

# *Coordinating Coronavirus Research with VIDO and IDO-COVID-19*

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Developers: Shane Babcock, John Beverley, Lindsay Cowell, Barry Smith

# *Outline*

- The Infectious Disease Ontology Ecosystem
- The Virus Infectious Disease Ontology
- The COVID-19 Infectious Disease Ontology

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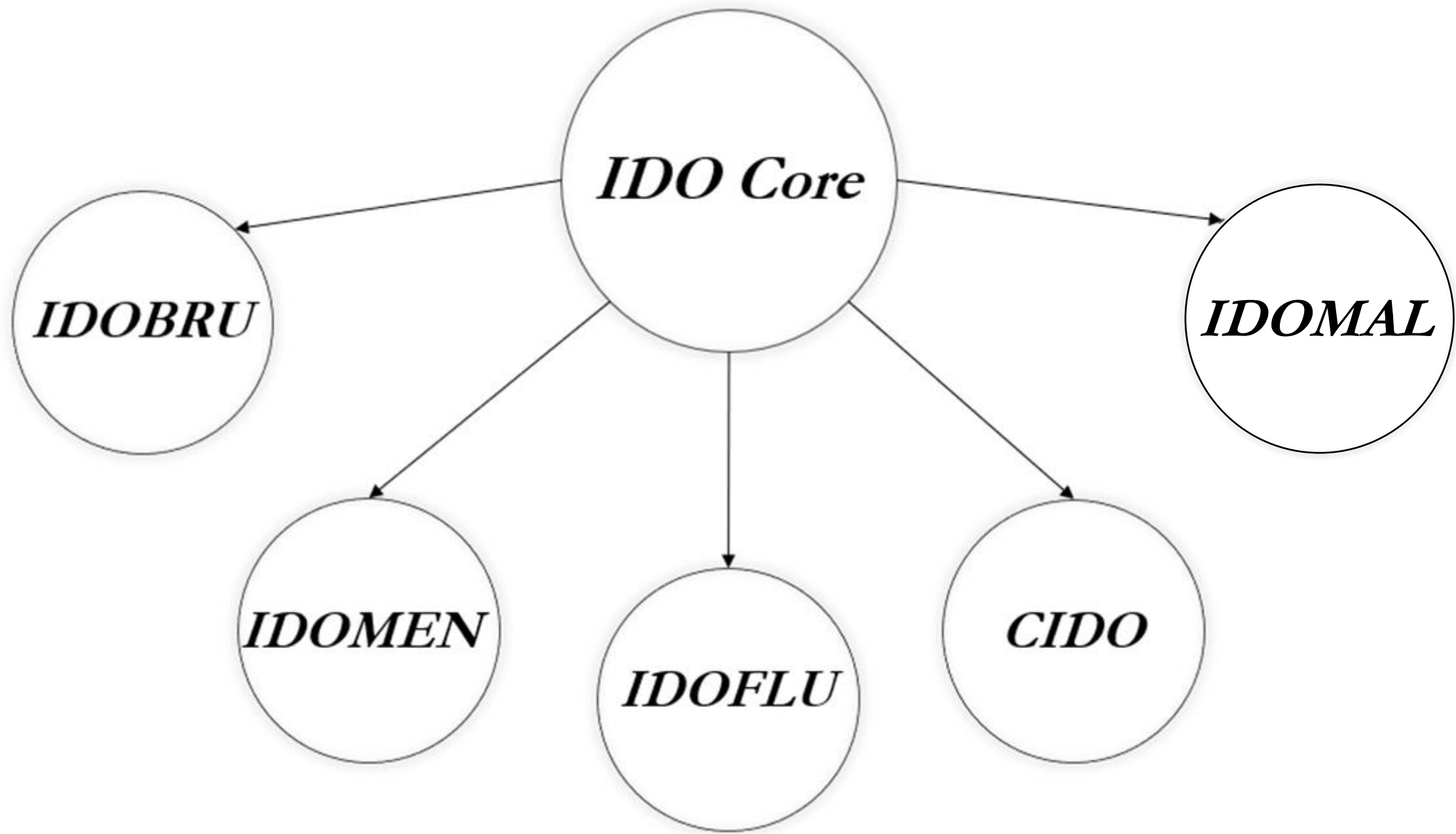
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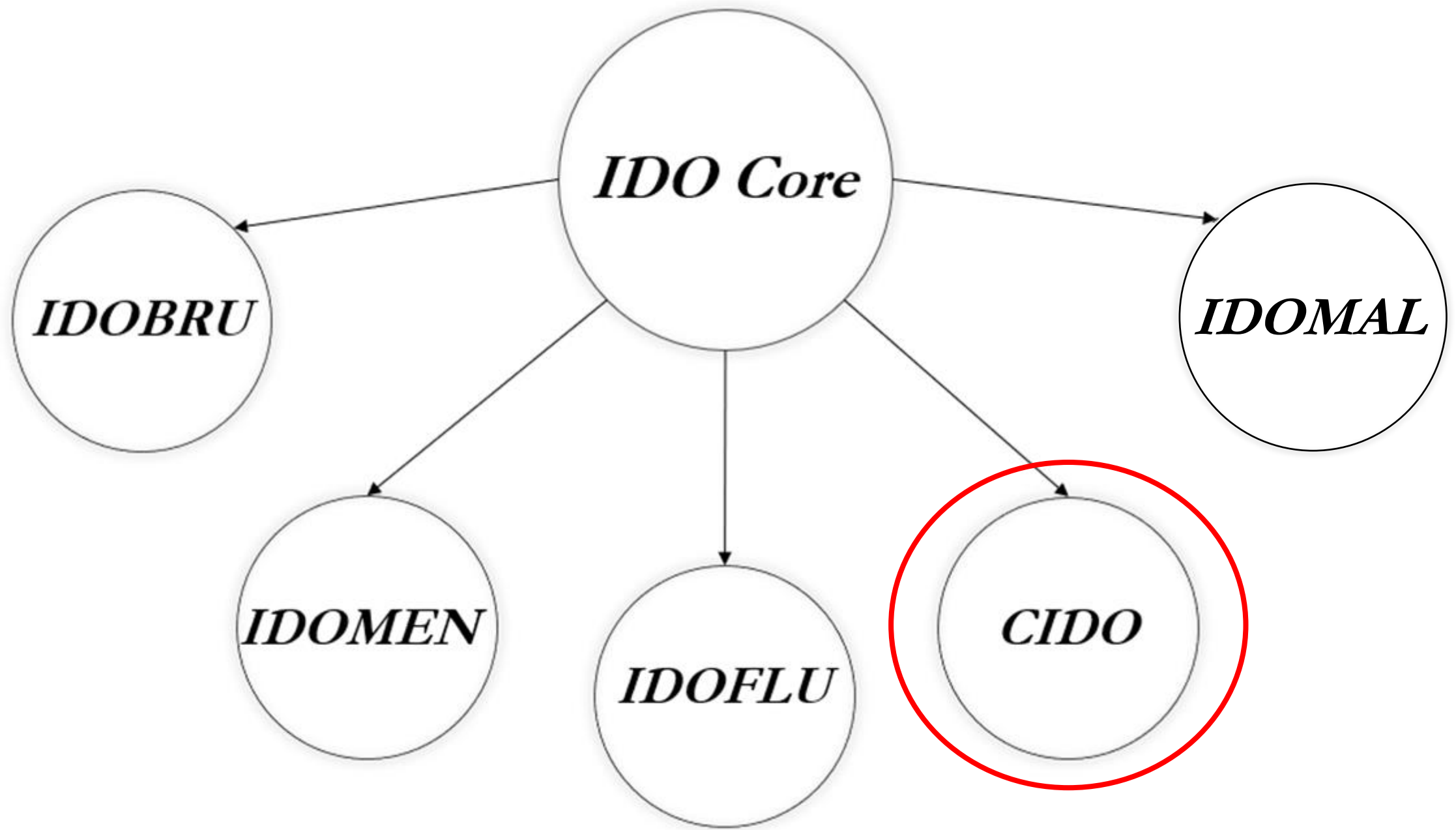
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- The Infectious Disease Ontology Ecosystem
  - The Infectious Disease Ontology Core
  - Extensions of IDO Core
  - The Coronavirus Infectious Disease Ontology

# *Infectious Disease Ontology Core*

- An extension of the Basic Formal Ontology to the domain of infectious diseases
- IDO Core provides researchers terminological content for domains covering specific infectious diseases
- Such as Brucella, Influenza, and - more recently - Coronavirus infections





# *Infectious Disease Ontology*

- Proliferation of virus-specific infectious disease ontologies such as CIDO
- Warranted development of a virus-specific reference ontology
- Bridging IDO Core and virus-specific extensions

