iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VI **Month of publication:** June 2020

DOI: http://doi.org/10.22214/ijraset.2020.6041

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VI June 2020- Available at www.ijraset.com

COVID-19 – SARS - Severe Acute Respiratory Syndrome

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Abstract: ***Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The people affected with COVID-19 will experience mild to moderate symptoms and recover without special treatment. The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air, and quickly fall on floors or surfaces Virus usually spreads by touching a contaminated surface and then eyes, nose or mouth .In the above studies the sequence for covid-19 encoding the protein nucleocapsid was retrieved from ncbi database. Its chemical structure, rna binding site, structure similarity and secondary structure of n-protein, and amino acid position were analyzed and based on the analysis it is found that the n-protein was serotonin rich (serotonin is a happy chemical which have wide function in human body).1,2 ethanediol was the ligand which binds the target n-protein .using chembl database drug indication for 1,2 ethanediol was found in that polyethylene glycol was selected as main drug molecule from that it is proved that PEG when combined with survanta can be used to treat respiratory syndrome ,lung disease and breathing problem. The patients affected by covid 19 virus can also be given with these combination of medicine(PEG+survanta) for breathing problem and lung infection.***

Keyword: Covid -19, Severe Acute Respiratory Syndrome, Serotonin, Polyethylene glycol, Nucleocapsid protein, 1,2 Ethanediol

I. INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease (Severe Acute Respiratory Syndrome) caused by a newly discovered coronavirus. 'CO' stands for corona, 'VI' for virus, and 'D' for disease. This disease was referred to as '2019 novel coronavirus' or '2019-nCoV.' The COVID-19 virus is a new virus linked to the same family of viruses as Severe Acute Respiratory Syndrome (SARS) and common cold. The people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness. The best way to prevent and slow down transmission is to protect our self from infection by washing our hands or using an alcohol based rub frequently and not touching our face.(www.who.int)

The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments.

To prevent infection and to slow transmission of COVID-19

1) Wash your hands regularly with soap and water
2) Clean them with alcohol-based hand rub.
3) Maintain at least 1 meter distance between you and people coughing or sneezing.
4) Avoid touching your face.
5) Cover your mouth and nose when coughing or sneezing.
6) Stay home if you feel unwell.
7) Stop smoking and other activities that weaken the lungs.
8) Practice physical distancing by avoiding unnecessary travel and staying away from large groups of people.

COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization.

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A. Most Common Symptoms

1) Fever.
2) Dry cough.
3) Tiredness.

B. Less Common Symptoms

1) Aches and pains.
2) Sore throat.
3) Diarrhea.
4) Conjunctivitis.
5) Headache.
6) Loss of taste or smell.
7) A rash on skin, or discoloration of fingers or toes.

C. Serious Symptoms

1) Difficulty breathing or shortness of breath.
2) Chest pain or pressure.
3) Loss of speech or movement.

On average it takes 5–6 days from when someone is infected with the virus for symptoms to show, however it can take up to 14 days. There is no specific treatment for disease caused by a novel coronavirus. Treatment was based on the patient's clinical condition.Wear a mask if you are coughing or sneezing. Masks are effective only when used in combination with frequent hand-cleaning with alcohol-based hand rub or soap and water. If you wear a mask, then you must know how to use it and dispose of it properly. To date there has been no information nor evidence to suggest that the new coronavirus could be transmitted by mosquitoes. Heat at 56°C kills the SARS coronavirus at around 10000 units per 15 min (quick reduction),The COVID-19 virus can be transmitted in ALL AREAS, including areas with hot and humid weather.

II. DIET

Fresh and unprocessed foods every day to get the vitamins, minerals, dietary fibre, protein and antioxidants your body needs. Drink enough water. Eat fruits, vegetables, legumes (e.g. lentils, beans), nuts and whole grains (e.g. unprocessed maize, millet, oats, wheat, brown rice or starchy tubers or roots such as potato, yam, taro or cassava), and foods from animal sources (e.g. meat, fish, eggs and milk). For snacks, choose raw vegetables and fresh fruit rather than foods that are high in sugar, fat or salt.



