultural, and identity-based human attributes represented within a group; equity is access to opportunity and advancement for all members of a group, and is distinct from equality and fairness (equitable environments address disparities and strive to eliminate unique and systemic barriers that have prevented the full participation of marginalized groups); and inclusion is the act of creating environments in which all members of a group are welcomed, respected, supported, and valued.

(D) Your Business Model & Funding

What is your business model? {Word limit = 500}

Your business model describes how you provide value to the populations you serve, both in terms of impact and revenue. Think about your key customers and beneficiaries. What products or services do you provide them? How do you provide these products or services? Why do they want or need them? If you're unsure how to answer this, start by completing the [Social Business Model Canvas](#) or enroll in our [online course](#).

...

[Done] Do you primarily provide products or services directly to individuals, to other organizations, or to the government?

- Individual consumers or stakeholders (B2C)

- Organizations (B2B)

- Government (B2G)

What is your plan for becoming financially sustainable, and what evidence can you provide that this plan has been successful? {Word limit = 500}

Explain how you are bringing/will bring in money to fund your work, whether through sustained donations and grants, selling products or services, service contracts to governments, raising investment capital, or a combination of all. In the long term, your revenue streams should cover your expected expenses. To see some examples, take a look at these [common revenue models](#). Also, provide examples of how your plans to fund your work have been successful to date: examples may include grants that you have received, revenue you have generated, or investment funding you have raised. We understand that some financial information may not be publicly shareable, but any specifics you can provide (such as funder names or monetary amounts) is helpful to the judges as they assess the potential for success of your solution.

...

Short term via grants and donations to fund personnel, basic infrastructure, and community activities to demonstrate the need and benefit of developing an open distribution network within the Reclone Community.

[REF] Table is a subset from the [common revenue models](#). However, likely looking at a cross of “low-income client” / “cooperative” / “organizational support”.

Business model	How it works	Examples	Key success factors
Free-for-service	Selling social services directly to clients or a third-party payer.	Membership organizations, museums, and clinics	Establishing the appropriate fee structure vis a vis the benefits
Low-income client	Similar to fee-for-service in terms of offering services to clients but focuses on providing access to those who couldn't otherwise afford it.	Healthcare (prescriptions, eyeglasses), utility programs	Creative distribution systems, lower production and marketing costs, high operating efficiencies

Cooperative	Provides members with benefits through collective services.	Bulk purchasing, collective bargaining (union), agricultural coops, credit unions	Members have common interests/needs, are key stakeholders, and investors
Service subsidization	Sells products or services to an external market to help fund other social programs. This model is integrated with the non-profit organization; the business activities and social programs overlap.	Consulting, counselling, employment training, leasing, printing services, and so forth	Can leverage tangible assets (buildings, land, employees) or intangible (expertise, methodologies, or relationships)
Organizational support	Similar to service subsidization, but applying the external model; business activities are separate from social programs	Similar to service subsidization—implement any type of business that leverages its assets	Similar to service subsidization.

Notes

- GHEC is good challenge, but difficult for regulations.
- THoughts about Education challenge
- Could be very competitive
- FF interested in a Conservation track.
- Adrian - show focus that can be applicable to work on Dx on different pathogens, and the reagents from XYZ collections, and can put the collections together in a ready to use format.
 - Fernan F - having a couple of targets will help app; case studies/pilots local for Africa, in LatAm, etc. and how to apply the tools.
 - Fernan working on waterborne, Giardia and Cryptosporidium (in LatAm), Typhii (have positive controls, story background)
 - Provide basic tech, can create own reagents. Lack of resources in itself is a challenge, but showing specific case studies in different context would demonstrate application of the collections.

[REFERENCE] A Copy of QUESTIONS and CONTENT from the previous 2020 MIT Solve application

Some content might be of use, but the scope has changed to a degree.

In 150 words or less, share the crucial details of your project. Your pitch should answer three questions: 1. What problem are you committed to solving? 2. What solution are you proposing? 3. How could your solution positively change lives if it was scaled globally?

The global supply chain for diagnostic reagents - the chemicals and enzymes that enable testing for infectious disease - is broken. COVID-19 has brought this issue, which was a day to day reality for all researchers and healthcare professionals in the global South, to international attention. The result is severe under-diagnosis and inability to make informed policy that balances public health with preserving already fragile economies and livelihoods.