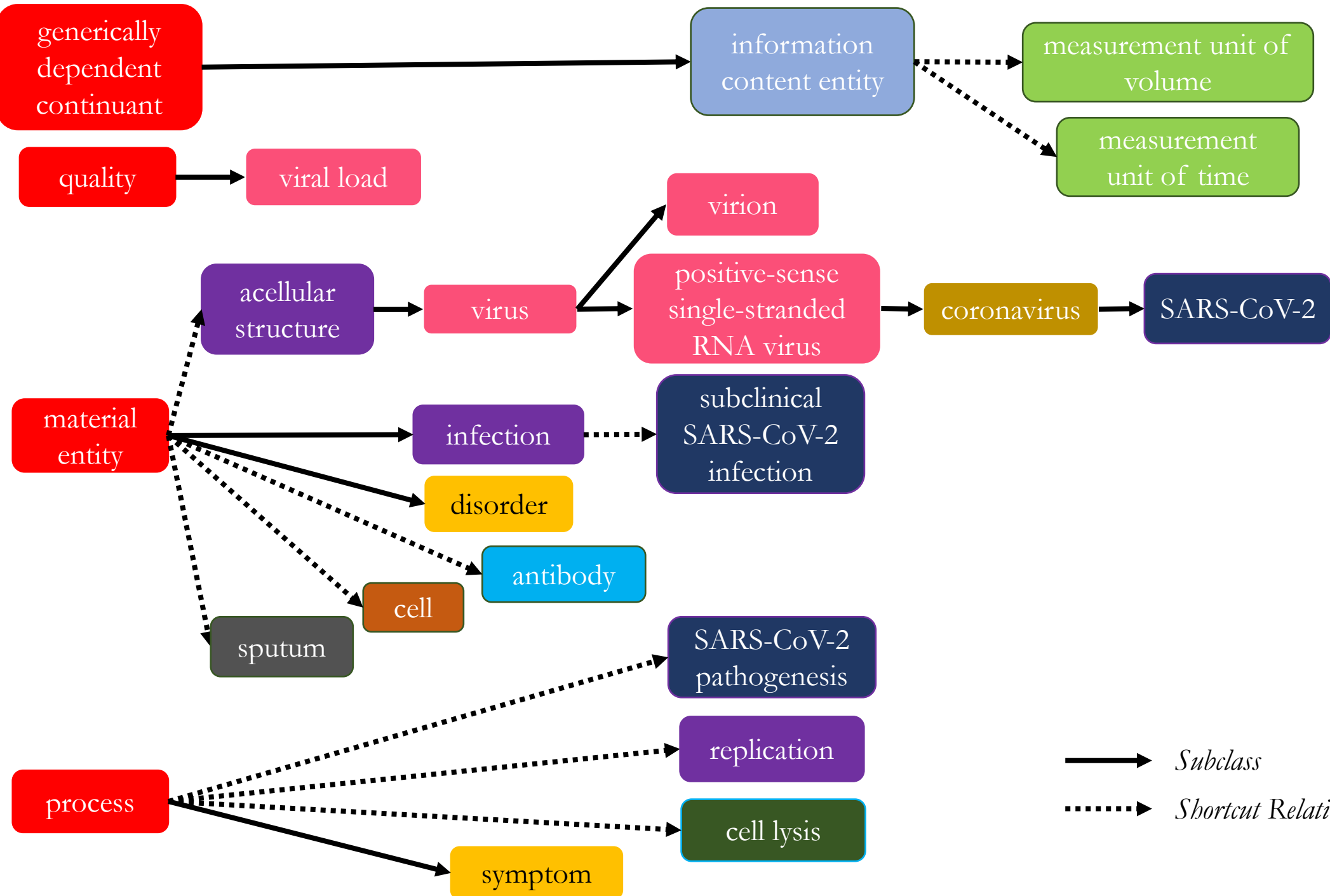


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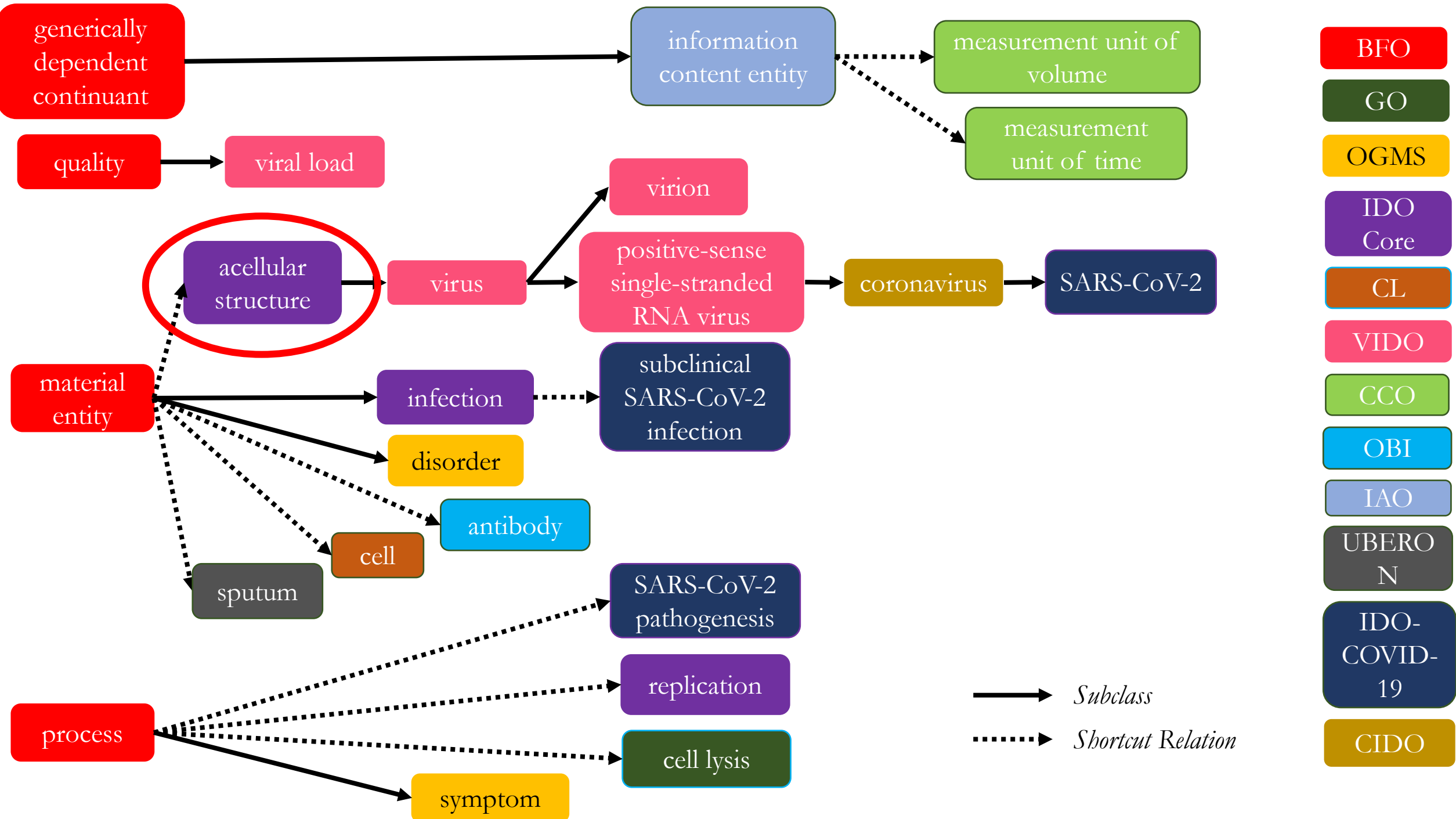
# *Outline*

- The Infectious Disease Ontology Ecosystem
- The Virus Infectious Disease Ontology
  - Interoperability
  - Acellular Structure
  - Viruses
  - Infectious Structure



