iDEC

International Directed Evolution Competition 2024

NEW ENGLAND BioLabs Inc.

Bluepha

REGENESIS

Instant Photo

FRIENDSHIP STAMP

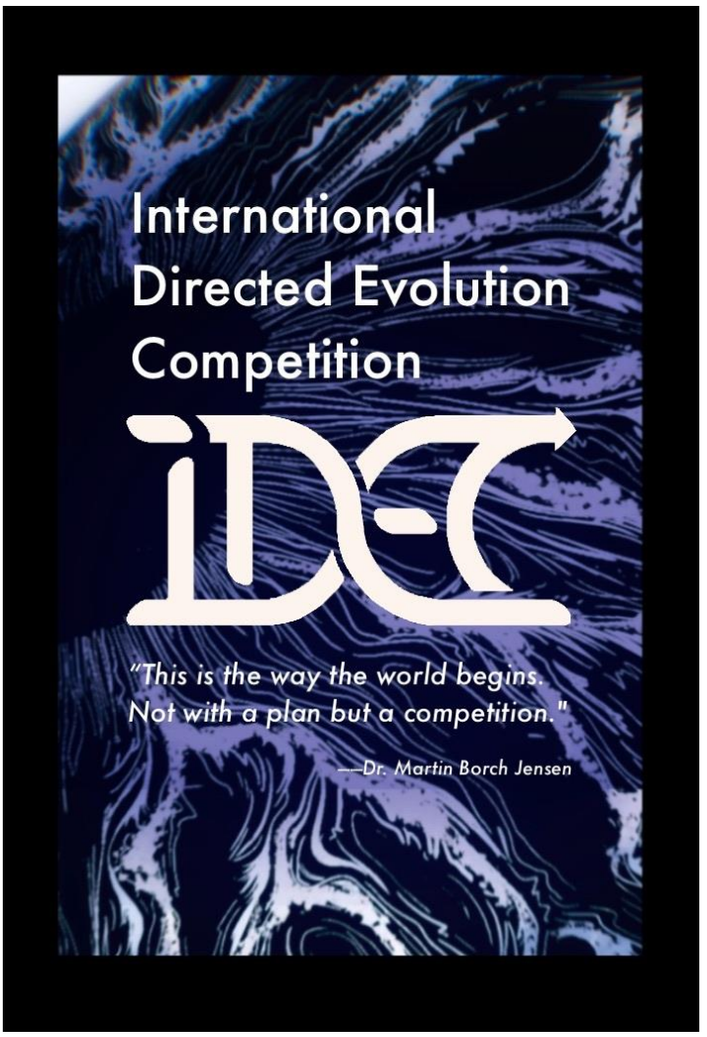
This is the Wall of iDEC Friendship!

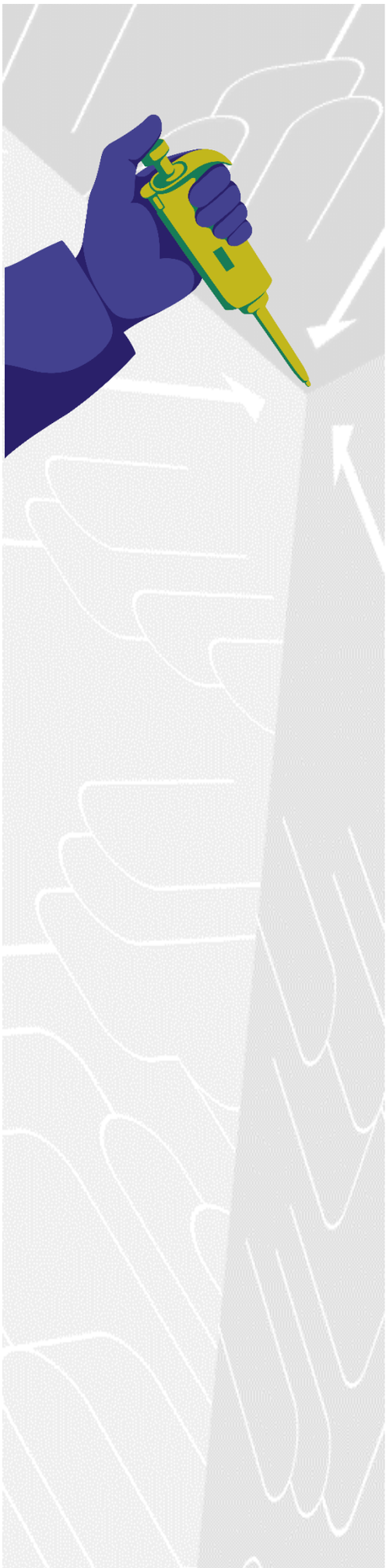
Instant photos: Everyone can have one free snapshot (£5 donation for the second), and you can invite our volunteers to take the photo for you and your friends.

Friendship Stamp: We set two bluetooth thermal printers on site.

You can download the APP on your mobile phone, then you can design a stamp pattern or text that represents you, your team, or your project, print it on a sticker, and paste your design, your team's LOGO with your best wish on the handbook of your new friends!

Contents





About iDEC

International Directed Evolution Competition (iDEC) is an international initiative focused on creating a scientific community for education, technology sharing, and academic exchange.

Directed evolution, a powerful irrational design approach rooted in rational foundations, will address shortcomings in genetic engineering over the next decade.

Our mission is to inspire young students to harness the creative potential of evolution, arming future bioengineers with the skills to tackle real-world challenges. The synergy of directed evolution technology, youthful creativity, and their innate drive for exploration promises to greatly expand innovation and practical applications, benefiting both the scientific and industrial sectors.

In 2024, the 4th edition of iDEC is being held on-site in Cambridge. We warmly welcome students and mentors from around the world to meet and exchange ideas.

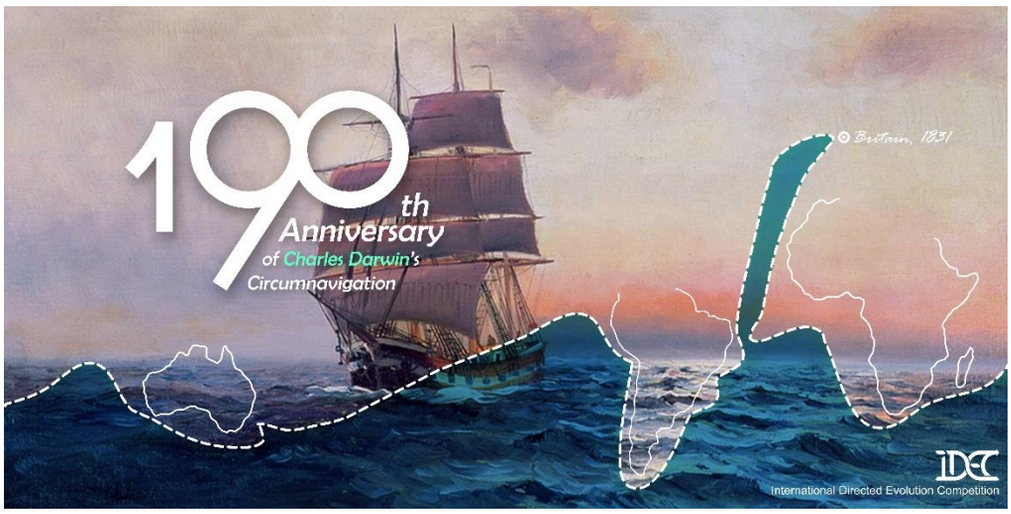
The ethos of iDEC

innovation

Diversity

Equality

Co-construction & Co-operation.



iDEC Founding Story

2019 is the 210th anniversary of Darwin's birth and the 160th anniversary of the publication of the masterpiece *On the Origin of Species*.