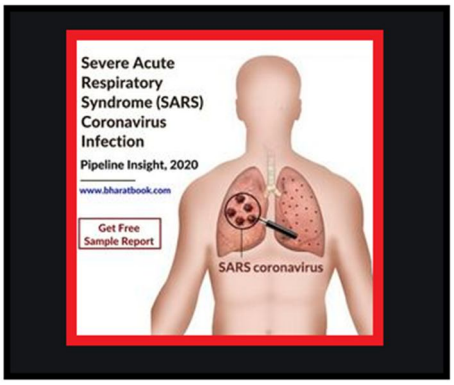
Figure 1 COVID19 virus

III. SEVERE ACUTE RESPIRATORY SYNDROME

SARS was recognized at the end of February 2003. A contagious and sometimes fatal respiratory illness caused by a coronavirus.

SARS appeared in 2002 in China. It spread worldwide within a few months, although it was quickly contained. SARS is a virus transmitted through droplets that enter the air when someone with the disease coughs, sneezes or talks. No known transmission has occurred since 2004.
Fever, dry cough, headache, muscle aches and difficulty breathing are symptoms.
No treatment exists except supportive care.

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`Figure2 Respiratory syndrome

IV. NUCLEOCAPSID PROTEIN(N-PROTEIN)

The nucleocapsid (N) protein of COVID-19 has nearly 90% amino acid sequence identity with SARS-CoV. The N protein antibodies of SARS-CoV may cross react with COVID-19 but may not provide cross-immunity. In a similar fashion to SARS-CoV, the N protein of COVID-19 may play an important role in suppressing the RNA interference (RNAi) to overcome the host defense.(www.ncbi.gv.in). The nucleocapsid protein (N-protein) is a structural protein that binds to the coronavirus RNA genome
In figure 3 nucleocapsid protein and corona virus nucleo protein sequence were compared in which n-protein shows 90percent of identical aminoacid sequence like corona sequence.

