Disruption of Monoamine Oxidase B Enzyme by SARS-CoV-2 Spike Protein: Implications for Neurodegenerative Diseases

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COVID-19, caused by the **SARS-CoV-2** virus, is primarily associated with respiratory symptoms, but increasing evidence suggests significant neurological effects, possibly due to the virus's interaction with monoamine oxidase (**MAO**) enzymes [1]. Our research investigates the binding of the SARS-CoV-2 spike protein to the **MAO-B** enzyme, with the hypothesis that this interaction disrupts the delicate balance of the monoaminergic system, potentially leading to neurodegenerative processes [2].

We employed a comprehensive computational approach to investigate the interactions between the **spike protein** and the **MAO-B** enzyme. Flexible molecular docking algorithms were used to predict binding orientations and affinities, followed by **molecular dynamics (MD) simulations** to stabilize and provide insights into the dynamics of the protein complex. High-affinity binding sites for the spike protein on MAO-B were identified, and MD simulations confirmed the stability of these interactions. **MM-GBSA** analysis revealed a high binding affinity of the spike protein to the MAO-B enzyme and consequential significant changes in the free binding energy of inhibitors and endogenous substrates on the complex. To further validate the impact of the spike protein on the catalytic activity of MAO-B and its potential effect on neurotransmitter metabolism and neurodegenerative pathways, **quantum mechanics/molecular mechanics (QM/MM) simulations** will be conducted.

The obtained results suggest a potential mechanism through which COVID-19 could affect the monoaminergic system, contributing to neurological symptoms in patients. The study highlights the need for further experimental validation and the development of therapeutic interventions to mitigate these effects. Understanding the described interactions opens new avenues for treating neurodegenerative consequences associated with COVID-19 [3].

References:

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