A discussion about the future of synthetic biology was sparked by Professor Jamie Davies' article, "Real-World Synthetic Biology: Is It Founded on an Engineering Approach, and Should It Be?"

We concur that synthetic biologists should have the freedom to explore diverse methods, and we recognize the growing significance of directed evolution tools in genetic engineering over the next 5 to 10 years. Thus, the idea of fostering the development and talent cultivation of directed evolution through an international event emerged.

In early 2020, the initial concept of hosting the student competition at either the University of Edinburgh or Cambridge University, both of which were Darwin's alma maters, was proposed. We believe that dedicating the first edition of this competition to the memory of Charles Darwin is both fitting and meaningful.

This idea of iDEC received wide support. 8 students and professors form the board of iDEC as charity trustees. Finally, with the support of young directed evolution enthusiasts, volunteers, and sponsors, iDEC was officially started in 2021.

Schedule

Date	Timelines		Poster
	Time (GMT+1)	**Events**	
25th Oct	16:00 – 18:00	Registration (Homerton College) Collect name badges, conference bags	
26th Oct	8:00 – 8:40	Registration (Homerton College) Collect name badges, conference bags, and **hang posters** **With Morning Coffee (8:15 – 8:45)** **in the Fellows' Dining Room (No. 13 on the map)**	
	8:45 – 9:00	Open Ceremony	
	9:00 – 9:25	Opening Speech by Dr. Zakir Tnimov	
	9:30 – 10:00	USTC	01
	10:00 – 10:30	CPU_CHINA	02
	10:30 – 11:00	**Coffee Break**	
	11:00 – 11:30	NJTECH-CHINA-A (online)	12
	11:30 – 12:00	Evolution Suisse	03
	12:00 – 12:30	OUC_DE	04
	12:30 – 14:00	**Lunch Break**	
	14:00 – 14:30	SynthImmunol_NMU	05
	14:30 – 15:00	iTidetron (online)	13
	15:00 – 15:30	**Coffee Break**	
	15:30 – 16:00	STU -China (online)	14
	16:00 – 16:30	NEFU_China	06
	16:30 – 18:00	**Poster Presentations**	
	Time (GMT)	**Switch to Winter Time (-1h) at 2:00 AM 27th Oct**	
27th Oct	8:30 – 9:00	**Morning Coffee** **in the Fellows' Dining Room (No. 13 on the map)**	
	9:00 – 9:30	Northwest Union	07
	9:30 – 10:00	Edinburgh	08
	10:00 – 10:30	**Coffee Break**	
	10:30 – 11:00	SUSTech Med (online)	11
	11:00 – 11:30	NAU-CHINA-DE	10
	11:30 – 12:00	NKLII-Evolution-China	09
	12:00 – 13:00	**Lunch Break**	
	12:30	**Group Photo online**	
	13:00 – 13:10	**Group Photo on-site**	
	13:10– 14:10	**Poster Presentations**	
	14:10 – 14:30	Announce Special Awards and Industry Advisory Group award	
	14:30 – 15:00	**Coffee Break**	
	15:00 – 16:00	Lecture by Dr. Benjamin G. Davis	
	16:00 – 17:00	Lecture by Dr. Mateo Sanchez	
	17:00 – 17:40	Lecture by Dr. Neil Dixon (online)	
	17:40 – 18:10	Announce Single Awards and General Awards	
	18:10 – 18:30	Go to the Eagle	
	18:30 – 19:30	Dinner	

Traffic

Traveling by air:

Stansted Airport is the most convenient among London airports, situated just 30 miles away from Cambridge via the M11. **Coaches and trains** are available from Stansted Airport to Cambridge. From **Gatwick and Heathrow airports**, make your way to **King's Cross for a train** to Cambridge. We recommend checking for the most efficient route to Cambridge upon your arrival at the airport.

Airport to Cambridge by train:

Stansted Airport: Inside the Stansted terminal, you will find a railway station where a direct train to Cambridge takes just 35 minutes. Please visit the website to check the train: https://www.stanstedairport.com/getting-to-and-from/by-train/

Heathrow Airport or Gatwick Airport: There are no direct train connections from Heathrow airport to Cambridge. You can go to central London stations by **Heathrow Express (to London Paddington) or Gatwick Express (to London Victoria)** first. For further transfer options, you can visit the website: https://www.thetrainline.com/ to check the trains.

A frequent train service connects **Cambridge - London**, with trains departing from **Liverpool Street** and **King's Cross stations**. The fastest journey takes just 52 minutes, and during peak hours, there are seven trains per hour.

Cambridge Railway Station to Homerton College/Møller Institute (partner accommodation)

Cambridge's train station is located south of the city centre. The distance between Cambridge Station and Homerton College is about 1 mile. You can easily reach the College by taxi (4 - 6 min) or bus (9-10 min).

From Cambridge railway station to Homerton College: Bus 1, Bus 7, and Bus U2 Universal depart from the railway station every several minutes, transporting you to the bus station **Blinco Grove** for Homerton College. If you prefer to walk, the journey to the College takes approximately 14 minutes on foot from the railway station.

From Cambridge railway station to Møller Institute: The distance is relatively far. You can take a taxi or **Bus A** (about 40 minutes). For information about Bus A, please visit: https://www.stagecoachbus.com/routes/east/A/st-ives-trumpington-p-r/XEBA000.O.

Please visit https://www.google.com/ and search the bus information by entering 'Cambridge Station to your destination'

Airport to Cambridge by Bus

Stansted Airport: National Express coaches offer service from London Stansted to Cambridge.

