

IDEC

**INTERNATIONAL
DIRECTED EVOLUTION
COMPETITION 2023**



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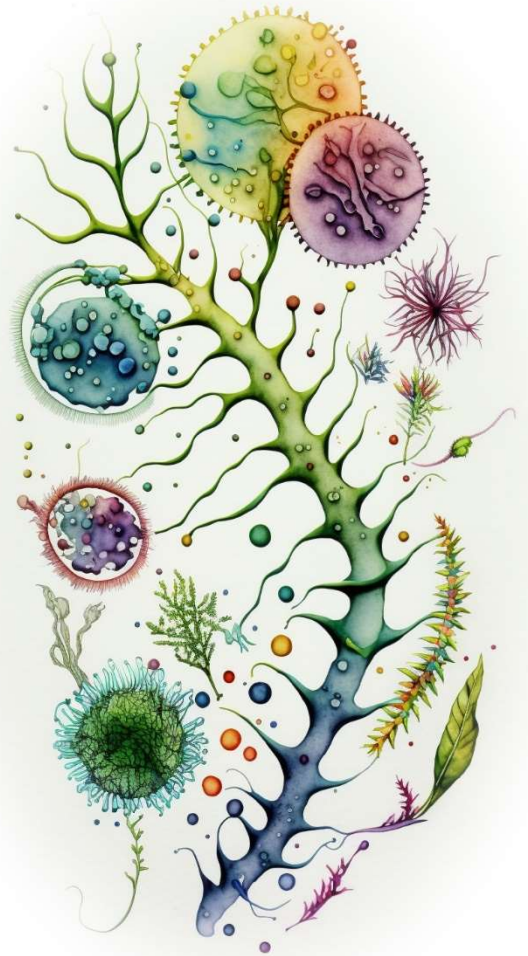
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What is iDEC

- **BACKGROUND**

The International Directed Evolution Competition (iDEC) is an international public welfare initiative dedicated to building a scientific community to facilitate education, technology sharing, and academic exchange.

Directed evolution represents the powerful irrational design method based on a rational foundation, which will fill in the shortcomings of rational design methods and reshape genetic engineering development in the next 10 years.

- **OUR PURPOSE**

By encouraging young students to harness the power of evolution creatively, we aim to disseminate the skills and knowledge required to tomorrow's bioengineers, which enable them to tackle real-world problems.

The combination of directed evolution technology, young talents' creativity and desire for exploration will significantly expand the technical innovation and application fields of directed evolution. In turn, it will bring new forces to the scientific and industrial circles.

- **ETHOS & LOCATION**

The ethos of iDEC is:

Innovation, Diversity, Equality, Co-construction & Co-operation.

iDEC is a Scottish Charitable Incorporate Organisation (SCIO), registered in Scotland, with charity number : SC050826.

In 2021, the 1st iDEC was held at the University of Edinburgh, Darwin's alma mater, in honor of the 190th anniversary of his historic circumnavigation.

In 2022, the 2nd iDEC was held at Cambridge.

- **History**

iDEC was held for the first time in 2021 and attracted 11 teams from 4 countries. In 2022, iDEC expands to 15 teams. The participants include students from Ph.D. candidates to high school students. iDEC HQ held the **iDEC Festival** online in 2021 and 2022, which was an academic event centered on participating students.

The iDEC teams presented their research achievements through posters and presentations. Simultaneously, iDEC invited senior scientists with great influence in the field of directed evolution as speakers and judges.