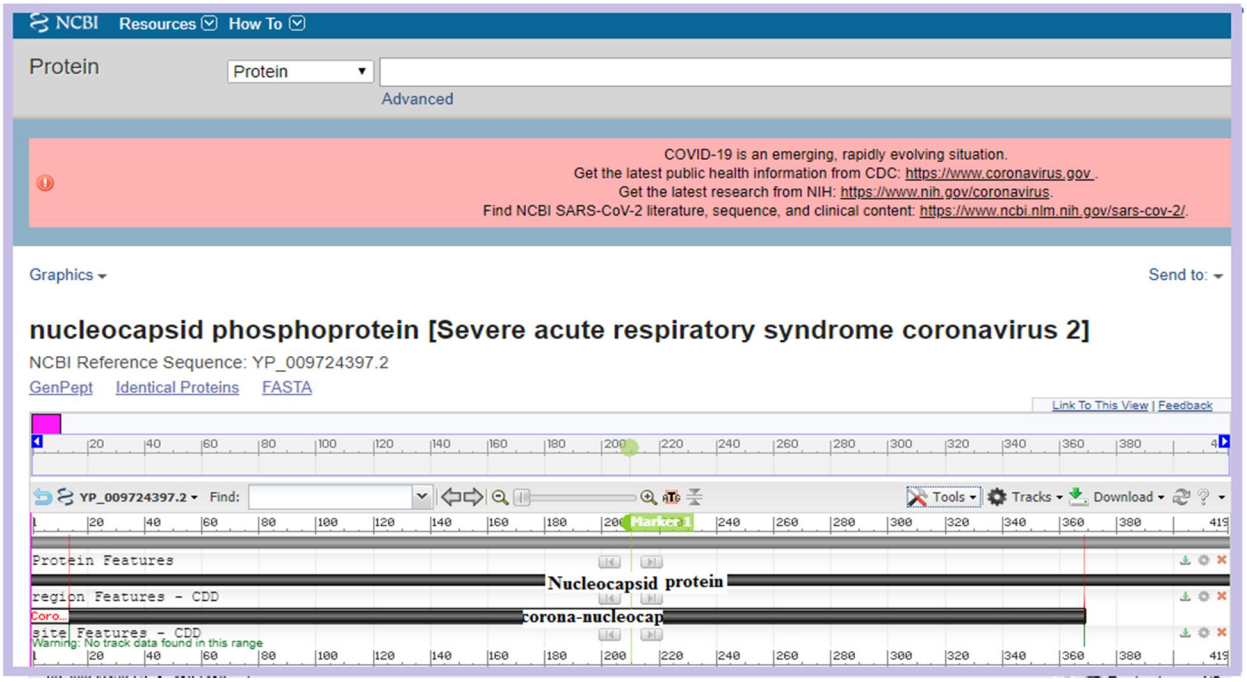
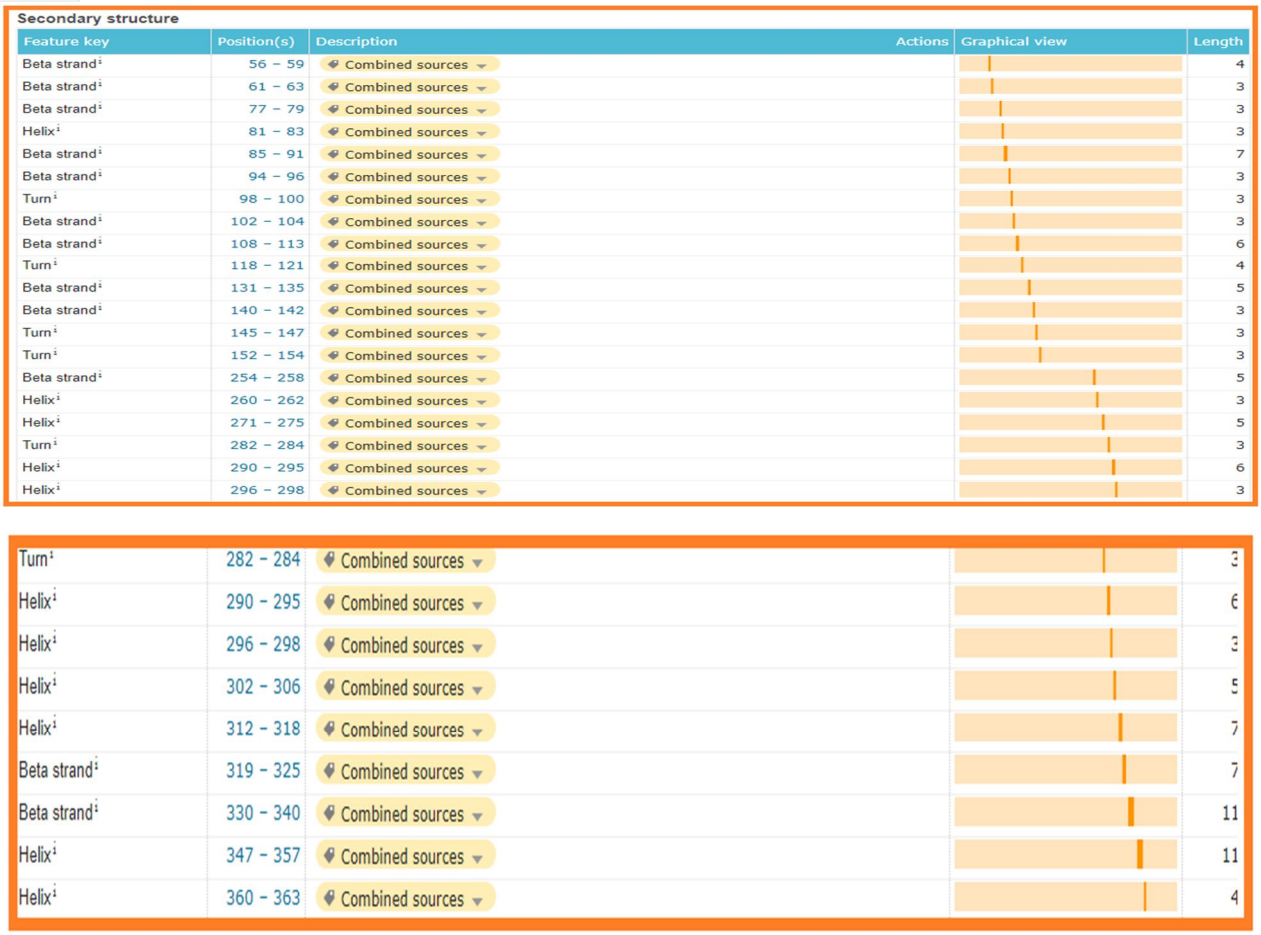


