

# Customer Screening for DNA Synthesis

*An interactive exercise from the  
International Biosecurity and Biosafety  
Initiative for Science*



## Instructions for workshop organizers

**Slides 3-8** are intended as an introduction to synthesis and customer screening, to be presented in 5-10 minutes. You **may be able to skip some or all** of this depending on the background of your audience.

The **Order Screening Game** itself can be run in about 30 minutes:

- **Slides 9-11** (<5 min) explain game, split into pairs, individuals read their profile
- **Slide 12** (5 min) round 1 of screening
- **Slides 13-14** (5 min) round 2 of screening game (roles reversed)
- **Slide 15** (3 min) debrief in pairs
- **Slide 16** (5 min) debrief in small groups
- **Slide 17** time permitting, share back with the whole group

**Slides 18-19** contain more information about IBBIS's mission and screening tools.

Want to run a workshop? Reach out to [screening@ibbis.bio](mailto:screening@ibbis.bio) for assistance!

## Instructions for workshop organizers

The latest version of the workshop materials (personas + instructions) can be found in:

**Screening Game Slides** (this slide deck; link will have the latest version)

[ibbis.bio/customer-screening-workshop-slides](https://ibbis.bio/customer-screening-workshop-slides)

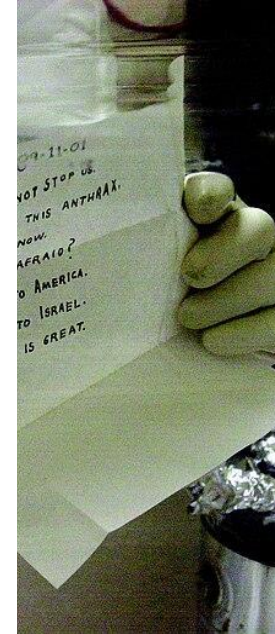
**Customer Profiles** (formatted to print)

[ibbis.bio/customer-profiles-for-screening](https://ibbis.bio/customer-profiles-for-screening)

An extra layer of organization is needed if you wish to run the game virtually or in a hybrid format. Please reach out to us for more specific guidance.

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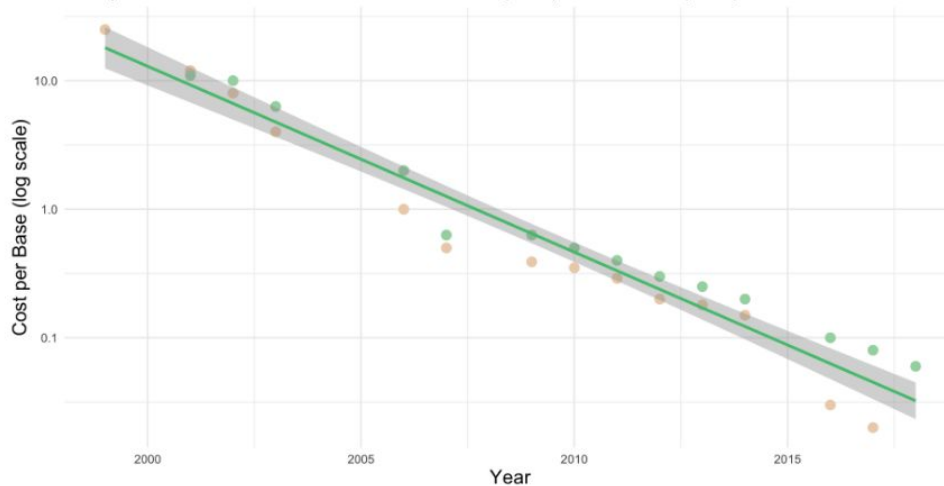
1. Few people are motivated to do harm **(good)**
2. Doing harm with biology is difficult **(good)**
3. ... because biology is difficult in general **(bad)**



**Synthetic NAs are exponentially cheaper, while orders are longer and more complex**

**Custom orders ship in the mail, print on benchtops, or are sourced from third parties**

USD per base, 1999-2018. Data from Rob Carlson (2023) and Potomac (2018)



Plot generated in R using assistance from GPT4. Data from Carlson (2023) and Potomac (2018).  
With thanks to Max Langenkamp (see in-text links).



In 2006, a journalist orders smallpox DNA in the mail, spurring BWC talks and industry action

• This article is more than 19 years old

## Lax laws, virus DNA and potential for terror

- Loopholes mean anyone can order gene sequences
- Scientists back voluntary regulation as first step

The smallpox virus last wreaked havoc on the human population in 1978 before a World Health Organisation programme eradicated it from the earth. It now exists only in government laboratories in the US and Russia.

But ordering part of this long-dead pathogen's DNA proved easier than anyone dared imagine. All it took was an invented company name, a phone number, a free email address and a house in north London to get the order by post.