- BFO
- GO
- OGMS
- IDO Core
- CL
- VIDO
- CCO
- OBI
- IAO
- UBERO N
- IDO-COVID-19
- CIDO

→ Subclass  
- - - - - Shortcut Relation

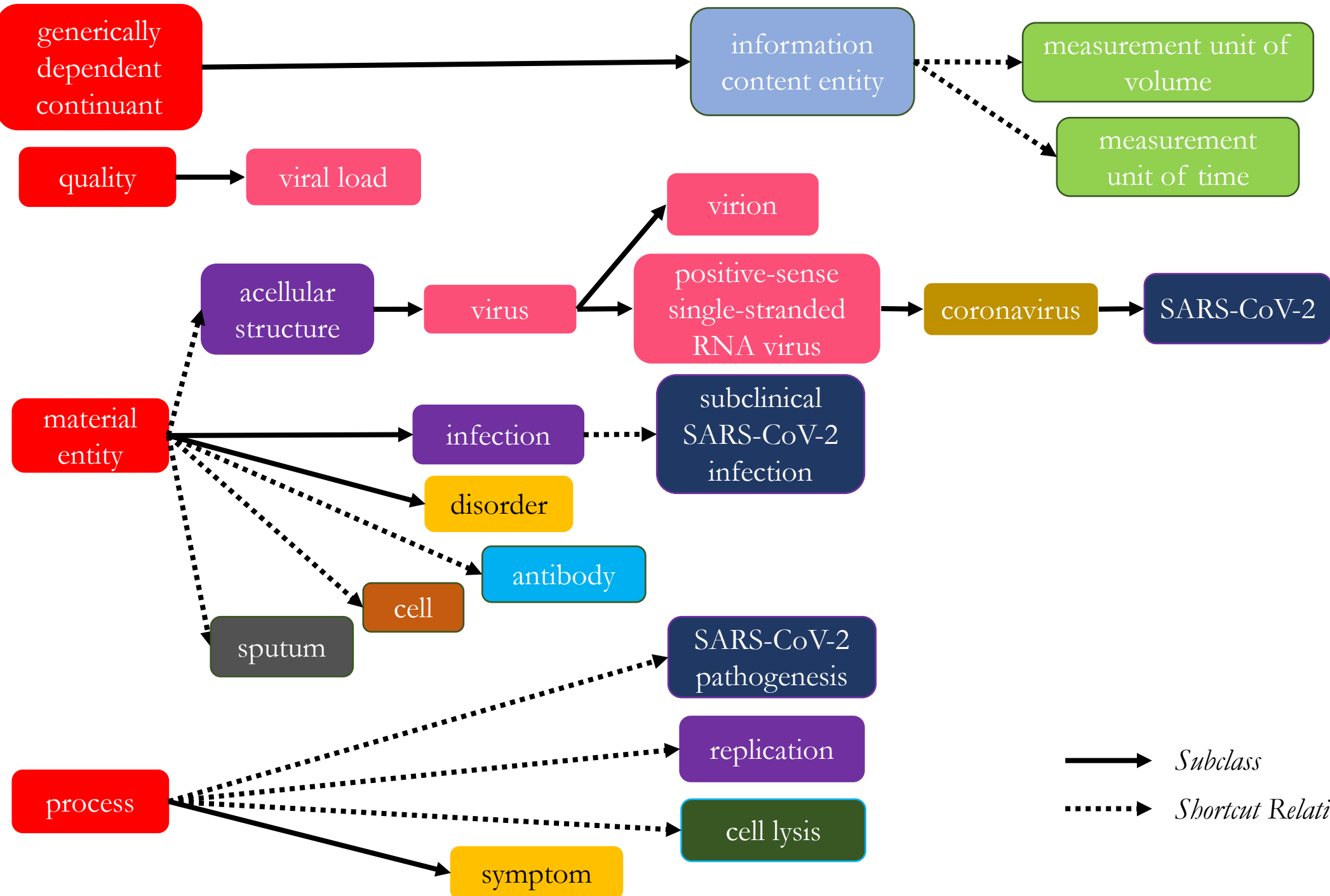


# *Acellular Structure*

- Many ontologies classify viruses as instances of *organism*, but viruses are acellular...
- VIDO imports *organism* but classifies viruses under the IDO Core class *acellular structure*:

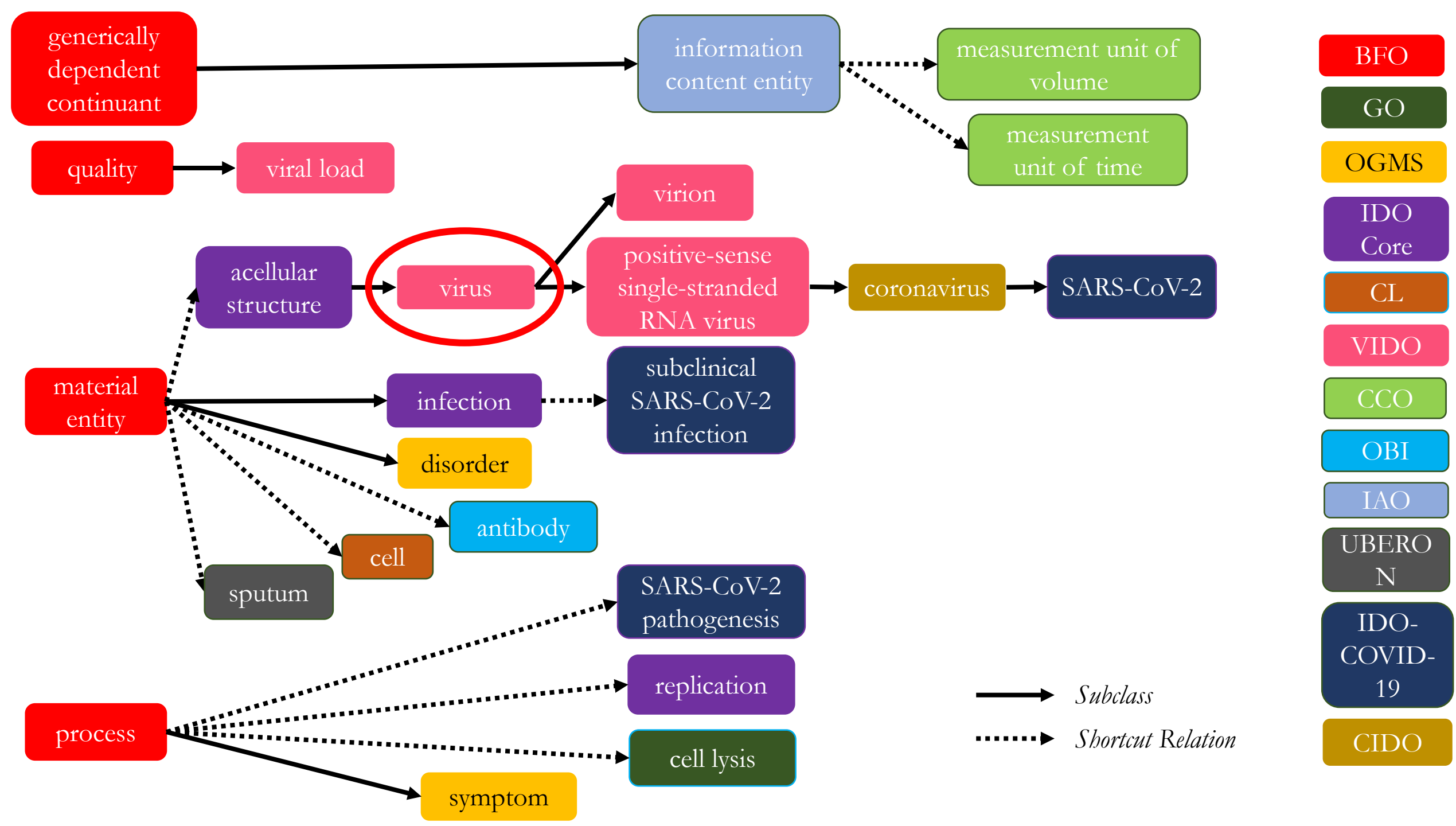
Object consisting of an arrangement of interrelated acellular parts forming an acellular biological unit

- Alongside prions, satellites, etc.



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# *Virus*

- VIDO populates children of *acellular structure* by importing from NCBITaxon where possible
- While supplementing imported terms with textual and logical definitions
- With respect to the class *virus*, VIDO arranges subclasses according to the Baltimore Classification





- infectious agent reservoir
- macromolecular complex
- molecular entity
- object
  - acellular structure
  - disordered prion
  - disordered virus
  - infectious structure
  - prion
  - virus
    - bacteriophage
    - double-stranded DNA retrovirus
    - double-stranded DNA virus
    - double-stranded RNA virus
    - mycovirus
    - negative-sense single-stranded RNA virus
    - oncovirus
    - **positive-sense single-stranded RNA virus**
    - single-stranded DNA virus
    - single-stranded RNA retrovirus
    - virion

● positive-sense single-stranded RNA virus — NCBITaxon:35278 — <http://purl.obolibrary.org/ok>

Annotations: positive-sense single-stranded RNA virus

Annotations +

label [language: en]

positive-sense single-stranded RNA virus

definition

Virus with genetic material encoded in single-stranded RNA that can be translated directly into proteins.

hasExactSynonym

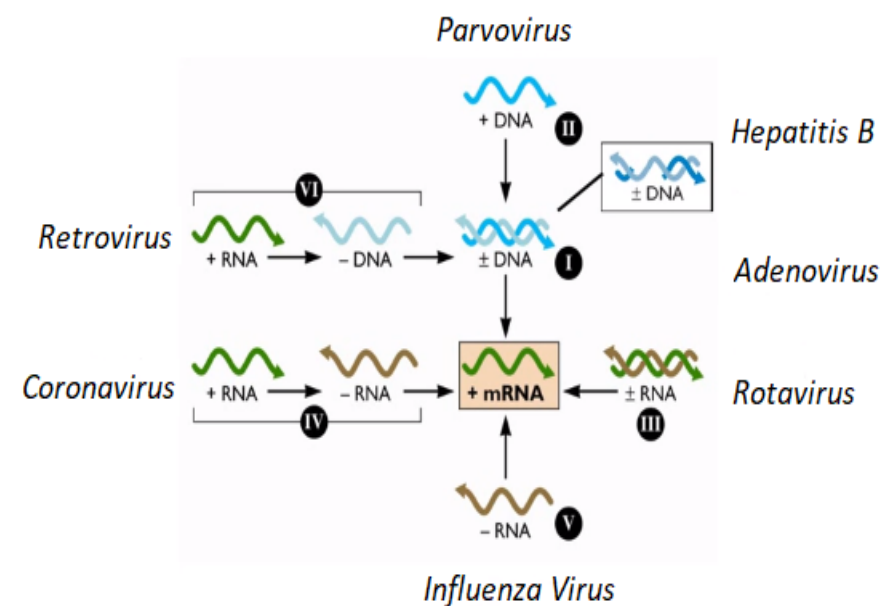
Baltimore Classification Group IV

'example of usage'