Figure 3 Sequence similarity



Figure4 Sequence description

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Secondary structure

Feature key	Position(s)	Description	Actions	Graphical view	Length
Beta strand	56 – 59	Combined sources			4
Beta strand	61 – 63	Combined sources			3
Beta strand	77 – 79	Combined sources			3
Helix	81 – 83	Combined sources			3
Beta strand	85 – 91	Combined sources			7
Beta strand	94 – 96	Combined sources			3
Turn	98 – 100	Combined sources			3
Beta strand	102 – 104	Combined sources			3
Beta strand	108 – 113	Combined sources			6
Turn	118 – 121	Combined sources			4
Beta strand	131 – 135	Combined sources			5
Beta strand	140 – 142	Combined sources			3
Turn	145 – 147	Combined sources			3
Turn	152 – 154	Combined sources			3
Beta strand	254 – 258	Combined sources			5
Helix	260 – 262	Combined sources			3
Helix	271 – 275	Combined sources			5
Turn	282 – 284	Combined sources			3
Helix	290 – 295	Combined sources			6
Helix	296 – 298	Combined sources			3

Turn	282 – 284	Combined sources			3
Helix	290 – 295	Combined sources			6
Helix	296 – 298	Combined sources			3
Helix	302 – 306	Combined sources			5
Helix	312 – 318	Combined sources			7
Beta strand	319 – 325	Combined sources			7
Beta strand	330 – 340	Combined sources			11
Helix	347 – 357	Combined sources			11
Helix	360 – 363	Combined sources			4

Figure5 Nucleo corona protein secondary structure description



Region

Feature key	Position(s)	Description	Actions	Graphical view	Length
Region	42 – 187	RNA-binding UniRule annotation	Add BLAST		146
Region	45 – 181	RNA-binding	Add BLAST		137
Region	259 – 362	Dimerization UniRule annotation	Add BLAST		104

Compositional bias

Feature key	Position(s)	Description	Actions	Graphical view	Length
Compositional bias	181 – 213	Ser-rich	Add BLAST		33
Compositional bias	220 – 225	Poly-Leu			6
Compositional bias	240 – 245	Poly-Gln			6
Compositional bias	370 – 376	Poly-Lys			7