The workflow

Construction of a library of plasmids

E. coli transformation

Protein expression

Co-encapsulation with substrate and reagents

Incubation

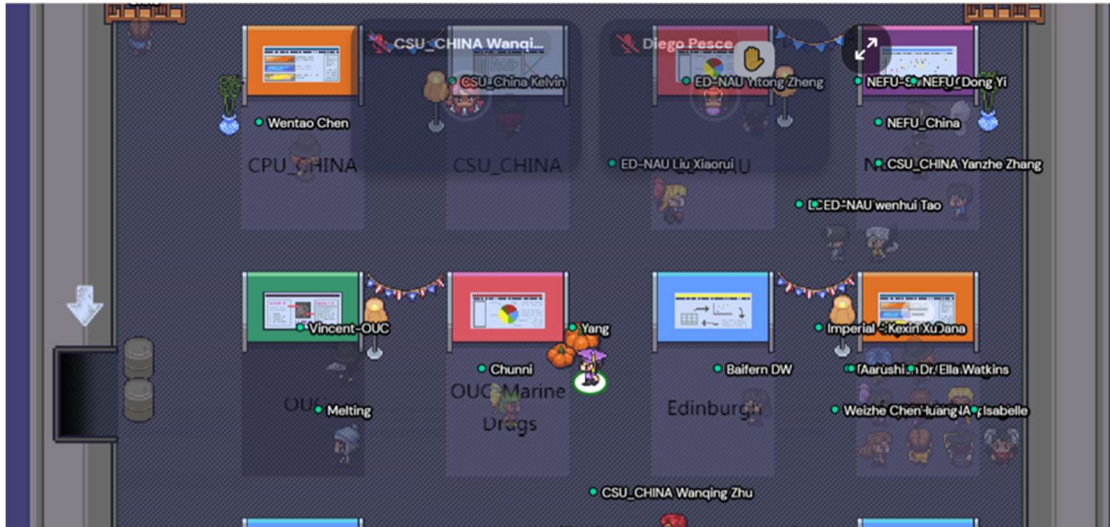
Recovering of plasmids from positive hits

Selection of the starting point

be retained into the droplets in the aqueous phase.
As if workflow So it's a typical directed evolution

Participants: Yang, Vilnius GMC - Lore..., Jonas

iDEC Festival presentation



iDEC Festival poster display

iDEC Festival Invited Lectures
17th Oct 2021 15:00 - 19:00 (GMT+1)

 Phage-Assisted Continuous Evolution of Novel Activities in Protein Translation
by Prof. Ahmed Badran

 Will machine learning displace directed evolution?
by Prof. Andrew Ellington

 Rapid evolution of proteins and enzymes with orthogonal DNA replication
by Prof. Chang Liu

Open registration QR code 

iDEC Festival 2022
Awards Ceremony Lectures

Registration: QR code 
16:00-18:00 GMT+1 23rd Oct Online

 **Biosystems Design by Directed Evolution**
Prof. Huimin Zhao
Steven L. Miller Chair of chemical and biomolecular engineering
Professor of chemistry, biochemistry, biophysics, and bioengineering at the University of Illinois at Urbana-Champaign (UIUC)

 **Design meets evolution: Theory and practice for the sake of a sick planet**
Prof. Víctor de Lorenzo
Head of Systems Biology Program, Consejo Superior de Investigaciones Científicas (CSIC)
Head of Environmental Synthetic Biology Laboratory, Centro Nacional de Biotecnología, CSIC

Invited lectures on directed evolution



iDEC Competition Medals



Timeline for iDEC 2023

Registration opens

March 20

Registration closes

May 1

Submission of Track Decisions

June 15

Registration for iDEC Festival

Submission of **Abstract**

July 1

Submission of **Safety Form**

Registration deadline

& fee payment for

iDEC Festival

Aug 15

Submission of

Final Abstract & Report

Sep 30

Wiki Freeze

October 8

iDEC Festival

October 28

Registration



iDEC registration is divided into three steps:

- Individual registration
(No need to register a new account if participated before)
- Team registration
- iDEC Festival registration

iDEC registration channel opening:

Mar 20 – May 1

iDEC Festival registration channel opening:

June 15 – Aug 15

- Team registration fees for iDEC 2023:

Early-bird Registration: £ 400 (Available for the first 20 registered teams)

Regular Registration: £ 800 (Applicable after the first 20 registered teams)

iDEC Festival Fees (Free if it is online):

£ 200 per iDEC participant or Free if it is online

Team size limit:

20 people

The iDEC team can consist of the following roles:

- **iDEC Player**

Available for students. This role takes primary responsibility for idea creation, project design, performing experiments, and presenting results.

- **iDEC Team Leader**

Available for students. The team leader is responsible for coordinating and organizing the team.

- **Supervisor**

The supervisor can provide supervision for iDEC players, potential funds, lab, equipment, agents, etc. Faculty members (e.g., University Professors), teachers (e.g., biology teachers in high school), or researchers from the biotech industry or a public research institution can take on this role. The primary supervisor must assume responsibility for the lab.

- **Mentor**

People who can give technical advice during iDEC or provide suggestions during every step in iDEC. We suggest senior students or postdocs for this position.

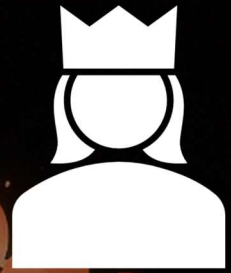
- **Advisor**

People who are not involved in the iDEC project directly but

can provide valuable suggestions.

Every team must have at least one **Supervisor** and one **Team Leader**.

Tracks & Awards

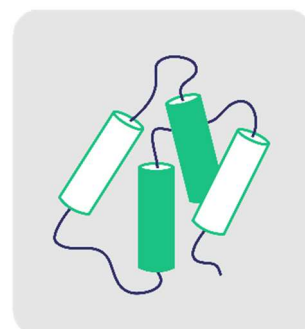


Your research project can participate in the following Tracks:

- Molecular Directed Evolution
- Pathway Directed Evolution
- Genome Directed Evolution
- Challenge (If there is a challenge topic to be released)

Track I: Molecular directed evolution

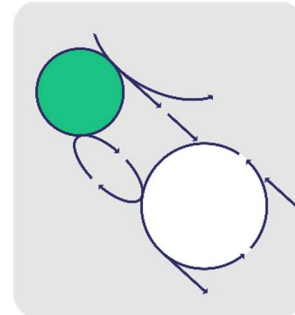
The first class usually refers to the directed evolution in a narrow and more conventional sense where the targets are typically individual biomacromolecules: protein- and nucleic acid-binders, or their enzyme variants. Any directed evolution project with molecules as an object meets the



definition of this track.

Track II: Pathway directed evolution

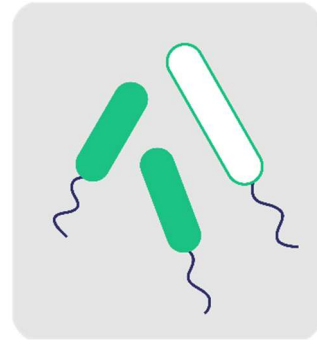
The second class is for the directed evolutionary strategies aimed at optimization of metabolic pathways and/or regulatory synthetic circuits.



Simply put, this type of project would involve construction, genetic diversification and screening, of the most robust, orthogonal to the host physiology and efficient in the production of desired trait molecules. This type of a project may not necessarily involve genetic changes of any component of genetic circuit but it should be directed to improve their relative ratios, order and kinetics of their expression, feedback control mechanisms and other types of their co-regulation.

Track III: Genome directed evolution

The last is kind of projects would relate to the umbrella term of 'directed evolution of the genome'. The works in this section may include the development of novel strategies in the field of adaptive laboratory



evolution, new means in the introduction of programmed targeted or random changes on a genomic scale, construction of effective selection screens for genomes and organisms with a desired trait. As opposed to the 'pathway directed evolution', a defined set of specific genes would not be typically targeted unless it would favor further planned changes in the genome of a given organism (e.g. SCRaMBLE tool for changes in the yeast genome).

Track Plus: Challenge

For this track, the Scientific Advisory Group or the Industry Advisory Group may propose a challenge. Participating teams can employ different methods to conduct directed evolution research on designated scientific or industrial goals. The challenging advisory groups will evaluate the final results

according to the corresponding standards set by them.

- Our challenge track will **only** be open if someone publishes challenge, and the challenge will be released before **May 1**.
- Each team can participate in multiple tracks.
- The teams need to decide the ownership of Tracks before **June 15**.

● Awards

1. General Awards

The general awards are mainly to encourage the participating teams to fully participate in all aspects of iDEC. Actively completing all aspects of iDEC will result in higher scores.

● Gold Award

The team that ranks in the top 10% of the total score will receive a Gold award.

● Silver Award

The team that ranks in the top 20%-10% of the total score will receive a Silver award.

● Bronze Award

The team that ranks in the top 40%-20% of the total score will receive a Bronze award.

● Science Contribution Award

For all the other qualified teams. The essential qualification condition is that the four display items are complete and conform to academic standards.

2. Track Awards

(1) Best New Evolution Machine

(3 teams for 3 tracks)

The definition of this award is to reward innovative, proven, and feasible directed evolution technology.

The nomination criteria are:

- The technology proposed by the project must be an original technology or an optimized design based on existing technology.
- The technology must be proved feasible and superior to the current technology by experimental data in a real directed evolution case.

(2) Best Evolution Outcome

(3 teams for 3 tracks)

The definition of this award is to reward the best-directed evolution achievement. This is the grand prize of the directed evolution output track.

The nomination conditions are:

- The goal of directed evolution must reflect novelty, but the target molecule can be the product of previous directed evolution works.

- The result of evolution provides an unprecedented mutant, and its performance is better than any known version.
- The output has broad scientific significance or has high application value in industry. If more than half of the judges believe that a project cannot meet the above standards, the project cannot be nominated.

3. Single Awards

(1) Best hardware

To reward the most original hardware design. The hardware should improve the directed evolution through innovative design, including improving efficiency, simplifying operations, reducing costs, etc.

(2) Best software

To reward the most original software design. The software should improve the directed evolution.

(3) Best algorithm

To reward the best original algorithm, which has universal significance for improving the predictability of directed evolution.

(4) Best target molecule

To reward the most exciting target molecule selection.

(5) The most potential tool

To reward the most novel directed evolution tool, which may currently have no advantages but has the potential to be further optimized.

(6) Best community building (Executive Committee Award)

To reward the team for making the most significant contributions to the iDCE community building.

(7) Best presentation

To reward for presentation with clear logic, attractive and impressive content.

(8) Best wiki

The iDEC wiki will focus on introducing science to the public. This award rewards the most creative scientific promotion content.

(9) Funniest evolution

To reward the funniest research topic.

(10) Industry advisory group award

To reward the project with the most industrial application value.

4. Special Awards

Besides the above awards, iDEC also offers special awards. Special awards will be given to teams that make outstanding accomplishments in a particular field.

Each special award can be given to more than one team in iDEC.

Mysterious Award 1

A reporter system is commonly used in biology research to quantify biological activity, especially in genetic engineering. Designing and choosing an appropriate reporter system can facilitate the screening and identification process in directed evolution. iDEC presents an award that will be given to teams who develop a novel or optimize a reporter system and use this system in their iDEC projects.

Mysterious Award 2

The discovery of Taq polymerase from *Thermus aquaticus* brought a revolutionary method to the field of molecular biology. In directed evolution, error-prone PCR is typical to create mutations in target genes for constructing the library. Thus, iDEC presents an award for teams establishing or optimizing

novel methods for genetic diversification in their research.

Mysterious Award 3

Screening and selecting the mutants with desired phenotypes from the mutated library is crucial in directed evolution. Thus, iDEC presents an award for establishing or optimizing the screening assay in their projects.

Requirements



iDEC teams will produce 4 elements for display and judgment:

- a report
- a wiki
- a poster
- a presentation

Report

At iDEC, we encourage participants to organize and present their research results in preprint publication. **iDEC is running a preprint publishing system for participating teams (<https://arxiv.idec.io/>).**



The contestants should organize their experimental methods and data as a meaningful story, and present their results, whether positive or negative, in a logical and professional manner.

Wiki

Wikis for iDEC serve two functions:

First, it ensures that all information pertaining to the research conducted, including but not limited to, experiment logs, and biosafety and biosecurity

forms, are properly documented and remain accessible. We encourage the teams to upload raw data and experiment records to public data repositories.



Second, it communicates the project's intention, significance, and outcome to both the scientific community and the lay public. Therefore, the contents of wiki pages should not be merely a web adaptation of the academic report. That is, it does not need to contain all the results, descriptions, or discussions. Instead, it should be as accessible, clear, and enjoyable as possible. Interactive multimedia, such as animations, short videos, and cartoons, are much encouraged. The wiki space will be available starting in **July 2023**.

Poster

Size: A0

The poster should be in format of an academic poster.

The poster must include the iDEC Logo, a project title, a QR code that links to the team wiki, a list of authors, the participating institute or organization, and any other necessary information of the team.

Other than the above, teams are free to determine the layouts of their posters.



Presentation

Every team should prepare a presentation that will be completed within 20 mins and be prepared for a Q&A session that will last no more than 10 mins.



● **Track Plus: Challenge**

There will be additional requirements associated with the Challenge Track.

The advisory groups who set the challenge can ask teams to perform directed evolution on specified genetic elements.

The advisory groups may also provide standard protocols and control samples through which the teams should verify their results with.

In some scenarios, a particular circuit design may be assigned for the purpose of result verification.

Contact



- **Donation and sponsorship**

Hope to support us or cooperate:

support@idechq.org

- **Set a challenge!**

iDEC recruits challenge topics from scientists and the biotechnology industry! If you want to challenge our participating teams: challenge@idechq.org

- **Teams**

Want to participate in iDEC? If you have any questions: support@idechq.org

- **Help**

If you need help in iDEC: support@idechq.org

Visit our website:

<https://idec.io/>

Visit iDEC preprint system idecRxiv:

<https://arxiv.idec.io/>

Visit iDEC resources:

<https://wiki.idec.io/resources/introduction/>