Coronavirus

'example of usage'

Picornavirus





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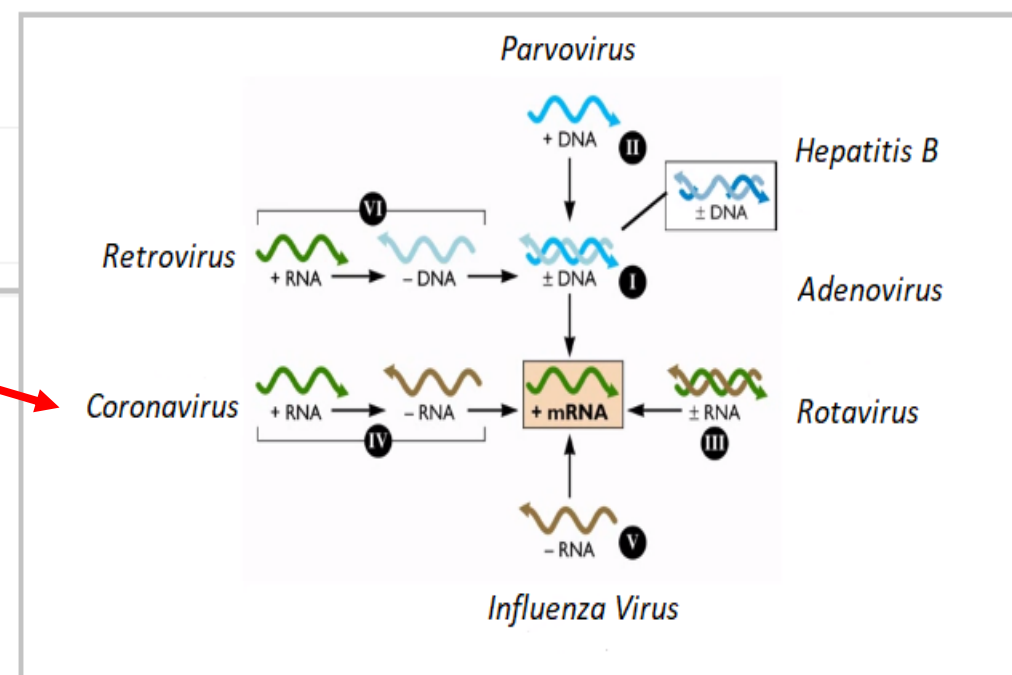
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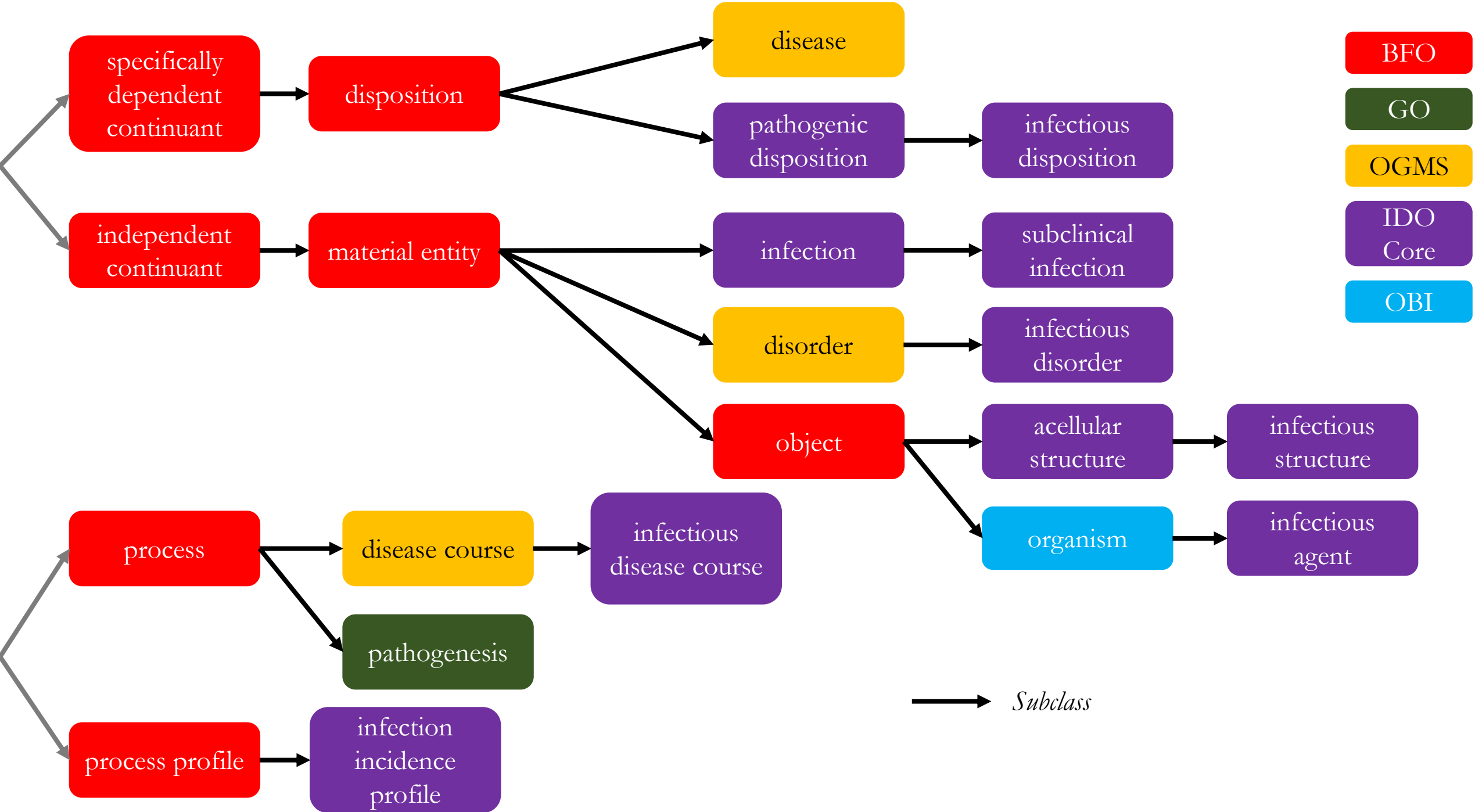
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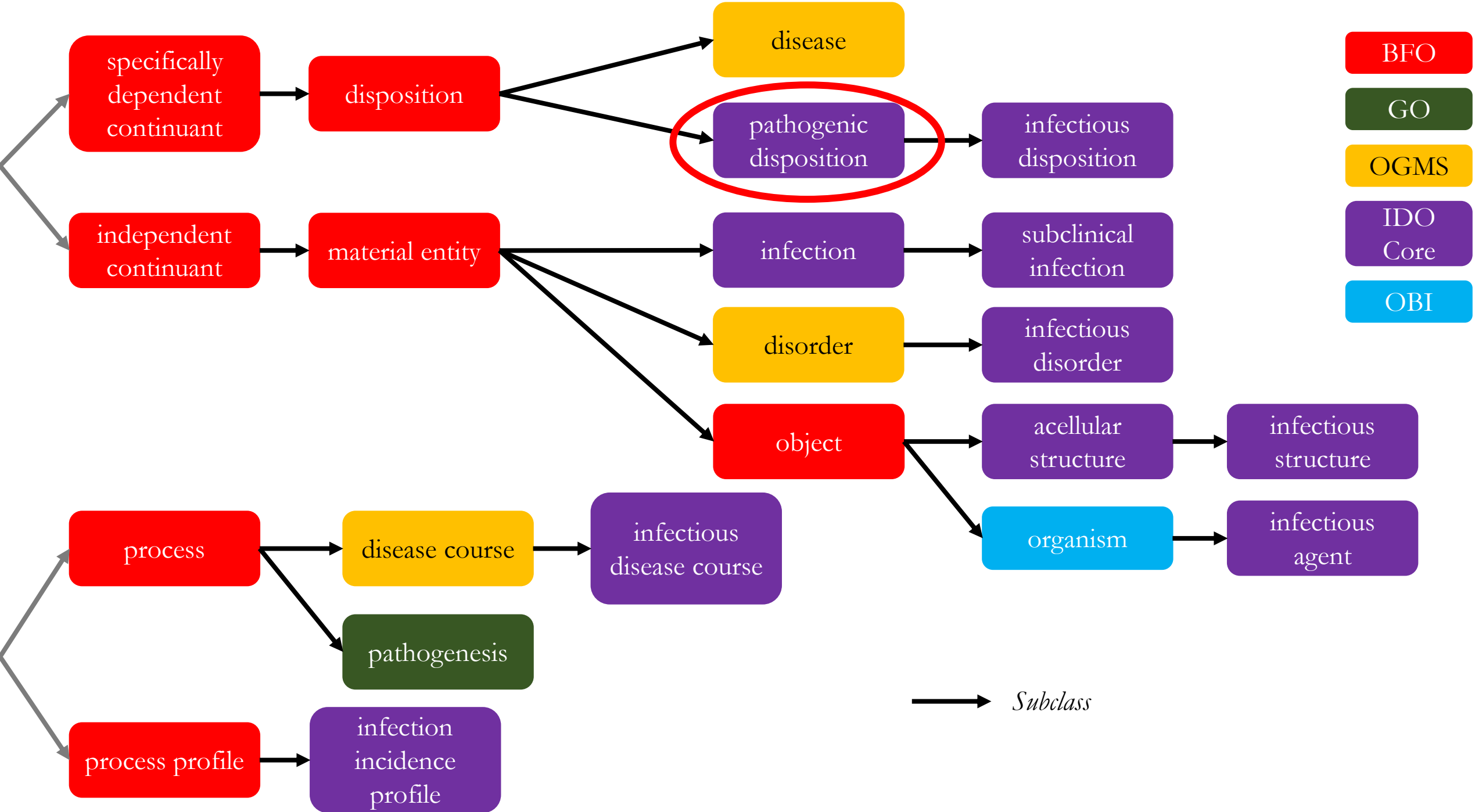
Coronavirus