Figure6 RNA- Binding region and repeated aminoacid sequence

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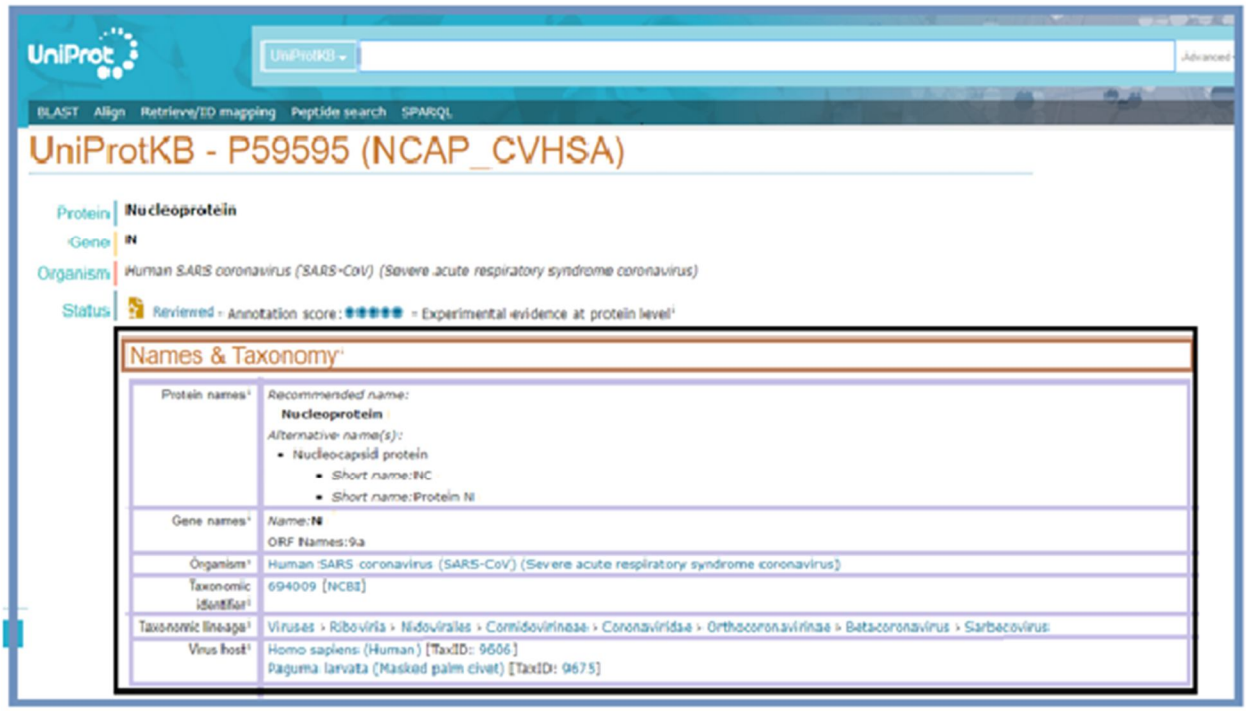
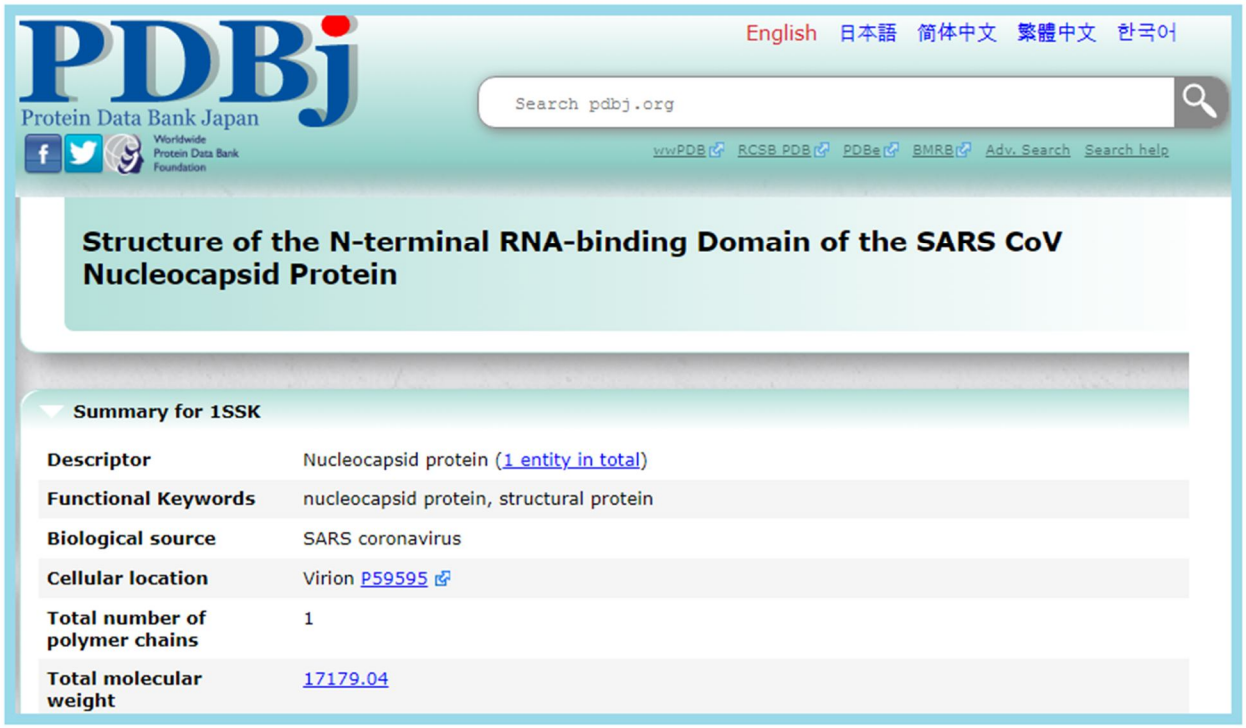