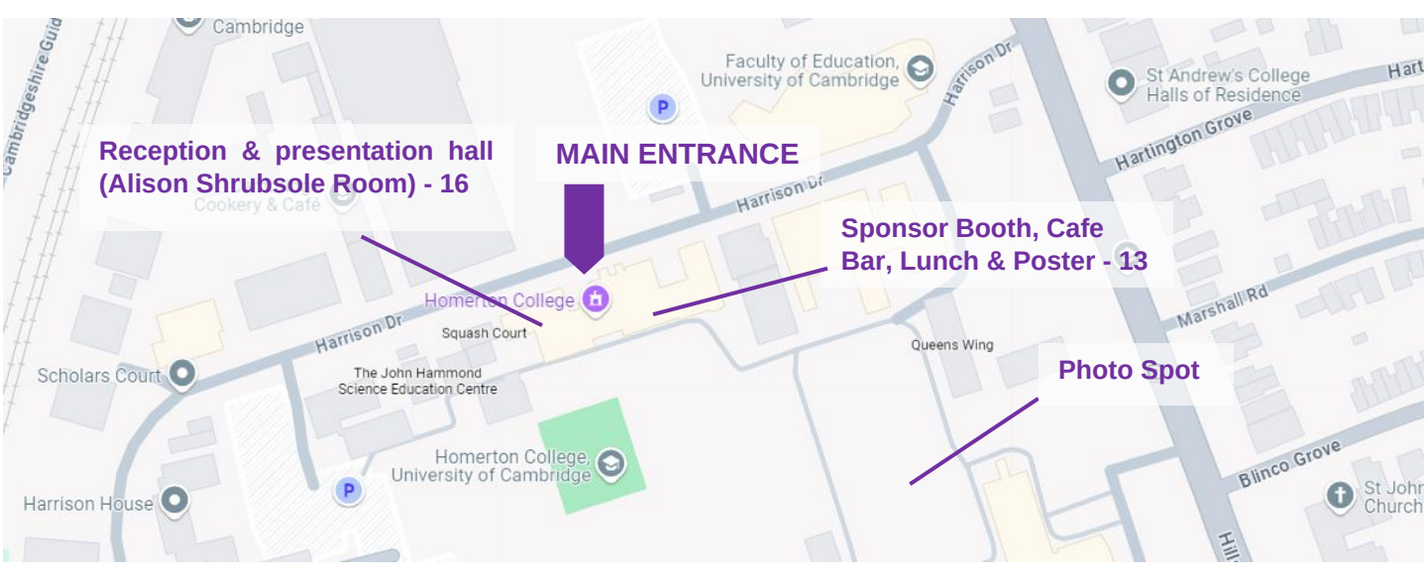
Heathrow Airport: National Express coaches offer service from London Heathrow to Cambridge.

Please visit the website https://www.nationalexpress.com/ to find more information.

Note: Please choose the bus station 'City Centre'.

MAIN ENTRANCE

Please use the map on the next page to find the **MAIN ENTRANCE FOR EVENTS RECEPTION** where our registration reception will be located. The entrance to the college is on **Harrison Drive**.



HOMERTON COLLEGE
EVENTS

KEY TO BUILDINGS

A MARY ALLAN BUILDING
- (1) Boulind Suite
- (2) Teaching and Seminar Rooms
- (3) Auditorium
- (4) Porters' Lodge
- (5) Library

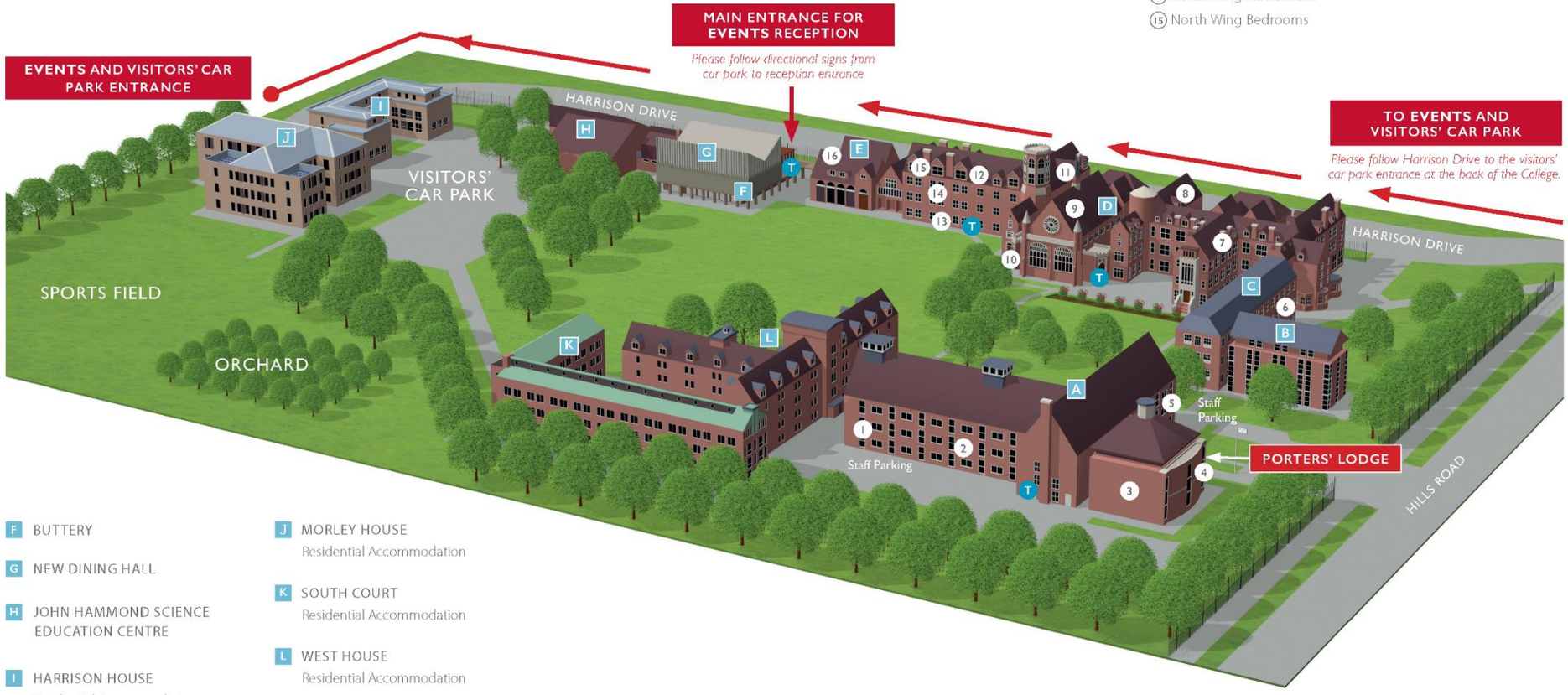
B EAST HOUSE
Residential Accommodation

C QUEEN'S WING
- (6) Gym and Fitness Studio

D CAVENDISH BUILDING
- (7) ABC Accommodation
- (8) JCR Common Room
- (9) Great Hall
- (10) The Griffin (Bar)
- (11) Drawing Room (Dining Room)
- (12) D & E Accommodation
- (13) Fellows' Dining Room
- (14) North Wing Auditorium
- (15) North Wing Bedrooms

E MEETING ROOMS
- (16) Events Reception
- *Skillicorn*
- *Bamford*
- *Upstairs Meeting Room*
- *Paston Brown*
- *Alison Shrubsole*
- *Ibberson 2*
- *Combination Room*

(T) Toilets



F BUTTERY

G NEW DINING HALL

H JOHN HAMMOND SCIENCE EDUCATION CENTRE

I HARRISON HOUSE
Residential Accommodation

J MORLEY HOUSE
Residential Accommodation

K SOUTH COURT
Residential Accommodation

L WEST HOUSE
Residential Accommodation

Online - Gather Town

To facilitate remote participation, Gather Town Space will remain open this year.

We will integrate Zoom with Gather Town to seamlessly blend online and on-site activities. All posters will be displayed synchronously on Gather Town, and our on-site judges will also join online teams for poster presentations through Gather Town.

For teams presenting online, we will collect your poster and presentation slides from **October 22nd to October 23rd**. For teams attending the iDEC Festival in person, we will collect your poster file and presentation slides upon your arrival.

As in previous years, about a week before the iDEC Festival, we will send a test link. We request that all online teams test their network connection, screen sharing, and audio transmission in the Gather Town virtual space prior to the competition. The new step for this year is that online teams will need to install Zoom and test launching the Zoom program within Gather Town.

Based on the situation at the on-site venue, we have decided that all teams will use Gather Town for their presentations directly, and we will also open the Zoom as a backup.

All online teams need to test your **internet speed, Zoom's Function**, and **try using Gather Town's screen sharing** feature.

We have allocated some **Breakout Rooms** in Gather Town for online teams, providing them with a separate space for communication and rehearsal before their presentations. The **Breakout Rooms** allocations are as follows:

Date	Timelines		Room
	Time	**Events**	
26th to 27th	No limit	NJTECH-CHINA-A (online)	A
	No limit	iTidetron (online)	B
	No limit	STU -China (online)	C
	No limit	SUSTech Med (online)	D

We would like to kindly require that the participants other than the above-mentioned teams should not enter these rooms to avoid disturbing the preparations of other teams.

Entre Gather Town iDEC 2024: QR code

Pass Word: 2024

USTC

Directed evolution of chalcone synthase to enhance production of naringenin and sakuranetin with biosensor in *Vibrio natriegens* (9:30 26th Oct)

The synthesis yield of sakuranetin, a compound with extensive medical applications and potential, is constrained by the condensation reaction mediated by chalcone synthase. In recent years, directed evolution has emerged as a promising approach for enhancing protein performance; however, traditional directed evolution techniques encounter challenges in high-throughput screening. By integrating rational design and protein structure analysis, we have modified chalcone synthase and the naringenin sensors TtgR transcriptional repressors. We selected *Vibrio natriegens* as the host organism due to its superior growth rate and exceptional protein expression capabilities, successfully establishing sensor engineering within this framework. Additionally, codon optimization has been employed to enhance protein expression. This study aims to develop synthetic platforms for naringenin and sakuranetin. Furthermore, we have made preliminary advancements in the development of biosensors capable of endogenous detection, thereby facilitating directed evolution pathways for substances that are difficult to detect, thus highlighting the significant potential of *V. natriegens* and biosensor technology.

CPU_CHINA

Computationally guided evolutionary engineering of ancestral glycosyltransferases (10:00 26th Oct)

Glycosyltransferases are widely involved in the glycosylation processes of various biomolecules, enhancing the stability and other characteristics of natural products through glycosylation modifications. However, natural glycosyltransferases typically exhibit poor regioselectivity and low catalytic activity; The broad substrate spectrum often compromises specificity. Therefore, using the glycosylation of flavonoid compounds as a reference standard, we aim to construct an ancestral protein of TcCGT1 with multi-catalytic functionalities to obtain a heat-resistant scaffold for modification. By employing molecular simulation and other multiscale computational methods in conjunction with directed evolution, we seek to achieve a more useful protein.

NJTECH-CHINA-A

Directed evolution of the alsR transcription factor to construct a D-allose biosensor

(11:00 26th Oct)

D-allose is a rare monosaccharide that is infrequently found in the natural environment. Being 80% sweeter than sucrose, D-allose is characterized by its extremely low caloric content and non-toxic properties, positioning it as an ideal substitute for sucrose in various food products. Its unique health benefits and physiological functions have been evidenced in diverse fields, including food systems, clinical treatments, and healthcare. However, its chemical synthesis poses significant challenges. In recent years, the biotechnological production of D-allose has emerged as a prominent area of research. This study presented a redesigned genetically encoded biosensor based on a D-allose regulatory gene for real-time monitoring of D-allose levels. Directed evolution of the transcriptional factor *alsR* gene yielded mutants with enhanced affinity for D-allose and improved detection sensitivity. The reconstructed biosensor was effectively utilized to detect intracellular D-allose synthesis, offering a potential selection tool for the directed evolution of enzymes associated with D-allose synthesis.

Evolution Suisse

Evolving E3 ligase towards recognising novel substrates for targeted protein degradation

(11:30 26th Oct)

Targeted protein degradation offers a novel therapeutic approach, enabling the selective degradation of disease-associated proteins that are otherwise difficult to target. Currently established strategies, such as PROTACs, frequently suffer from off-target effects and poor pharmacokinetics. This study presents a potential alternative strategy that could leverage the ubiquitin-proteasome system to degrade non-canonical targets by delivering an evolved E3 ligase capable of recognizing novel, disease-associated substrates. Specifically, we set out to evolve the degron bound by SIAH to enable recognition of NLRP3, a protein implicated in various inflammatory and neurodegenerative diseases. The previously established Phage-Assisted Continuous Evolution (PACE) was chosen as the evolution method due to its success in reprogramming peptide-specific enzymes such as proteases. While the optimization of the selection system outlined here is still ongoing, we are confident that this alternative approach toward targeted protein degradation could address some of the major challenges of other drugs in this field.

OUC_DE

Directed evolution of alginate lyase for enhanced activities

(12:00 26th Oct)

Alginate oligosaccharides have found extensive applications in the fields of food, healthcare, and biomedicine. Alginate lyase serves as the primary tool for the preparation of alginate oligosaccharides. Thus, the identification of alginate lyases with high enzymatic activity is significant importance. However, the activity of wild-type alginate lyases is often insufficient for practical applications. Therefore, engineering alginate lyases at the molecular level to enhance their activity is a promising strategy. Error-prone PCR is a widely utilized technique in directed evolution. By altering the reaction conditions, it increases the mutation rate during PCR, leading to the random incorporation of incorrect bases into the amplified genes at a certain frequency, thereby generating a population of randomly mutated DNA. Among these mutants, some may exhibit improved performance. Our objective is to carry out directional evolution based on the existing high-activity sequences and obtain sequences with higher enzyme activity. We employed error-prone PCR for the directed evolution of these genes, followed by the expression of alginate lyases in *Escherichia coli*. The produced enzyme solution will then be reacted with alginate. We measured the enzymatic activity of each mutant, with the aim of identifying mutants with enhanced activity that hold potential for industrial application. Additionally, from the point of view of computational simulation, the possibility of obtaining high activity enzyme was discussed. We found a positive mutant protein molecule R30W.

Time for Lunch

Gluten-free food is separated. The food with Cilantro and Fungal (mushroom) is labelled on-site

Vegan selection

Roasted red peppers with sundried tomato and basil

Falafel with tomato chutney and lettuce

Houmous with roasted red peppers and rocket

Falafel with humous, roasted red peppers and rocket

Houmous with roasted vegetables

Vegetarian selection

Mature cheese with salad and plum chutney

French brie with tomato and basil

Free range egg with mayonnaise and watercress

Cream cheese with salad

Houmous and roasted red peppers

Fish selection

Smoked salmon with cream cheese and cucumbers

Prawn with mayonnaise and lettuce

Prawn with sweet chilli sauce

Tuna and salad with mayonnaise and cracked black pepper

Tuna and cucumber with mayonnaise

Meat selection

Chicken tikka with cucumber and rocket

Coronation chicken with spinach

Ham with wholegrain mustard and lettuce

Chicken salad with mayonnaise

Gammon ham and mature cheddar

Savoury items

Mango and brie parcels

Battered calamari rings with garlic mayonnaise

Vegetable dim sum

A Selection of Cakes

~

Easy peel small fruits

~

Homerton bottled water

Pressé

Tea & coffee

SynthImmunol_NMU

A Directed Evolution-Derived Chimeric Receptor Displaying a Natural Killer Receptor Repertoire Exhibits Pan-cancer Cytotoxicity

(14:00 26th Oct)

CAR-NK cells embody a cutting-edge approach for cancer immunotherapy. Despite their potential, solid tumors frequently present clonal heterogeneity and a deficiency in lymphocyte activation signals, impeding NK cell proliferation and cytotoxic effectiveness. To address this, we developed a novel class of chimeric receptors through charge-induced oligomerization (eCAR). This system incorporates a second-generation CAR design featuring positively charged transmembrane regions paired with negatively charged transmembrane domains equipped with IL2Rβ and/or IL2Rγ intracellular domains. eCAR is proved to enhance tumor antigen-dependent lymphocyte proliferation and activation. Further, we integrated NKR library as a sensor within eCAR structure, which was expressed in NK-92 cells. This engineered cell library demonstrated ligand-dependent cytotoxicity against a broad spectrum of tumor cells and tumor-derived organoids. The study underscores a novel strategy for NK cell-based cancer immunotherapy that exploits an NKR library as a sensor, enabling targeted and efficient destruction of tumor cells across a diverse set of malignancies.

iTidetron

Strengthening the antimicrobial ability of Lactobacillus platarum using deep learning and directed evolution technologies

(14:30 26th Oct)

Existing models for bio-functional peptides (BioPeps) prediction struggle with limited accuracy and applicability in industrial contexts. We introduce a deep learning model integrating three Bi-directional Long-Short Term Memory (BiLSTM) networks, achieving superior performance across 13 BioPeps categories. For antimicrobial peptide (AMP) identification, the model attained 94.8% accuracy in blinded testing and 88% in experimental validation using high-throughput AMP screening data. Additionally, we developed a cell-free AMP synthesis platform, boosting AMP yields to 0.5-2.1 g/L within hours. The model also mapped BioPeps profiles for 40 probiotics and 94 medicinal herbs, identifying *Lactobacillus plantarum* as a prime AMP producer. Using a microdroplet-based sorting method, we isolated a *L. plantarum* mutant with enhanced broad-spectrum antimicrobial activity and organic acid production, underscoring its industrial potential. This study advances BioPeps prediction and synthesis, offering new avenues for antimicrobial agent development and industrial applications.

STU -China

Discovery of extremophiles and extremozymes via deep learning and directed evolution

(15:30 26th Oct)

Extremophiles, with their unparalleled ability to thrive in extreme environments, are invaluable resources for applications spanning material synthesis to environmental monitoring. However, identification of these microorganisms remains laborious and reliant on manual screening. Here, we introduce iExtreme, a comprehensive database comprising 1,030 genomes across three extremophile categories, and present a novel, genome-based deep learning method for their identification. This method achieves a highest accuracy of 0.99 in predicting extremophile living conditions. Furthermore, iExtreme has successfully identified 520 previously unknown extremophilic species and 4,419 extremophilic genomes from diverse genomic databases. Leveraging this database, we employed structure-based clustering to screen for novel D-psicose 3-epimerases (DPEase) and α-amylases. Additionally, we developed a directed evolution method for extremozymes using phage-assisted noncontinuous evolution in droplets, effectively mitigating interference from permeable substances. The evolved DPEase exhibited a 3-fold increase in activity and a 5.4-fold extension in half-life, culminating in the highest reported yield of 243 g/L D-allulose.

NEFU_China

Directed Evolution of the NdmB Enzyme for the Synthesis of Paraxanthine

(16:00 26th Oct)

Paraxanthine (PX) is a naturally occurring dietary ingredient with a wide range of applications in promoting physical performance and treating psychiatric disorders. However, its production still relies on low-yield and poorly specific chemical synthesis. The current study modified the NdmB enzyme through directed evolution to enhance its catalytic efficiency in PX synthesis. An efficient screening system based on a whole-cell biosensor was designed and machine learning models were employed to discover that alterations at glutamine 289 (Q289) significantly enhanced the catalytic efficiency of NdmB in promoting the N3-demethylation of caffeine. Site-directed saturation mutagenesis experiments showed that the NdmBQ289T mutant increased PX production from 0 g/L to 1.22 g/L. Further optimization of the promoter region boosted PX yield to 5.42 g/L, a 29-fold increase over the highest reported yield. This research shows the potential of combining directed evolution, biosensors, and computational tools to optimize biocatalysis and guide future PX production.

Poster Presentations (16:30 - 18:00 GMT+1, 26th, 13:10 – 14:10 GMT, 27th)

TEAMS	NO.	LOCATION
USTC	1	On-site
CPU_CHINA	2	On-site
EVOLUTION SUISSE	3	On-site
OUC_DE	4	On-site
SYNTHIMMUNOL_NMU	5	On-site
NEFU_CHINA	6	On-site
NORTHWEST UNION	7	On-site
EDINBURGH	8	On-site
NKLII-EVOLUTION-CHINA	9	On-site
NAU-CHINA-DE	10	On-site
SUSTECH MED	11	Online
NJTECH-CHINA-A	12	Online
ITIDETRON	13	Online
STU -CHINA	14	Online

Northwest Union

Utilizing directed evolution of recombinant GLP-1 protein to explore innovative approaches for controlling blood sugar levels (9:00 27th Oct)

Diabetes is one of the most significant contributors to premature mortality globally, stemming from the difficulties in effectively regulating blood sugar levels. Traditional methods of blood sugar control heavily rely on injectable medications, which have inherent drawbacks, making it difficult for many individuals to access treatment. As a result, there is a widespread call for innovative approaches to blood sugar management. Numerous new findings indicate that innovative probiotic therapies based on directed evolution may offer new hope for patients with abnormal blood sugar levels. This study obtained a recombinant glucagon-like peptide-1 (GLP-1) through directed evolution, which is capable of releasing under hyperglycemic conditions and turning off under hypoglycemic conditions. We assessed bacterial growth and metabolic activity, confirming robust performance consistent with prior research. Western blot analysis revealed the expression of target proteins BCoAT and GLP-1, while HPLC demonstrated a significant increase in short-chain fatty acids (SCFAs) in DLPC-encapsulated strains, although butyrate production was notably reduced. Our findings indicate that engineered bacteria can respond dynamically to glucose fluctuations, supporting their therapeutic potential. Additionally, time-series analysis showed a steady release of GLP-1 during logarithmic growth, and transmission electron microscopy confirmed successful DLPC encapsulation. However, a decrease in colony count highlighted the need for optimizing encapsulation techniques to balance benefits with bacterial viability. These results underscore the promise of engineered bacteria in glucose-responsive therapies for diabetes, warranting further investigation for *in vivo* applications.

Edinburgh

Site-specific mutagenesis of *E. coli* surface proteins, Curli and Antigen43, for enhanced cell adhesion to polystyrene (9:30 27th Oct)

The issue of plastic waste is a growing concern as existing recycling and upcycling strategies are energy-intensive and largely inefficient. Recent discoveries of a toolbox of biocatalysts capable of plastic degradation under mild conditions have paved the way for a generation of biotechnological solutions to address the plastic waste crisis. Prior research in the Sadler laboratory at the University of Edinburgh demonstrated that overexpression of plasmid-encoded cell surface proteins Antigen 43 (Ag43) and Curli in *Escherichia coli* enhances plastic adhesion. Herein, we report the use of directed evolution, via site-specific and random mutagenesis, to generate mutant variants of Curli and Ag43 that exhibit enhanced adhesion to polystyrene. We identified 54 Curli mutants that demonstrated significant improvements in adhesion. Improving the co-localization of these whole-cell biocatalysts via enhanced adhesion to plastic surfaces may facilitate the development of more efficient enzymatic degradation technologies.

SUSTech Med

Targeted Killing of *Vibrio cholerae* Using GP20 Tail Fiber-Mediated Recognition and PVC System for VgrG3 Toxin Delivery

(10:30 27th Oct)

Based on Professor Feng Zhang's article, *"Programmable Protein Delivery with a Bacterial Contractile Injection System,"* we utilized the extracted PVC injection system from the study and aimed to assess its ability to counteract *Vibrio cholerae* infection. To achieve this, we constructed the corresponding plasmid proteins and transformed them into E. coli competent cells. After expression, PVC proteins were extracted via ultracentrifugation. Once the protein was successfully obtained, we conducted bactericidal assays using spot plate experiments with *V. cholerae* on agar plates. We then observed the bactericidal effect of PVC on *V. cholerae* under transmission electron microscopy (TEM) to evaluate whether PVC can serve as an effective tool for combating *V. cholerae*. This experiment aims to validate PVC's potential for future therapeutic applications.

NAU-CHINA-DE

Complete bio-degradation of PBAT via evolved hydrolases and construction of a engineering *Pseudomonas putida* KT2440 strain

(11:00 27th Oct)

Poly (butylene adipate-co-terephthalate) (PBAT), a polyester made of terephthalic acid (TPA), 1,4-butanediol and adipic acid, is extensively utilized in agricultural plastic films. However, research on the biodegradation mechanism and technological development of PBAT plastic films is still insufficient, which seriously limits its market application and leads to more serious cumulative pollution problems. This study employed error-prone PCR and site-directed mutagenesis techniques to perform directed evolution of Ideonella sakaiensis PETase (IsPETase), *Bacillus subtilis* Lipase A (BsLipA) and Lipase1028, in order to achieve efficient degradation of PBAT. Furthermore, the evolved IsPETase mutants were transformed into the Pseudomonas putida KT2440-tph, constructing a KT2440 strain with high PBAT degradation capacity and the ability to utilize the terephthalic acid (TPA) and 1,4-butanediol (BDO) as carbon sources. This work offers an attractive approach for the controllable degradation of biodegradable plastics that benefits environmental sustainability.

NKLII-Evolution-China

Develop a Gas6-Fc Fusion Protein to Ameliorate the Immunosuppressive Tumor Microenvironment through Directed Evolution Strategy

(11:30 27th Oct)

The efferocytosis of tumor cells by tumor-associated macrophages (TAMs) leads to an immunosuppressive environment and tumor immune escape. Gas6 is a bridge protein between macrophages and tumor cells. How to modify Gas6 to change the immunosuppressive environment needs to be further explored. In this study, we have developed a novel recombinant fusion protein named Gas6-Fc, which retains the N-terminal domain of Gas6 for binding to apoptotic cells while substituting the C-terminal domain responsible for MerTK receptor binding with an antibody Fc fragment. By engaging with FcR instead of MerTK receptors on macrophages, Gas6-Fc promotes macrophage activation and triggers antibody-dependent cellular phagocytosis (ADCP) towards apoptotic cells. We aim to establish a eukaryotic expression system for the Gas6-Fc fusion protein and enhance its affinity towards tumor cells through directed evolution strategies, enabling it to effectively compete with endogenous Gas6. Subsequently, we will evaluate the impact of Gas6-Fc at both cellular and animal levels. The anticipated outcome is that the Gas6-Fc fusion protein will mitigate the immunosuppressive state within the tumor microenvironment and augment the efficacy of tumor therapies.

Time for Lunch

Gluten-free food is separated. The food with Cilantro and Fungal (mushroom) is labelled on-site

Vegan selection

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Mature cheese with salad and plum chutney

French brie with tomato and basil

Free range egg with mayonnaise and watercress

Cream cheese with salad

Houmous and roasted red peppers

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Prawn with sweet chilli sauce

Tuna and salad with mayonnaise and cracked black pepper

Tuna and cucumber with mayonnaise

Meat selection

Chicken tikka with cucumber and rocket

Coronation chicken with spinach

Ham with wholegrain mustard and lettuce

Chicken salad with mayonnaise

Gammon ham and mature cheddar

Savoury items

Mini spring vegetable roll with sweet chili sauce

Cheese and bacon potato skins with sour cream and chive

Chicken satay

A Selection of Cakes

~

Easy peel small fruits

~

Homerton bottled water

Pressé

Tea & coffee

Group Photo

Group photos are divided into online and on-site.

The online photo session time is 12:30 GMT 27th Oct.

The location for the online group photo is the lawn outside the Gather Town venue. Please **choose your favorite look for your avatar**, and choose a location on the lawn where everyone can see you and your name.

The online group photo will be made into a postcard and sent to each contestant as a souvenir.

The on-site photo session time is 13:00 GMT 27th Oct.

The location for the on-site group photo is on the large lawn in front of the Great Hall.

Our volunteers will guide everyone to the photo location after lunch. The on-site photo will also be made into postcards as souvenirs.

Cambridge rains a lot in winter. If it rains, the group photo will be taken indoors.

Invited Speakers

iDEC HQ is honored to invite three senior scientists in the field of synthetic biology and directed evolution to bring invited lectures to our participants.

The topics of the three invited lectures jointly outline the core themes that contributed to the creation of iDEC:

Acknowledgment

iDEC 2024 could not be successfully organized without the help of our sponsors, collaborators, iDEC HQ members and participants.

We thank **Bluepha** and **New England Biolabs** for their generous support.

iDEC 2024 Invited Speakers:

Dr. Mateo Sanchez from Cambridge University

Dr. Benjamin G. Davis from Oxford University

Dr. Neil Dixon from the University of Manchester

Dr. Zakir Tnimov from Constructive Bio

Dr. Daniel Dunkelmann from the University of Cambridge & MPI-MP, Potsdam

Dr. Joanna Sadler from the University of Edinburgh

iDEC 2024 Judge List:

Dr. Ella Watkins-Dulaney from Caltech, US

Dr. Fabian Rehm from the MRC Laboratory of Molecular Biology (LMB), UK

Dr. Fankang Meng from the Imperial College London, UK

Dr. Ganesh Agam from the MRC Laboratory of Molecular Biology (LMB), UK

Dr. Kenneth Wu from the MRC Laboratory of Molecular Biology (LMB), UK

Dr. Rongzhen Tian from the MRC Laboratory of Molecular Biology (LMB), UK

Dr. Saja Fadila from the MRC Laboratory of Molecular Biology (LMB), UK

Dr. Svenja Vinke from Harvard University, US

Dr. Shiyuan Li from Cathay Fortune Capital Investment, CN

Dr. Xiao Yi from the SIAT, CN

Dr. Yeqing Zong from the Bluepha, CN

iDEC Executive Committee Members:

Prof. Tom Ellis, Prof. Chris French, Shan Jiang, Dr. Nadanai Laohakunakorn, Dr. Yang Liu, Dr. Zakir Tnimov, Prof. Ye Chen, Prof. Chang Liu.

iDEC 2024 Organizers:

Dr. Trevor Y. H. Ho, Chong Teng, Yinan Ren, Katherine Martin, Kening Chen, Tong Lyu, Huandi Xu, Dr. Stefan Bassler, Dr. Svenja Vinke, Gokul Bhaskaran, Levin Joe Klages, Irina Rais, Swaranjeet Singh, Dr. Yang Liu, Kenneth Wu, Dr. Fabian Rehm, Dr. Ganesh Agam, Dr. Nikos Nikolopoulos, Talal Haddad, Dr. Yangqi Gu, Dennis Wang, Dr. Yue Ren, Zachary Liang, Yuancheng Din.

iDEC 2024 Sponsor Representatives:

Qiang Geng from Bluepha, Erin Varney and Dr. Emma Mitchell from New England Biolabs.

iDEC 2024 Teams:

Northwest Union, SUSTech Med, OUC_DE, NAU-CHINA-DE, Edinburgh, Evolution Suisse, USTC, NKLII-Evolution-China, NEFU_China, CPU_CHINA, NJTECH-CHINA-A, SynthImmunol_NMU, STU -China, iTidetron

Sponsors & Collaborators

iDEC is generously supported by our sponsors and collaborators to carry out public welfare education and young talents in scientific and technological innovation.

This year, our sponsor Bluepha provided iDEC with strong financial and industry-related support again.

Bluepha
蓝晶微生物

The iDEC Special Awards are titled by our Sponsor Bluepha as:

Bluepha Reporter System Award

Award to teams who develop or optimize a reporter system and use it in their iDEC projects.

Bluepha Library Constructing Award

Award to teams that optimize or establish novel methods for genetic diversification in their research.

Bluepha Screening Assay Award

Award to teams who establish or optimize screening assays in their projects.

At the same time, iDEC 2024 has received strong support from more iDEC sponsors.

We are grateful for the generous support from the industry:

NEW ENGLAND BioLabs® Inc.

For more information about iDEC sponsors, please read our sponsor pages.

We also maintain collaboration with the non-profit organization Regenesis, the Møller Institute (Cambridge University), and the Homerton Events.

MØLLER INSTITUTE
CHURCHILL COLLEGE UNIVERSITY OF CAMBRIDGE

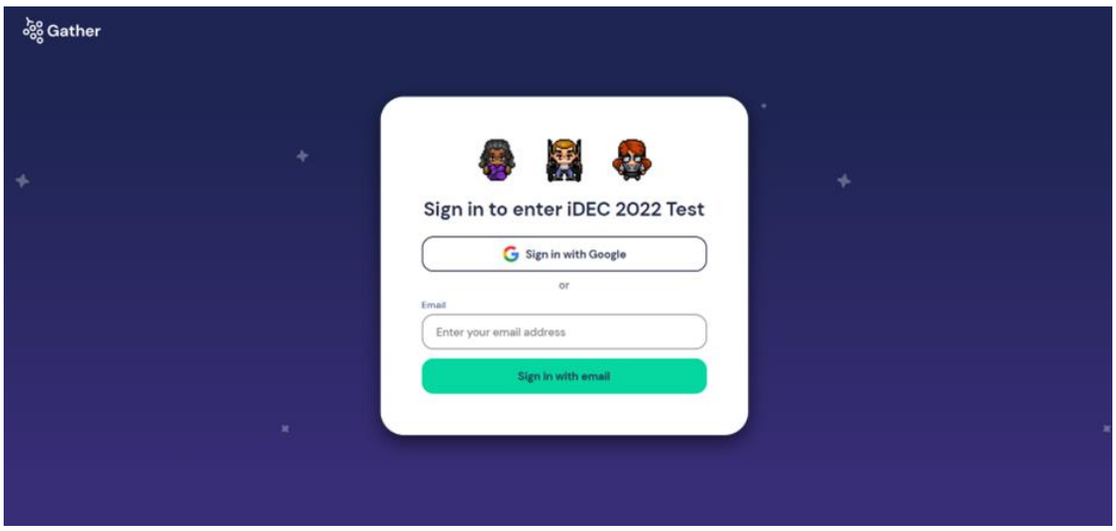
HOMERTON COLLEGE EVENTS

REGENESIS

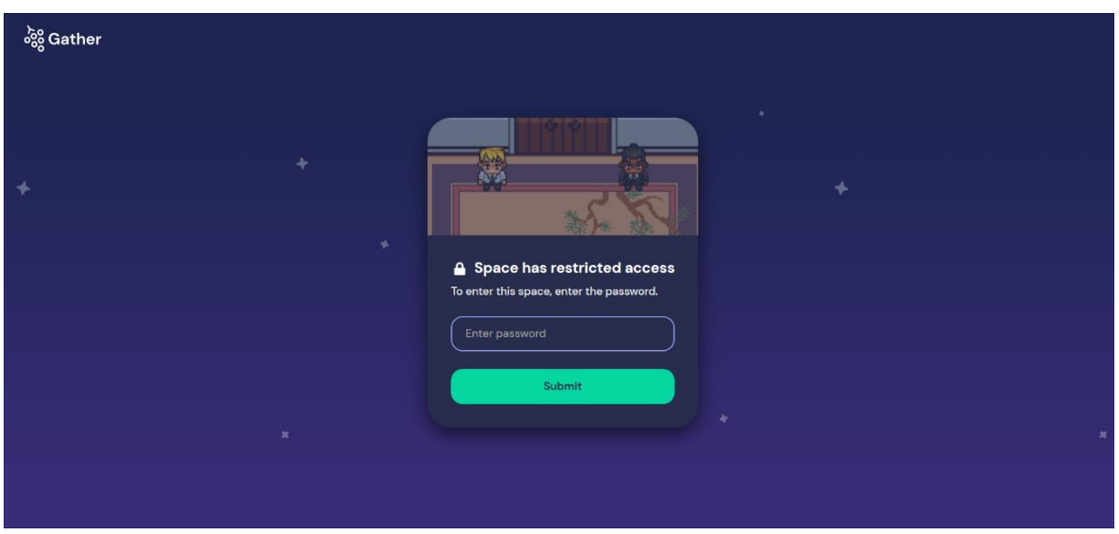
Gather Town Guide

2D virtue platform Gather Town is used for the online iDEC Festival.

All team members will receive a link to join Gather Town before the opening ceremony. Here is a simple guide on how to use Gather Town.



Every participant must sign in before entering the iDEC 2024 space by the link we send. **The password is '2024'**.



In the Gather virtual environment, you can set your own image and move freely. When the virtual character is close to others, you can hear each other's voices.

You can also find tables and chairs placed on the carpet in the virtual venue. The carpet area is a private space where only virtual characters who enter the carpet region can talk.

iDEC HQ have built breakout rooms for the iDEC teams. The iDEC team can prepare presentations without interruption in a separate virtual room.

In the poster display area, we will hang the posters of each team and marked them with number. During the poster presentation, the judges will visit the poster from time to time and listen to the introduction of the poster content by the team.

The carpet area in front of the poster is a soundproof space, and only people who enter the area can talk to each other.

iDEC 2024

Sponsor

Bluepha is a biomanufacturing and material innovation company providing breakthrough products based on synthetic biotechnology. Founded in October 2016, Bluepha has been actively committed to the design, development, manufacture, and marketing of new bio-based molecules and materials, including:

- Bio-polymers PHAs which are biodegradable in any environment without leaving harmful footprints
- Materials for regenerative medicine
- Novel functional ingredients for personal care and medical beauty
- New food additives
- Probiotic products, etc.

The glory of Bluepha is inseparable from the core team coming from top research institutes such as Tsinghua University, Peking University, Chinese Academy of Sciences and the Fortune Global 500. A dream team of experts and consultants is composed of leaders in the field of SynBio industry, education, and research.

In 2022, the first product pipeline of Bluepha with a super-factory of marine degradable material PHA: Bluepha™ was officially started construction in Binhai, Yancheng, Jiangsu, with annual production capacity of 25,000 tons. The performance of Bluepha™ has been verified by several enterprise customers from Fortune Global 500, and has obtained orders and intentional orders from many enterprises. At present, Bluepha has signed strategic cooperation agreements with a few partners worldwide to expand the global market with unlimited potential of Bluepha™.

In addition, Bluepha has reserved dozens of R&D pipelines for new products. The application scenarios cover the fields of health & medical care, agricultural environmental protection, beauty & cosmetic and innovative food. Each product pipeline corresponds to a direct market size of more than $1 billion.

Since establishment, the Bluepha has built an interdisciplinary team composed of senior scientists and engineers in different fields such as robotics, software development, mechatronics, big data, and synthetic biology. An automated and datamated infrastructure "Synbio OS" was set up. It is expected that in the next 3 years, the R&D cycle of a single Bluepha product pipeline will be shortened by 70% on the existing basis.

NEW ENGLAND BioLabs® Inc.

be INSPIRED
drive DISCOVERY
stay GENUINE

Putting science first.

Post-Doctoral Fellowships at New England Biolabs®

Established in the mid 1970s, New England Biolabs, Inc. (NEB®) is the industry leader in the discovery and production of enzymes for molecular biology applications and now offers the largest selection of recombinant and native enzymes for genomic research. NEB continues to expand its research and development into areas related to DNA replication, programmable nucleases, epigenetics, molecular parasitology, sample preparation for next generation sequencing, synthetic biology, glycobiology and RNA analysis.

Scientists in the Research Department at New England Biolabs conduct basic research in the areas of Molecular Enzymology, Nucleic Acid Replication, Protein Expression and Modification, Genome Biology and RNA Biology. The Post-Doctoral Fellowship program at NEB aims to train recent Ph.D. graduates in a modern industrial molecular biology setting. Post-doctoral fellows conduct basic research, publish in high quality journals and present at scientific conferences.

Employment at NEB offers a stimulating and creative work environment in a state-of-the-art research and production facility, with a team of exceptional scientists and professional staff. The NEB culture emphasizes personal and professional growth through creativity, teamwork, respect and responsibility, while maintaining a casual campus-like working environment. Our diverse and talented team of scientists enjoy a collaborative research environment with much of the freedom and intellectual challenge of academia. Our unique corporate philosophy encourages dialogue and innovation.

For information about Post-Doctoral Fellowships at New England Biolabs please visit: **https://www.neb.com/about-neb/careers**

International Directed Evolution Competition 2024

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Not with a plan but a competition.