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# *Pathogenic Disposition*

- VIDO imports the following from IDO:

*pathogenic disposition* =def Disposition borne by a material entity to establish localization in or produce toxins that can be transmitted to, an organism, either of which may form disorder in the organism or immunocompetent members of the organism's species.

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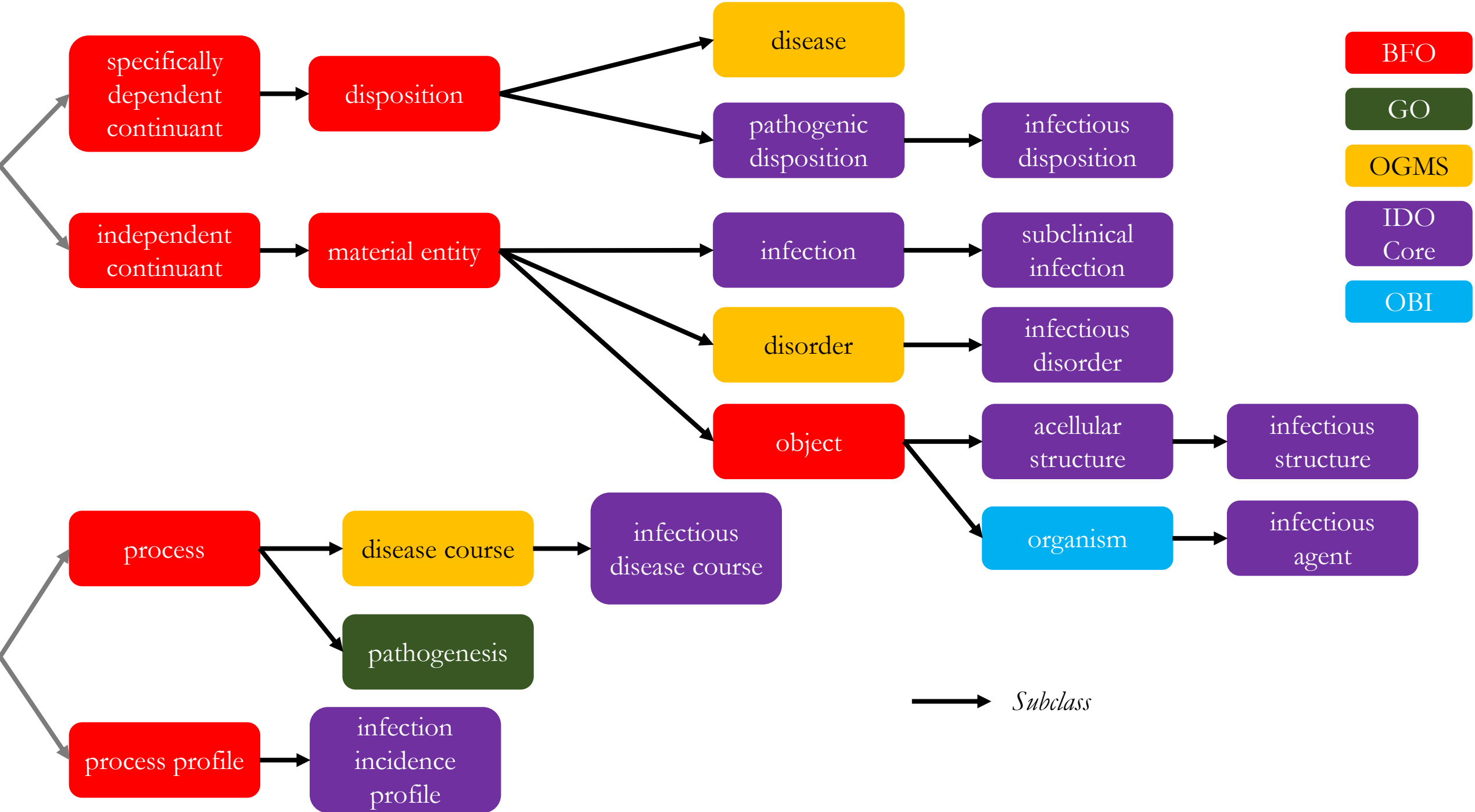
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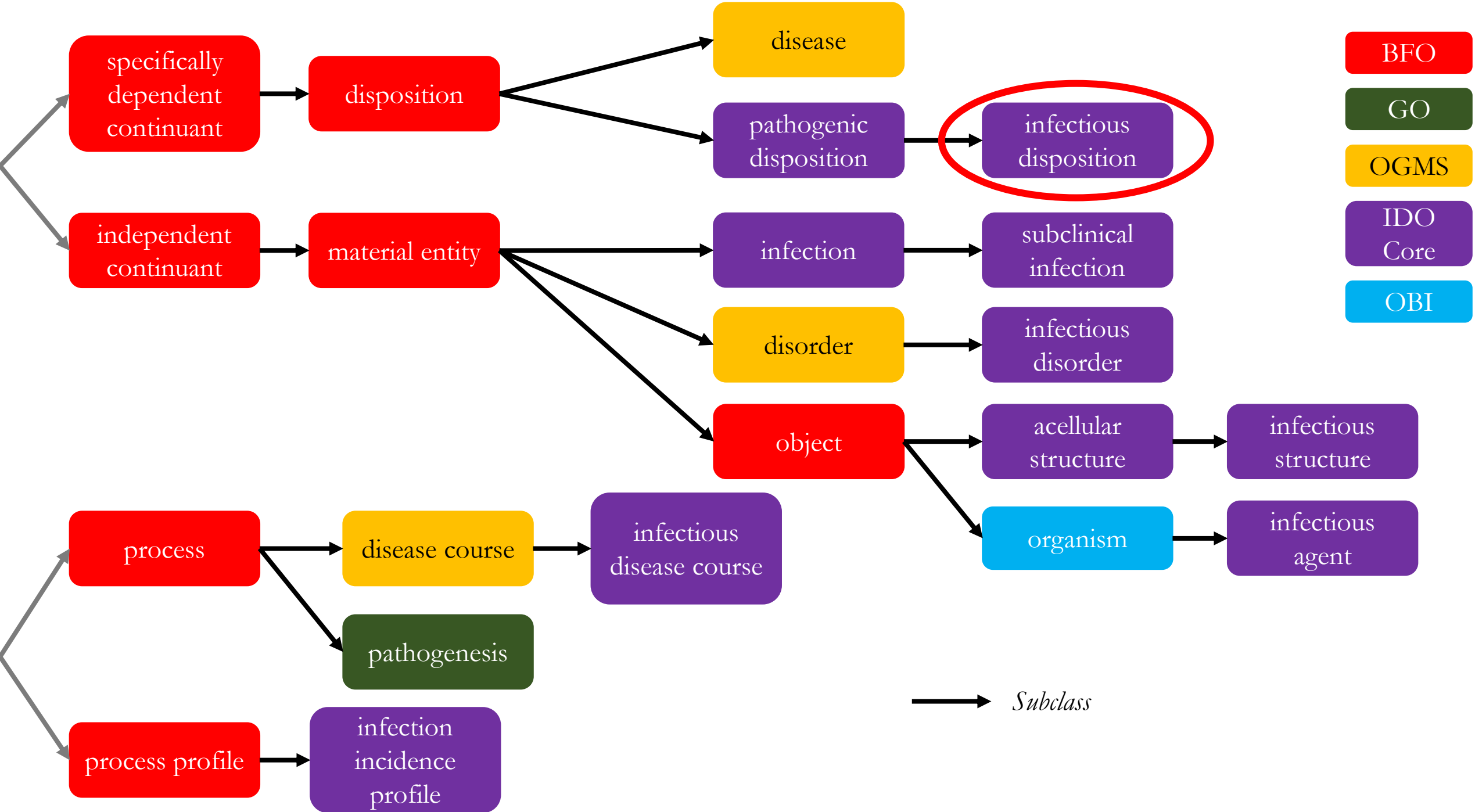


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# *Infectious Disposition*

- Some pathogens are also *infectious*:

*infectious disposition* =def Pathogenic disposition borne by a pathogen to be transmitted to a host and then become part of an infection in that host or immunocompetent members of the same species as the host.

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# *Infectious Structures*

- “Pathogen” is indexed to stages of species development
- Bearing dispositions to localize *and* cause disorder
- But when pathogens are also disposed to transmit *and* cause infection, they are infectious
- Acellular structures bearing an infectious disposition are *infectious structures*, a class under which we find viruses

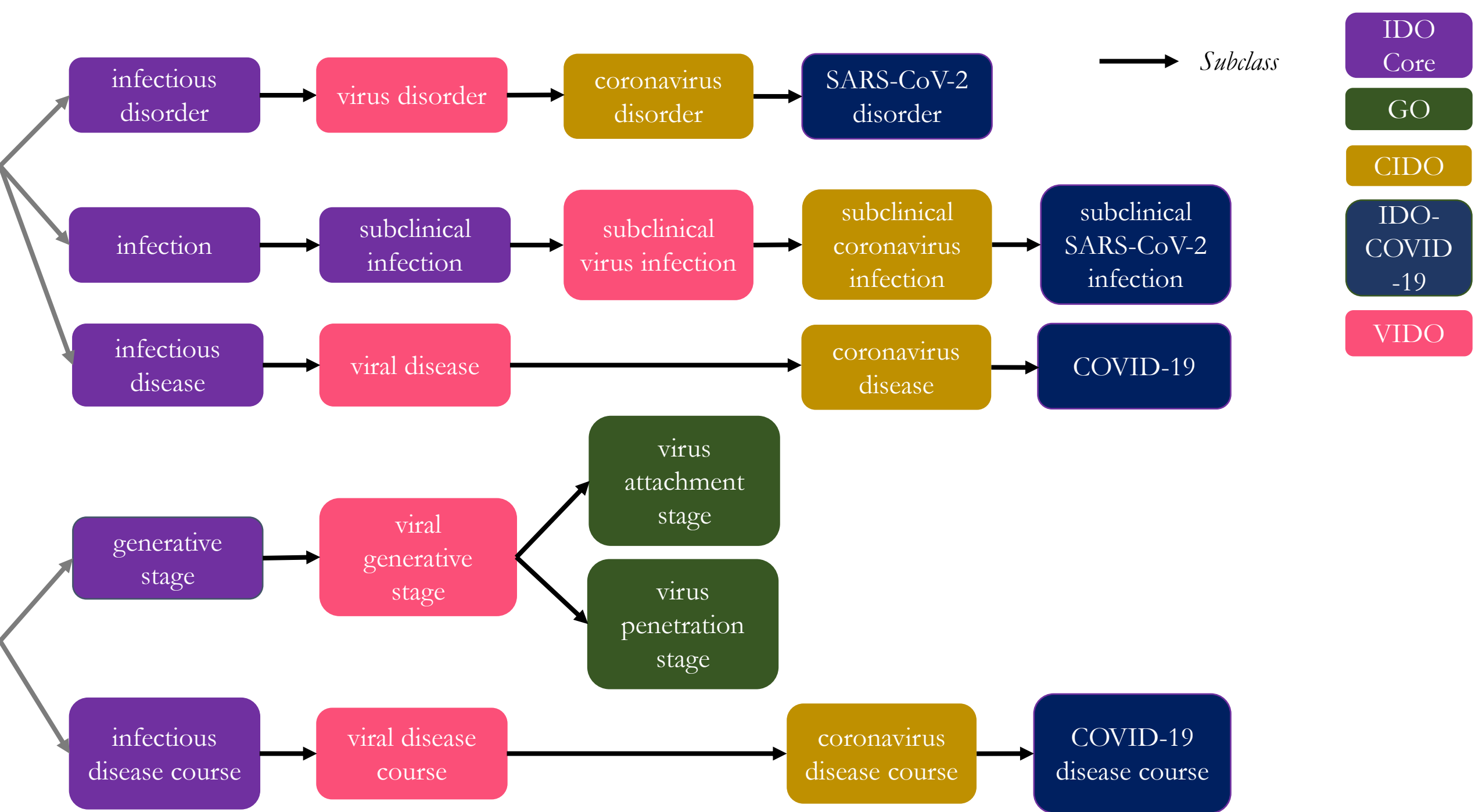
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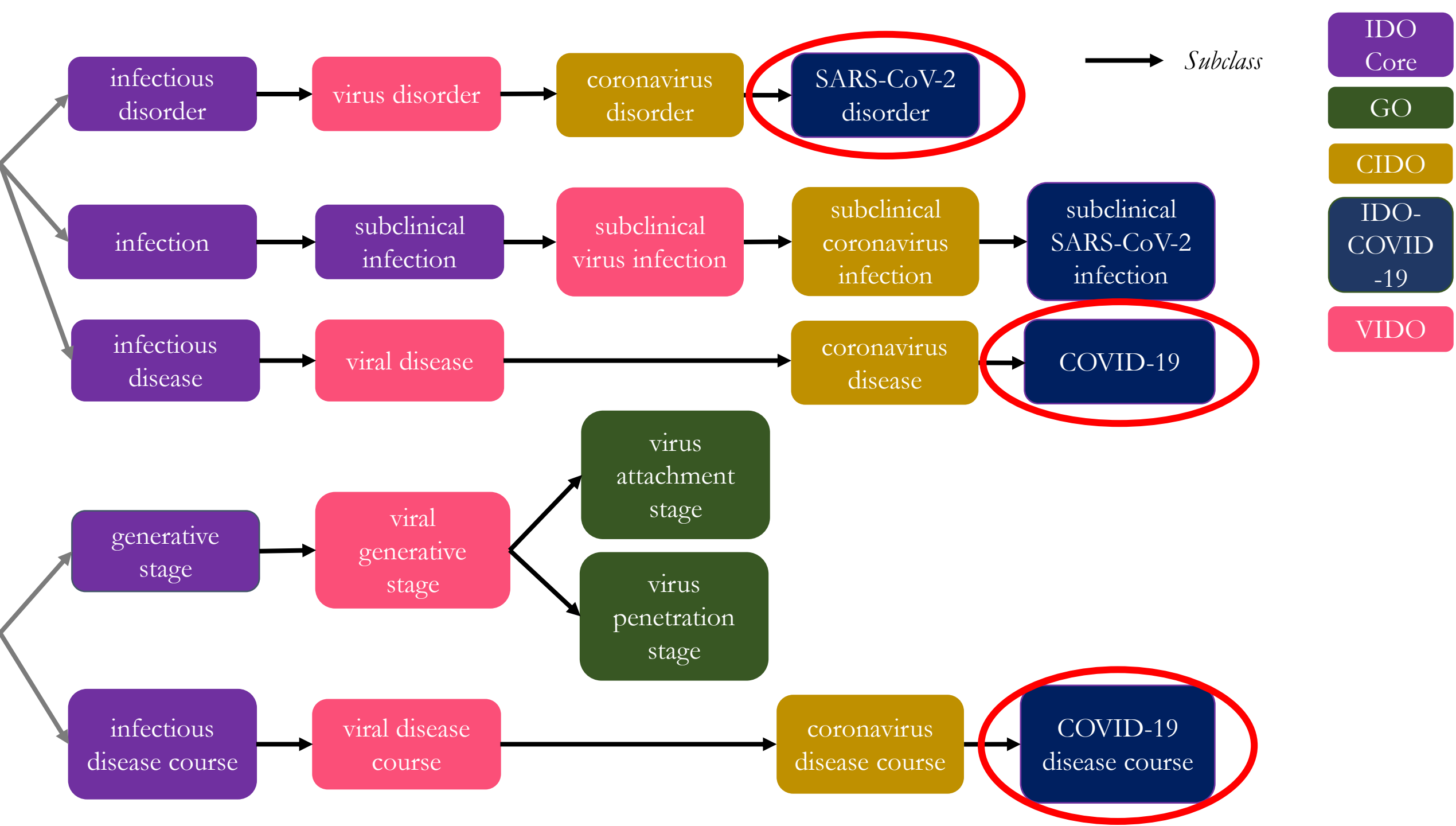
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  - COVID-19 Epidemiology
  - SARS-CoV-2 Pathogenesis
  - Epidemic to Pandemic