Reclone Network is a global coalition of scientists working on a solution: an open source manufacturing model for local production of test reagents to international standards that are lower-cost, faster and adapted for use in the resource-limited contexts. We aim to increase the technological autonomy of countries in Latin America, Africa and Asia and reduce distribution time and overall costs of test materials by up to 90% which would help save thousands of lives and drastically increase pandemic preparedness and response capacity.

What specific problem are you solving? (Required)

Describe the specific problem within the Challenge that you are working to solve. What is the scale of the problem in the communities you are working in, and globally? How many people are affected? Which factors contributing to the problem relate to your solution? Include any relevant local or global statistics. If you're not sure where to start, take a look at these resources [here](#) and [here](#). You can also review answers from successful Solver applications, [such as this one](#).

Diagnostic testing is essential during a pandemic: in a direct sense to ensure infected patients get the care they need but also because it's our primary lens onto the pandemic and its spread. Testing is essential to contain pandemics and lessen their impact through tracing contacts, ensuring medical professionals are uninfected and informing interventions such as lockdowns. Deploying these at the right time is especially important in fragile developing and emerging economies.

However, diagnostic manufacturing is concentrated in North America, Europe and specific parts of Asia (China, India, South Korea, Japan), leaving most of Asia, Africa and Latin America heavily dependent on importation of test components which are disproportionately expensive compared to their purchasing power. Combined with richer countries imposing export controls and prioritising national needs during a global pandemic, countries with no domestic manufacturing capacity are facing severe shortages. Africa CDC head John Nkengasong said that “a failure of international solidarity [has] shoved Africa out of the diagnostics market. African countries have funds to pay for reagents but cannot buy them”. This is contributing to low testing rates in Africa and Latin America of <3 tests per thousand population in many countries, compared to >50 per thousand in Europe.

What is your solution? (Required)

Describe your solution and how it works in simple terms. What is it? What does it do? What processes and technology does it use?

Reclone Network seeks to revolutionise the reagent supply chain for pandemic research and diagnostics in the global South.

Our solution is a combination of technology and novel partnerships. We have synthesised an open source toolkit of DNA that produces diagnostic enzymes and we're developing a Reclone Manufacturing Blueprint including detailed Standard Operating Procedures and template Quality Assurance documents to assist local producers to use it and meet international standards for in vitro diagnostics manufacture.

This package of technology will rapidly enable production of diagnostic enzymes in the bacteria *Escherichia coli* using “tried and tested” techniques (induction of expression by the chemical IPTG and purification by affinity chromatography using nickel) by a network of public private partnerships operating as collaborations between universities, national public health laboratories and local biotech companies. We have partners in Chile, Colombia, Peru, Argentina, Ghana, Ethiopia and Cameroon who are starting to manufacture enzymes.

Our approach enables rapid redistribution of material from any node and accelerates development through collaboratively sharing know-how; thus Reclone Network will test a toolkit of DNA that could drastically reduce costs through inducing expression of the enzymes using light and purifying them with cheap materials like cellulose, in collaboration with networks of biofoundries.

Who does your solution serve, and in what ways will the solution impact their lives? (Required)

Describe the target population whose lives you are working to directly and meaningfully improve. Who are they? What are you doing to understand their needs, and how are you engaging them as you develop the solution? How will the solution address their needs?

Our solution serves those seeking accurate diagnosis. We expect this to increase regional preparedness for rapid containment of future epidemics. Inequitable access to scientific tools is a long-standing problem in infectious disease surveillance that the co-applicants are deeply committed to addressing through more decentralised strategies.

Explain how the problem, your solution, and your solution's target population relate to the Challenge. (Required)

Alignment to the Challenge is critical to your application's success. Many solutions are poorly rated by our judges because they either do not align to the Challenge or they fail to convincingly describe how they do. Use this space to explain how the problem, solution, and target population you described above are well-aligned to the Challenge.

Testing is fundamental to slowing the spread of an emerging outbreak, meaning that the supply chain for diagnostic reagents, which are the same materials used in pandemic surveillance and critical biomedical research, is vital to health security, pandemic preparedness and response. National governments as well as agencies like the UNDP and WHO through their [Tech Access Partnership](#), are viewing the current situation as an unprecedented opportunity to equip countries to be more autonomous, expand local manufacturing capabilities and increase health innovation as well as access to avoid a repeat of the severe supply problems seen in COVID-19.

Describe what makes your solution innovative.

Current approaches to overcoming the reagent supply chain focus on group purchasing mechanisms for developing countries rather than increasing local manufacturing capacity; or they focus on bilateral relationships between incumbent manufacturers in the global North and new entrants in the global South.