What the investigation makes clear is that anyone, without any attempt to prove they are part of a legitimate research organisation, can order DNA sequences from any potential pathogen without fear of extensive questioning. In our case, VBI Bio Ltd did not realise it was supplying the smallpox genome, but many scientists argue that it is the responsibility of companies selling custom-made pieces of DNA to check their orders for potentially dangerous sequences.



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### WORLD'S TOP GENE SYNTHESIS COMPANIES ESTABLISH TOUGH BIOSECURITY SCREENING PROTOCOL

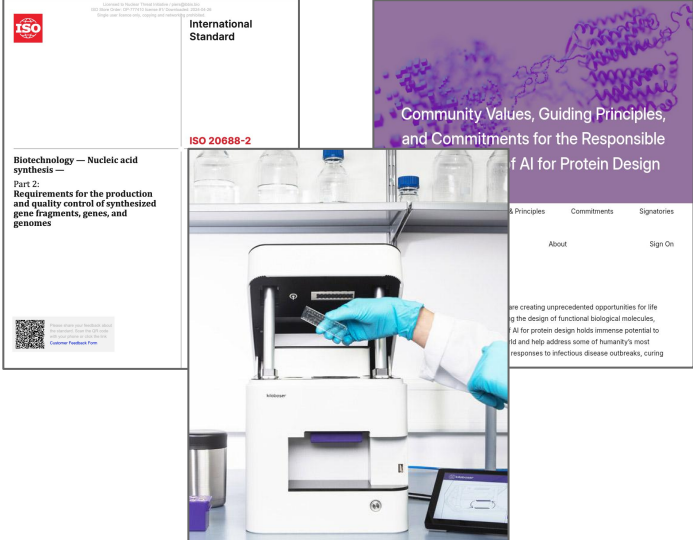
Form International Gene Synthesis Consortium (IGSC)  
to Coordinate Best Practices in Risk Reduction

Five Member Companies Represent 80 Percent of Worldwide Gene Synthesis Capacity

Washington D. C., November 19, 2009—Five of the world's leading gene synthesis companies today announced agreement that they will apply a common screening protocol to promote biosecurity in the gene synthesis industry. By screening the sequences of synthetic gene orders and the customers who place them, the companies aim to support government efforts to prevent the misuse of gene synthesis technology. Blue Heron Biotechnology, DNA2.0, GENEART, GenScript and Integrated DNA Technologies together represent approximately 80 percent of the global gene synthesis capacity. They have formed the International Gene Synthesis Consortium (IGSC) to coordinate ongoing best practice development and to work together with governments and others concerned to promote the beneficial application of gene synthesis technology and to safeguard biosecurity.

"We are proud to announce the formation of the International Gene Synthesis Consortium and equally proud of the commitment to the secure and safe synthesis of DNA it demonstrates," said John Mulligan, Founder and CEO of Blue Heron Biotechnology. "The depth and breadth of expertise in gene synthesis represented by the participating companies, in concert with our dedication to policy based on sound science and thoughtful leadership, will enable us to shape the growth of a safe gene synthesis industry poised to help address the technological needs of the 21st century."

Today, new standards respond to changing risk landscape (AI tools, long synthesis, biofoundries)



ISO  
International Standard  
ISO 20688-2  
Biotechnology — Nucleic acid synthesis —  
Part 2:  
Requirements for the production and quality control of synthesized gene fragments, genes, and genomes

Community Values, Guiding Principles, and Commitments for the Responsible Use of AI for Protein Design

Principles Commitments Signatures

About Sign On

We are creating unprecedented opportunities for life in the design of functional biological molecules. AI for protein design holds immense potential to aid and help address some of humanity's most responses to infectious disease outbreaks, curing

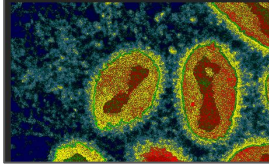
**Acquisition:** reconstructing a functional pathogen or toxin from digital sequences

**Engineering:** enabling more people to engineer pathogens and toxins

## How Canadian researchers reconstituted an extinct poxvirus for \$100,000 using mail-order DNA

A study that brought horsepox back to life is triggering a new debate about the risks and power of synthetic biology

6 JUL 2017 • BY KAL KUPERSCHMIDT



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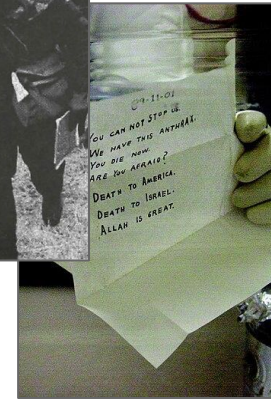
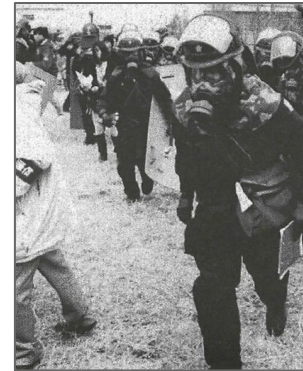
Article | Published: 04 May 2020

### Rapid reconstruction of SARS-CoV-2 using a synthetic genomics platform

Tran Thi Nhu Thao, Fabien Labrousse, Nadine Ebert, Philip V'kovski, Hanspeter Stalder, Jasmine Portmann, Jenna Kelly, Silvio Steiner, Melle Holwerda, Annika Kratzel, Mitra Gultom, Kimberly Schmied, Laura Laloli, Linda Hüsler, Manon Wider, Stephanie Pfaender, Dagmar Hirt, Valentina Cioabă, Silvia Crespo-Pomar, Simon Schröder, Doreen Muth, Daniela Niemeyer, Victor M. Corman, Marcel A. Müller, ... Volker Thiel [Show authors](#)

[Nature](#) 582, 561–565 (2020) | [Cite this article](#)

151k Accesses | 256 Citations | 1506 Altmetric | [Metrics](#)



**1. Recognize potentially risky sequences**  
toxins, pathogen genomes, virulence factors



**2. Decide whether to trust user or customer**  
with risky sequences by screening legitimacy



**1. Recognize potentially risky sequences**  
toxins, pathogen genomes, virulence factors



**2. Decide whether to trust user or customer**  
with risky sequences by screening legitimacy



## Legitimate customers come in many shapes and institutions

- Orders from **academic researchers** could be centralised across entire departments or conducted by individual undergraduates
- Early-stage **biotechnology companies** may lack legal standing, lab space, online presence, and other indicators of legitimacy
- Third parties like **CROs, CMOs, and biofoundries** may not have designed the experiments for which they order DNA
- Biosafety best practices **vary around the world**, including whether formal review is conducted





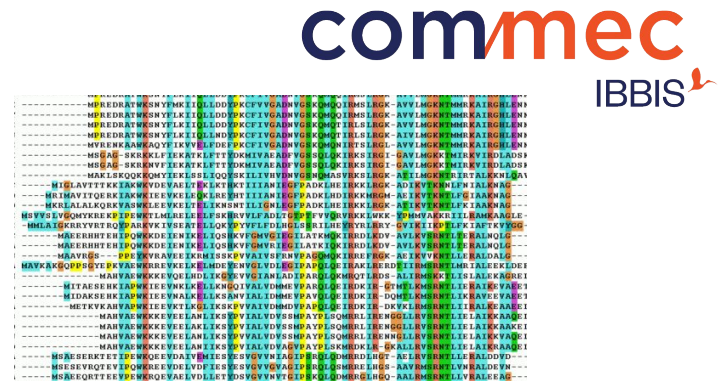
# Order Screening Game

*An interactive exercise from the  
International Biosecurity and Biosafety  
Initiative for Science*

Each of you will play a synthesis screener and a customer.

Customer profiles based on real examples of legitimate scientists and attempted bioterror

Flagged orders screened using IBBIS's Common Mechanism



1. Read your customer profile.
2. Find a partner. **Do not show them your profile!**
3. Decide who will play the customer first. The other person will be the screener.
4. The customer should **hand their printed order** to the screener.



**As the customer,** you want the screener to send the sequence.

**As the screener,** you must decide to:

1. **Fulfill** the order
2. **Deny** the order
3. **Deny** and report to law enforcement



# switch!

without sharing your true identity,  
change screener and customer roles.



**As the customer,** you want the screener to send the sequence.

**As the screener,** you must decide to:

1. **Fulfill** the order
2. **Deny** the order
3. **Deny** and report to law enforcement



# reveal!

**Show your partner your customer profile.**

Take 3 minutes to discuss if this is surprising, and if you would change your decision about whether to fulfil the order.



**Join 1-2 other pairs.**

**For 5 minutes, discuss:**

- What did you notice?
- What information did you wish you had?
- What systems would help with follow-up screening?



Share a **question** or **observation** from your group with the rest of the room.



You can use IBBIS screening tools right now

commec



**commec**: a free, open-source, globally available tool for sequence screening

**customer screening forms** and decision guidance to help rigorously verify legitimacy

Reach out to **screening@ibbis.bio** with questions or for help getting started!

**Safeguarding modern bioscience and biotechnology**  
so it can advance and flourish safely and responsibly

*for DNA synthesis:*

**Increasing the share of synthesis orders**  
for which sequences and customers are  
screened

**Supporting international standards**  
that are inclusive and rigorous