# ***COVID-19***

- *A disease is a disposition* to manifest various symptoms and signs
- For example, COVID-19 is a disease to manifest signs and symptoms associated with SARS-CoV-2 infectious disorder
- An instance of *COVID-19* has a *SARS-CoV-2 disorder* as a material basis, and may manifest in a *COVID-19 disease course*

# *Pathogenesis*

- To represent various aspects of the disease course, we import the following from [GO](#), expand it to pathogens, and extend:
- *pathogenesis* =def Collection of specific processes that generate the ability of a pathogen to induce an abnormal, generally detrimental state in an organism
- *SARS-CoV-2 pathogenesis* =def Pathogenesis of SARS-CoV-2 generating detrimental states in an organism

# *SARS-CoV-2 Pathogenesis*

One aspect of pathogenesis is a pathogen realizing its pathogenic disposition, which involves:

Appearance of SARS-CoV-2 disorder

Process of establishing SARS-CoV-2 infection

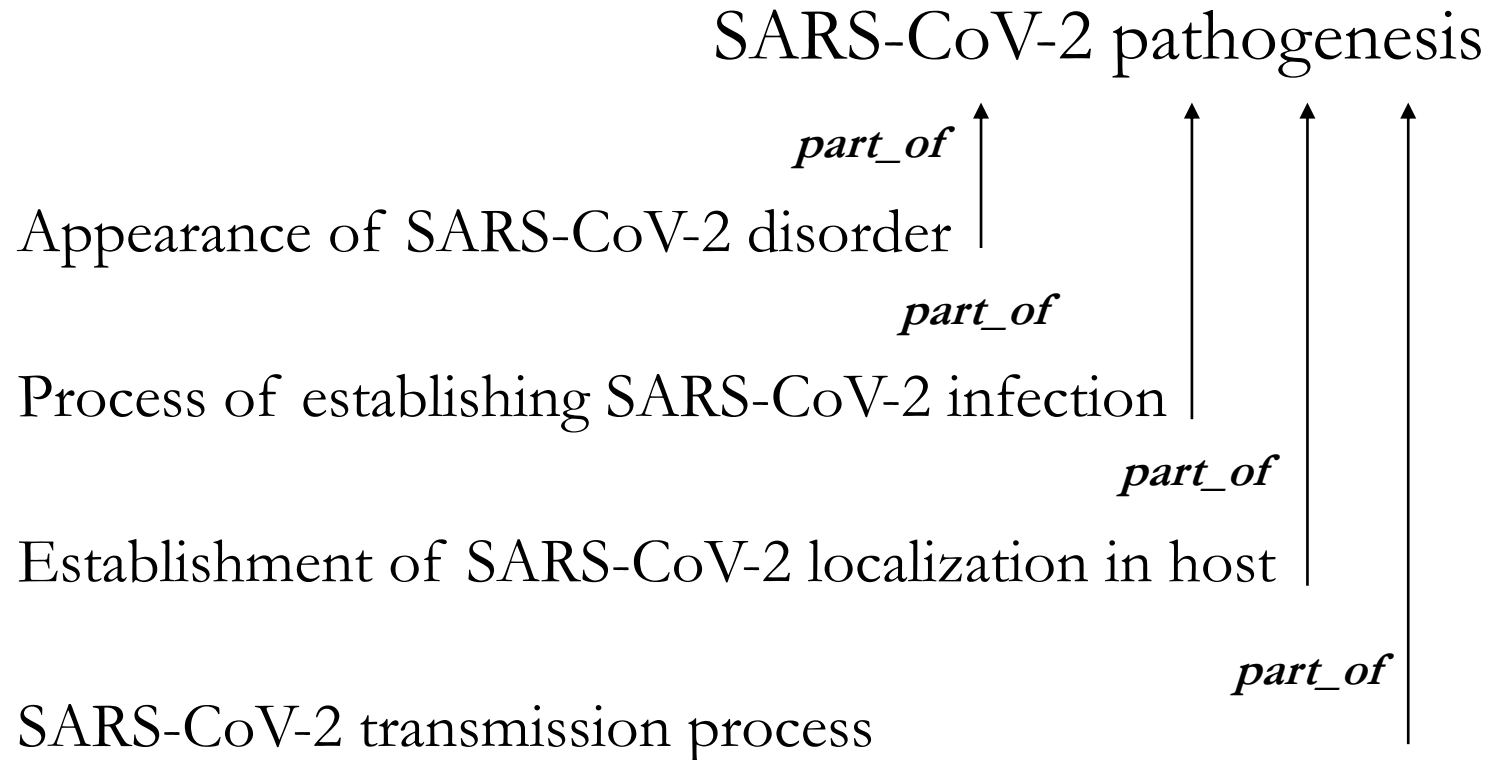
Establishment of SARS-CoV-2 localization in host