Our approach of sharing a manufacturing toolkit and know how as an open source project and establishing a distributed network of manufacturing nodes is, as far as we know, a unique solution.

Our technological solution is also innovative for the following reasons:

4. Our Research in Diagnostics DNA toolkit and Reclone Manufacturing Blueprint combine technologies that take a great deal of effort to synthesise (from the scientific literature, patents, biological databases, biorepositories and labs) into a well-documented and tested package enabling transfer of know-how to new locations.
5. The Manufacturing Blueprint focuses on the needs of resource-constrained labs in developing and emerging economies, which is unique to our knowledge.
6. While the Research in Diagnostics Toolkit contains "ready to use" modules with tried and tested technology, we considered user innovation as a built in feature of the system. The DNA toolkit is designed to be modular and interchangeable using approaches from synthetic biology. Moreover, enzymes that the user needs to "hack the kit" and exchange modules e.g. to use an enzyme purification matrix that is easier for them to obtain or to produce a new enzyme that we didn't think of; are also available in the kit. A hardware analogy is the RepRap 3D printer which "prints itself".

Describe the core technology that powers your solution.

Every successful Solve solution must include technology—whether new or existing—as a key component. If your solution is a new technology or a new application of an existing technology, describe the technology and how it is used. If your solution is a new business model or process, describe how it relies on technology to function. We define technology broadly—it could be hardware or software, digital or manufactured, advanced or not. (We have selected solutions that involve drones, AI, blockchain, seed technology and irrigation, and biodegradable banana fiber sanitary pads.)

Maximum 250 words

Word Count:

Our technology focuses on enzymes, which are foundational technologies for molecular diagnostic test. The Relcone DNA Toolkit collection includes

- ready-to-use expression cassettes to produce essential enzymes used in diagnostic among which RT, Bst-LF, RPA enzymes, RNA inhibitors.
- A set of DNA constructs for the production of Sars-CoV-2 RNA positive and negative controls to enable validation of diagnostic tests for COVID-19;
- DNA modules to build up DNA expression cassettes tailored to each lab's resources with a choice between 20 genes, 6 promoters, 10 purification tags (including purification using low cost materials such as silica, chitosan, cellulose etc) and 6 cleavage sites among others. The DNA modules are compatible with many common DNA assembly techniques including MoClo, SEVA, Loop, CIDAR assembly compatible.

In addition we will include enzymes used to manipulate the Toolkit and reassemble the parts, giving researchers and enzyme manufacturers over 200 possible combinations.

Provide evidence that this technology works.

If your solution utilizes a widely used and accepted technology, describe how and where it's already used. If it's a less common technology, consider providing a link to an academic paper or some other form of publicly available evidence. If possible, share a link to a video of a product demo.

Maximum 250 words

Production of enzymes is widely undertaken in the biotechnology industry but typically at quite large scale in facilities with high-cost capital infrastructure.

Our ready-to-use expression cassettes and associated protocols that are suited to small- to mid-scale expression in resource constrained labs are considered ready-to-use because they use tried and tested methods that we validated through literature review of papers and patents or in our own labs. In particular, the Reclone Network node at the University of Cambridge [documented a literature review](#) on each enzyme and how to express it and the broader Reclone Network is sharing validated protocols.

Control materials for SARS-CoV2 were selected based on literature reviews and work by other labs.

DNA modules were chosen from literature reviews so each module has been shown to work in a particular context but the goal for the network is to validate different combinations through distributed experiments that can then feedback into new "ready to use" blocks.

How many people does your solution currently serve? How many will it serve in one year? In five years?

Your answer should include three numbers: the current number of people you're serving, the number you'll be serving in one year, and the number you'll be serving in five years. Focus on the number of people that your solution will directly and meaningfully affect.

Maximum 250 words

Word Count:

What are your goals within the next year and within the next five years?

We look for solutions that will have a transformational impact on millions of lives. Use this space as an opportunity to describe your impact goals and how you plan to achieve them, whether through your organization or through other approaches to scale, such as replication.

Maximum 250 words

Word Count:

What barriers currently exist for you to accomplish your goals in the next year and in the next five years?

Highlight specific financial, technical, legal, cultural, or market barriers that may limit your impact in the next year and the next five years.

Maximum 250 words

Word Count:

How do you plan to overcome these barriers?

Consider addressing each barrier individually. Highlight resources that you have or will pursue, and explain how you will use them. You may refer back to these barriers when completing the questions in the Partnership Potential section, where we ask how the Solve community can help.

Maximum 250 words

Word Count: