Ontological Representation and Analysis of the Molecular Interactions Related to COVID-19-associated Acute Kidney Injury

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Why AKI and COVID-19?

Over a quarter of patients hospitalized with COVID-19 develop AKI.

Mortality among hospitalized COVID-19 patients is higher among those with AKI.

The exact mechanism of kidney injury in COVID-19 patients is still unclear yet.

Understanding the underlying processes involved in AKI helps improve outcomes and develop pharmaceutical drugs.

Hypothesis:
We hypothesize that COVID-19 associated AKI is a result of protein-protein interactions between host and viral proteins.

Workflow

Data collection from ASCT+B

Extracted 17 kidney biomarkers (out of 146) with SARS-CoV-2 interactions

36 total interactions from BioGRID (17 host proteins with 14 viral proteins)

Reactome Pathway Analysis

Input interactions into CIDO
By using ASCT+B and BioGRID, we found 17 biomarkers (out of 146) interacting with 14 SARS-CoV-2 viral proteins, yielding a total of 36 interactions.
Coronavirus Infectious Disease Ontology (CIDO) modelling

![CIDO-based classification and hierarchy of newly added SARS-CoV-2 and host PPIs. 5 out of 36 of the PPIs are shown in the above figure, particularly the interactions with ORF7B protein. Associated annotations are also shown on the right.](image)

**Fig. 2.** CIDO-based classification and hierarchy of newly added SARS-CoV-2 and host PPIs. 5 out of 36 of the PPIs are shown in the above figure, particularly the interactions with ORF7B protein. Associated annotations are also shown on the right.

Our CIDO-based ontological representation provides a systematic and computer-interpretable logic knowledge representation of the molecular interactions related to COVID-19-associated AKI mechanisms.

**Summary and next steps**

We collected and analysed proteins and interactions related to COVID-19 associated AKI.

Each of the 17 kidney biomarkers recorded in ASCT+B Kidney table has demonstrated interaction(s) with SARS-CoV-2 viral protein(s), suggesting that the coronavirus closely interacts with the kidney biomarkers.

SLITs and ROBO signalling, found in our host-coronavirus interaction study, are likely associated with COVID-19 associated kidney injury.

The human-coronavirus PPIs are ontologically represented in the CIDO ontology, which can be further enhanced and used to support COVID-19 related AKI studies.