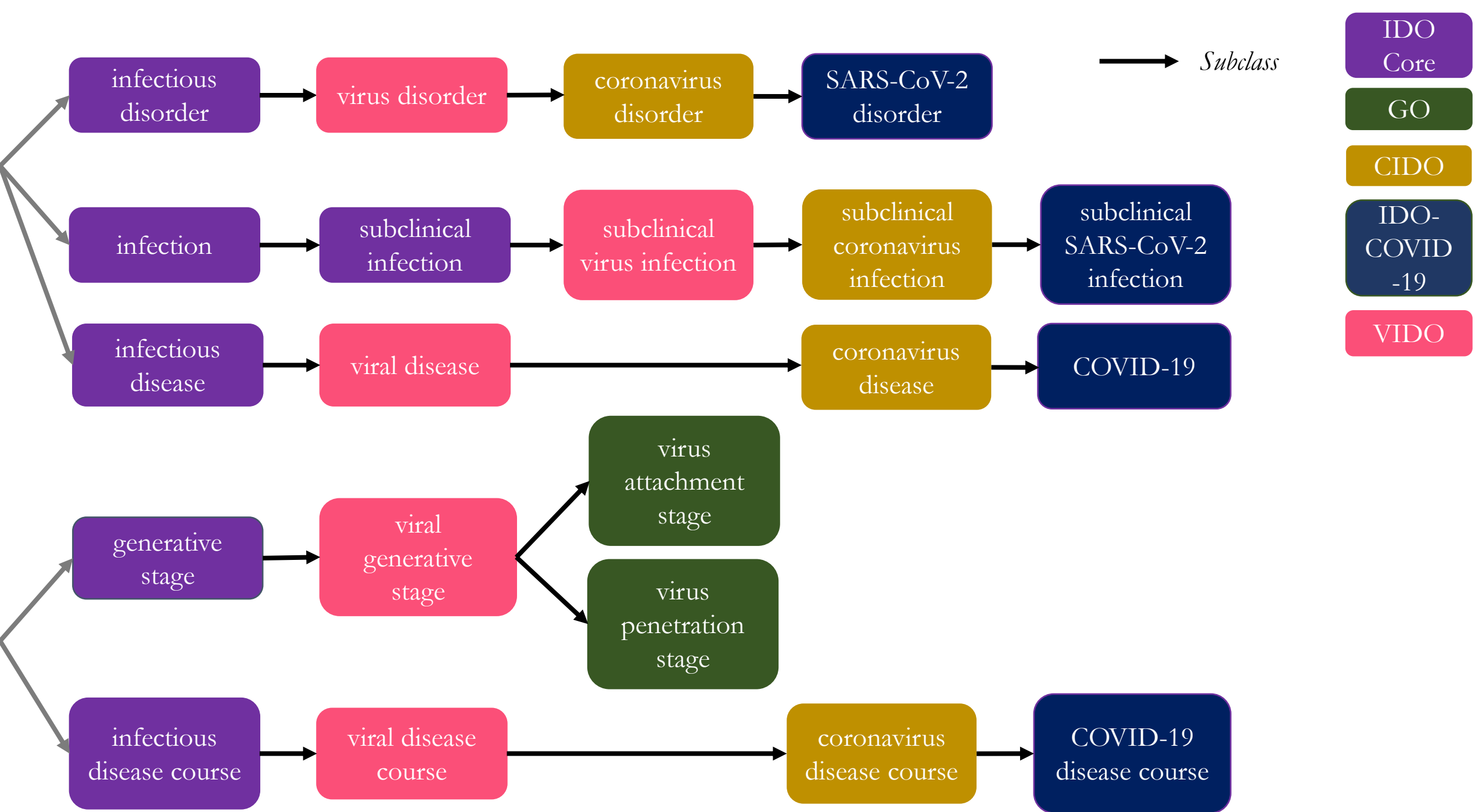
SARS-CoV-2 transmission process

*preceded\_by*

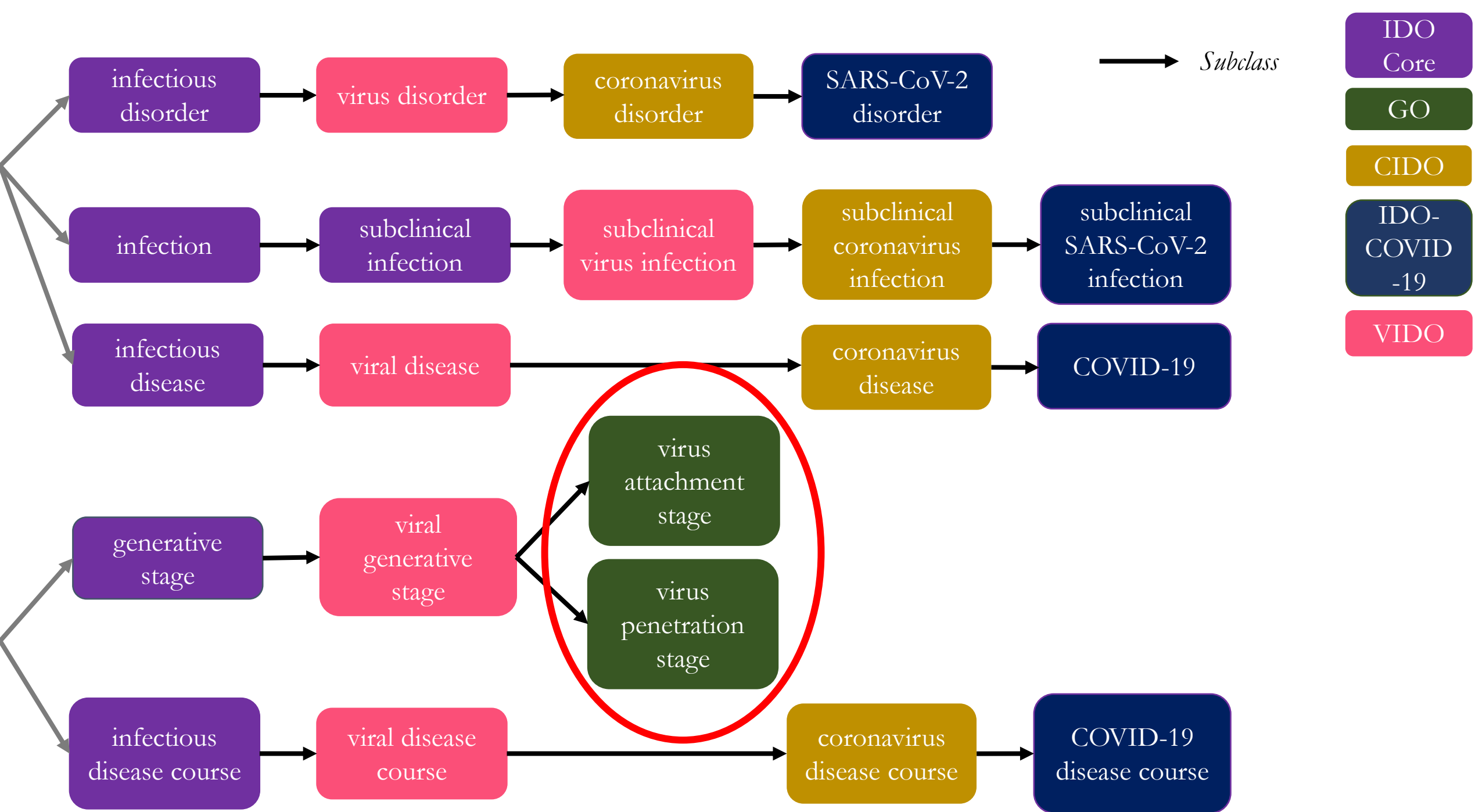


# ***SARS-CoV-2 Pathogenesis***

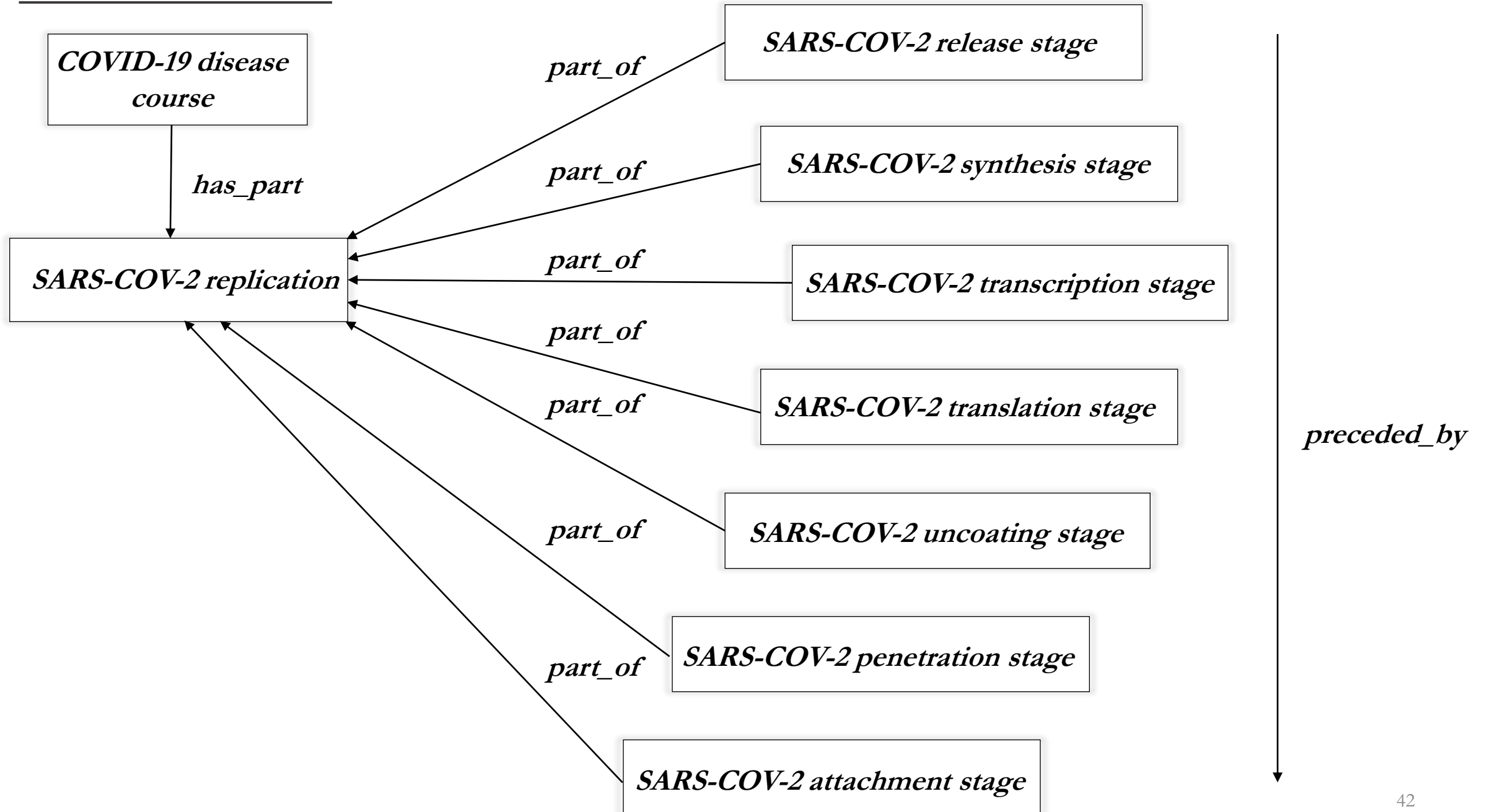








# IDO-COVID-19



# *Epidemic to Pandemic*

- VIDO includes:

*viral disease epidemic* =def Infectious disease epidemic of viral disease realizations in which there is a statistically significant increase in the infectious disease incidence of a population.

*viral disease pandemic* =def Infectious disease pandemic in which multiple viral disease epidemics of the same type of viral disease unfold over overlapping periods of time and affect organism populations located in different geographic regions, including different countries and continents.



*infection incidence*



*epidemic*



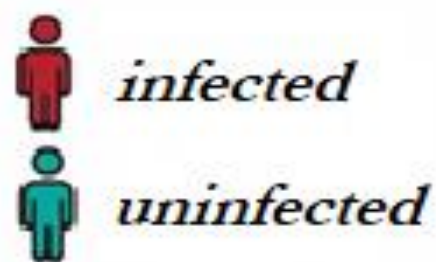
*pandemic*



*pandemic*



*epidemics*



# *Process Profiles*

- Aspects of which can be tracked with terms such as:

*viral disease incidence profile* =def Infectious disease incidence profile comprised of a series of determinate viral disease incidence qualities caused by a specific virus in a population over time.

*viral disease proportion profile* =def Infectious disease proportion profile comprised of a series of viral disease incidence proportion qualities caused by a specific virus per unit time.

# *Concluding Remarks*