Global catastrophic risks connected with biological weapons and genetic engineering

All information is taken from open sources, mostly wikipedia

Biological agents which could be genetic engineered for global lethality

Complexity of the organism

Prions
- Artificial prions (already created) may be easily transmissible
  Mad cow disease, Kuru

Genes
- Horizontal transfer of dangerous genes
  - poisonous
  - drug-resistance
- Plasmids
  Some now carry AB resistance genes
- Nano particles with genes

Toxins
- Aflatoxin, Botulism, other - wiki
  Toxin coding genes in plasmids
  New toxins and chemical weapons coding genes

Viruses
- Flu
  - Spanish flu has been sequenced and published
  - Sites in flu genome are known which will make it very dangerous
  - Flu could be carried by birds everythere
  - Many variants exist, no universal vaccine currently
  - See flutrackers.com
- Small-pox
  - Smallpox could be easily modified for 100 per cent mortality (mousepox article)
  - North Korea may have samples
  - May be combines with Ebola?
  - Could be carried by wind
- Ebola
  Exponential growth in 2014 was prevented by strong international team.
- AIDS
  - AIDS has now only 1 in 100 chance of infection during sexual intercourse and do not present in saliva, what if it will be made more effective?
  - Its genes may be inserted in flu or other viruses?
  - Could its mutation rate rise?
- SARS MERS
  link
  New viruses of this class could be created
- Onco-viruses
  - SV-40 Could cause cancer.
  - Other oncoviruses exist (papillomavirus)
  - 20 per cent cancers caused by viral load
  - Artificial cancer causing genes may be inserted into flu
- Others known viral bioweapons
  - encephalitides
  - yellow fever
- Others known human viruses, which may be used to create future BW
  Marburg
  Rotavirus
  Rabies
  Hantavirus
  Rotavirus
  Noravirus
  Hundreds of human viruses exist
  Link on list
  9 deadly virus
- Biopreparat's agents list, wiki
  Pathogens that were successfully weaponized by the organization included (in order of completion):
  Smallpox
  Bubonic plague
  Anthrax
  Venezuelan equine encephalitis
  Tularemia
  Influenza
  Brucellosis
  Marburg virus (believed to be under development as of 1992)
  Machupo virus (believed to be under development as of 1992)
  Veepox (hybrid of Venezuelan equine encephalitis with smallpox)[citation needed]
  Ebolapox (hybrid of ebola with smallpox)[citation needed]
  Annual production capacities for many of the above listed pathogens were in the tens of tons, typically with redundant production facilities located throughout the Soviet Union.
- Ebolapox
  "A genetic combination of Ebola and smallpox, said to have been developed by Russian biological weapons experts. Parts of the Ebola virus were grafted into a smallpox virus".
  link, link

Bacteria, archea and protozoa
- Anthrax
  - 200 tons was created and lost near Aral sea, wiki.
  - Could be airbone, if weaponised inside capsules
  - Could contaminate structures for decades
- Yersinia
  Could be made more easily transmittable with with GM-mice
- E.Coli
  Could be made:
  - Toxin producing
  - AB resistant
  - Oncogene carrier (SV-40)
- TB
  Multiple drug resistant TB already exist, could be made even more dangerous
- Toxo plasma
  Could change behavior
- Antibiotic resistant bacteria
  Many types exist
- Others bacterial bioweapons

New Poisonous organisms
- New types of Botulism-toxin producing bacteria with ability to live in any environment
- Dioxin producing bacteria
- Locust with infectious agent producing ability (anthrax, virus)
- New type of neurotoxin producing algae
  wiki

Cancer cells
- Cancer cell line mutations
  HeLa has contaminated other cancer cell lines and is mutating – maybe it could adapt to humans?
- Transmittable cancers
  - Wiki
  - Hamster cancer is transmissible by mosquito bites
  - Could result in species extinction (Tasmanian devil),
  - New form found

Artificial insects
- Upgraded known insects
  Locust, ants
- Cyborg-insects
  capable of carrying living virus
- Entomological warfare, wiki

Animal-carriers
- Mosquito, mites, fleas
  Fleas were used for most successful bio attack during WW2
- Anthrax disseminators
- Prion-producing gut bacteria
- Mice
  "Black death" epidemic
  Birds
  flu
- Artificial predators based on dogs, cats, bats, snakes, bees with poisonous venom or carring infections (rabies)

GMO-food
- Mostly safe
- Unsafe version may be created

Fungi
- Genetically modified fungi species
- Fungus infections are known to cause specie extinctions
  - Amphibian die-off wiki,
  - Banana

Pests
- Universal pest, killing all crops
  Wheat rust UG99

Parasites
- New effective parasites

Gene drives
- Mosquito capable to transfer new diseases
  link

Potential mechanisms of global effect

Green goo
- Synthetic organisms replicate uncontrollably link
- Omnivorous bacteria or locust
- Universal virus able to attack any living cell

Synthetic life
- Different DNA code
- Different protein chirality
- Nano-bio-robots
  DNA-origami
  bio-computers inside a cell

Biosphere collapse
- Universal replicator
  Virus, capable of replicating in any cell
- Cellulose converting bacteria
- Locust,
  capable to eat everything
- Food chain collapse

Multi pandemic
- Hundreds different pathogens created and released simultaneously

Natural risks
- Flu pandemic
  Recombination of several flu viruses
- Animal viruses transmission
  like SARS, Ebola, AIDS

Two stage bioweapon
- *1st stage:* silent dissemination
  2 stage: activation
- Two bioweapons interact deadly
  like: AIDS+smallpox
  AIDS+TB

Zombie
An agent influences people so that they want to disseminate it
- Bacteria, able to produce addictive drug
  which makes people aggressive (meth)
- Zombie virus, which makes humans carnivorous zombies
  similar to rabbis
- Empathic drug creating bacteria (MDMA?)

Longterm non-lethal
consequences, resulting in population decline
- Intelligence decline
- Health decline
- Fertility decline
- Aggression increase

Properties of "ideal" x-risk virus
- The illness becomes contagious before any clinical manifestations
- Delayed onset of the illness (long incubation period)
- Virus build to evolve to be more dangerous
- The nature of the illness discourages people tests on it (no cure, stigmatization)
- The illness subtly affects cognition, making people more risky and less responsible
- Disables immune system
- Quickly mutates and creates new types
- Super AIDS, super flu easily transmittable
- - The ability to quickly replicate in any condition
  - No natural enemies
  - Quick replication rate

New ways of dissemination

Known:	Possible new high-tech (weaponisation):
• Insects • Food • Vaccination • Air travel • Air flows, droplets • Water • Sex • Surfaces, closing • Body fluids • Blood • Ground, dust • Animals, parasites • Goods, fomite	• Drone-sprayers • Food and drug poisoning • Clever carriers (mice) • Hacking bioprinter remotely • Spores of anthrax covered by protective layers and able travel in air on high distances • Attack from multiple locations • Human super-seeders

Climate
- Warming
  - Methane producing bacteria
  - Other green house gases producers
- Cooling
  Sun dimming by clouds of air floating bacteria (seems improbable)
- Oceans poisonings
  - HS4, wiki
  - Reef killers bacteria, link

Cognitive effects
- Addictive drugs
- Lowering intelligence or productivity

Technology collapse
- Plastic eating bacteria goes out of control

Self-replicaing computer-controlled bio-laboratory
- Universal bioprinter
  Computer controlled cell culture able to create new DNA or sequence it, and thus transform in any organism or cell culture

Vaccines
- SV-40 virus contamination case

Biotech used to create other dangerous technologies
- Nanotech
- Nuclear
- AI
  See double scenarios map

New diseases which become global risks only after technological collapse
- After nuclear war vaccination fails and smallpox becomes global risks again, especially if modified.
- AB resistant bacteria win after collapse

The ways of genetic augmentation of viruses

Pseudotyping
- Change of surface antigenes of virus to make it invisible to vaccines (link)

Recombination
- Adding new properties to existing viruses by adding new genes from other viruses (Ebolapox)
- Recombination of two similar viruses on one host cell (flu)

SNIPing
- Replacing several letters in code of the exiting virus to change its antigenic properties, or type of receptor to which it could connect

RNA to DNA
- Translating code of RNA viruses into DNA-viruses (may be it was done in Biopreparat)

Selection
- Selection of most deadly viruses on animals (or even human prisoners)

Other ways of genetic modification
- CRISPR
- Virus-vectors
- Custom DNA synthesis
- Animal sources

Factors increasing the probability of biological x-risks

Technological

- Moore's law in biotech
  1 000 000 times cheaper DNA sequencing for 15 years
- Bioprinters and DNA synthesizers
  home grown drugs
- Dangerous experiments
  Creation of pandemic viruses for testing their spreading abilities
- Biohackers
  - Citizen scientists and DIY movement
  - DIY biology kit in the internet
  link
- Killer virus is cheap to create now
  - Link on crispr price
  - Even in 2002, link on Wimmer and polio
  - Amateur scientists could do it in two weeks
- Library of elements
- Custom synthesis
  Home kits, internet orders
- Knowledge of mass destruction
  Hispanic Flu DNA published
- Quick transition to cheap virus creation will result in multipandemic in unprepared world
  Transition would take 2-5 years if doubling period is 1-2 years in biotech
- Computational biology
  New viruses could be calculated on computer and ordered in the internet
- Critics
  link

Social

- Asymmetric war
- Nuclear-biological war
- Bio doomsday weapons
- Weaponisation
  - Longterm survival in the environment
  - Vaccines for good guys
  - Gene-targeted
- Black market
- Secret development
- Personal targeted bioweapons
- Viral archeology
  - The great influenza virus of 1918 was successfully recovered from a corpse 90 years later by a very careful laboratory, link
  - Other viruses may be reconstructed
- Air travel
  Quick transportation may result in quick dissemination of a virus
- Easy to cover
  Civic and military labs look similar

Biological

- Small human biodiversity
  Humans are almost clones because of bottleneck 70 000 years ago, link
- Agriculture helps to create new risks
  - Transfer of viruses from animals
    Humans are in close contact with very large pool of animals of all known species
  - Antibiotic resistance
    Most known AB are overused and genes against them evolved and spread
  - Pigs as bioreactors
    - Pig could be infected with human, bird and animal flu and recombine them.
    - 1 billion pigs in China live in close connection with humans and birds
    - Other animal "bioractors": birds

Potential creators

Persons

- Suicidal scientists
- Existential terrorists
- Arrogant scientists proceeding with dangerous experiments, link, link2
- Biohackers

Organizations and states

- Doomsday cults
  Aum Shinrikyo
  Islamic state
- Rogue states
  North Korea;
  Doomsday blackmail weapons
- Military of a superpower creates BW
  Russia

Unintended consequences

- Unpredictable accidents
- Recombination of flu viruses in poultry
- Failed safety in a biolab
  - terrorist attack on a lab
  - leakage
- Luck of ability to see consequences
  dangerous experiments

Prevention methods (See more in my map of x-risks prevention)

Prevention of dangerous virus creation

- Universal vaccines
  universal flu vac
  New AB
- Mutual control between scientists
- Strong international surveillance WHO
- Legislation
  Project Bioshield Act
- DNA custom synthesis control
- Constant control of safe 4 level labs and scientists
- Anti-terrorism efforts
- Control over signs
  Internet searches
  Bioprotection equpments
  Animal test

Pandemic control measures

- Strong local medicine
- Quick response teams
- Drug and food stockpiles
- Effective sterilization
  UV home systems
- Effective quarantine systems
  Air travel bans?
- Labs for quick analysis and and developing of vaccine

Bio-shield

AI-based system of distributed sensors

Global artificial immune system

Resources

Flutrackers.com
viralzone.expasy.org/
https://en.wikipedia.org/wiki/Bioterrorism
Some other useful literature:
Biowar for dummies
http://research.lifeboat.com/biowar.htm
Scientific journal:
Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science http://online.liebertpub.com/loi/bsp/
PDFs/v1n303/p203_s.pdf
Assessing the Bioweapons Threat. Is there a foundation of agreement among experts about risk? - Delphi method predcition
http://www.upmchealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2015/Boddie%20et%20all%20Science%20final%20accepted%20combined.pdf
Genome editing is aweapon of mass destruction.
https://www.technologyreview.com/s/600774/top-us-intelligence-official-calls-gene-editing-a-wmd-threat/
War With Nrth Korea: Smallpox and Bioweapons Are the Real Threat, Not Nukes
http://mic.com/articles/32885/war-with-north-korea-smallpox-and-bioweapons-are-the-real-threat-not-nukes#.K8q3IOVh2
Gene Editing Is Now Cheap and Easy—and No One Is Prepared for the Consequences

http://singularityhub.com/2015/09/08/gene-editing-is-now-cheap-and-easy-and-no-one-is-prepared-for-the-consequences/

https://en.wikipedia.org/wiki/Bioterrorism#Types_of_agents