Figure7 Taxonomy and description for N-protein



Figure 8 N-protein Secondary structure



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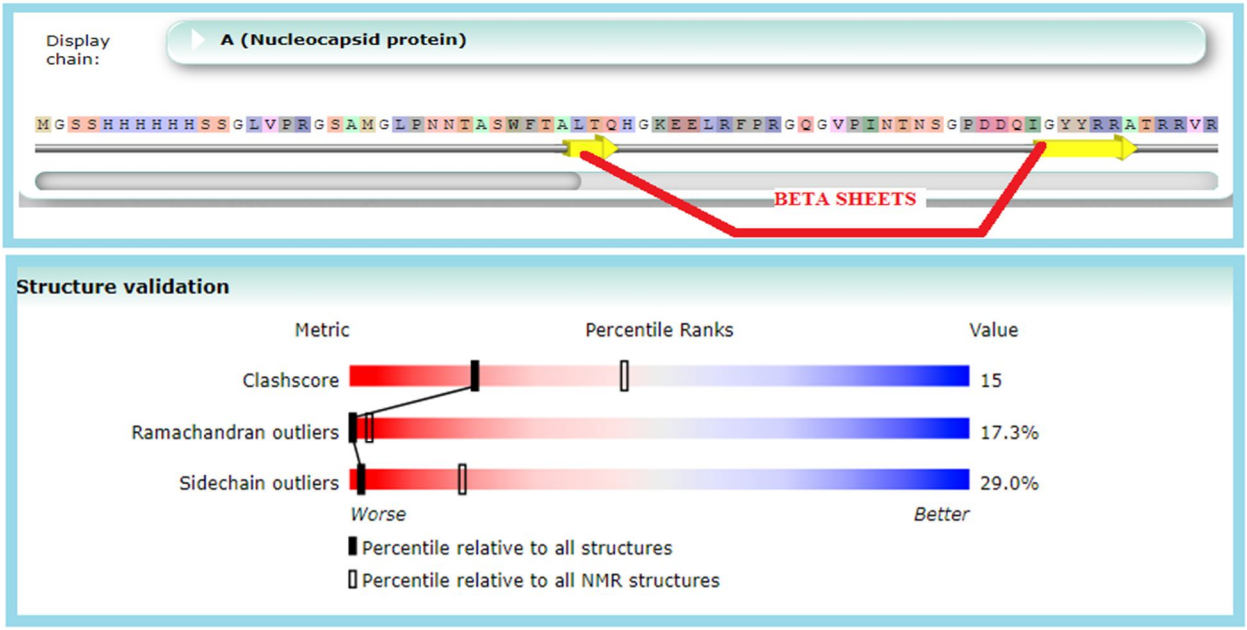


Figure 9 N-Protein structure validation

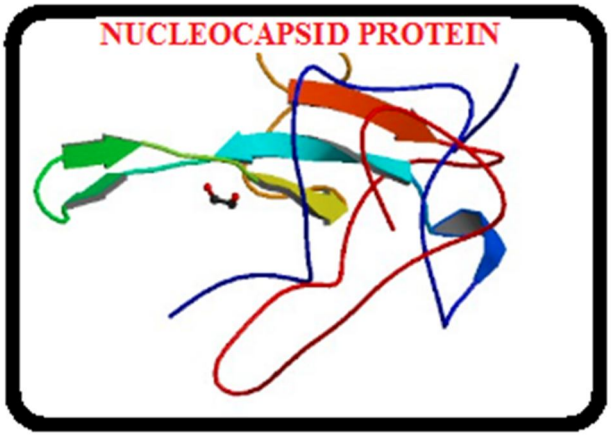


Figure10 N-protein structure

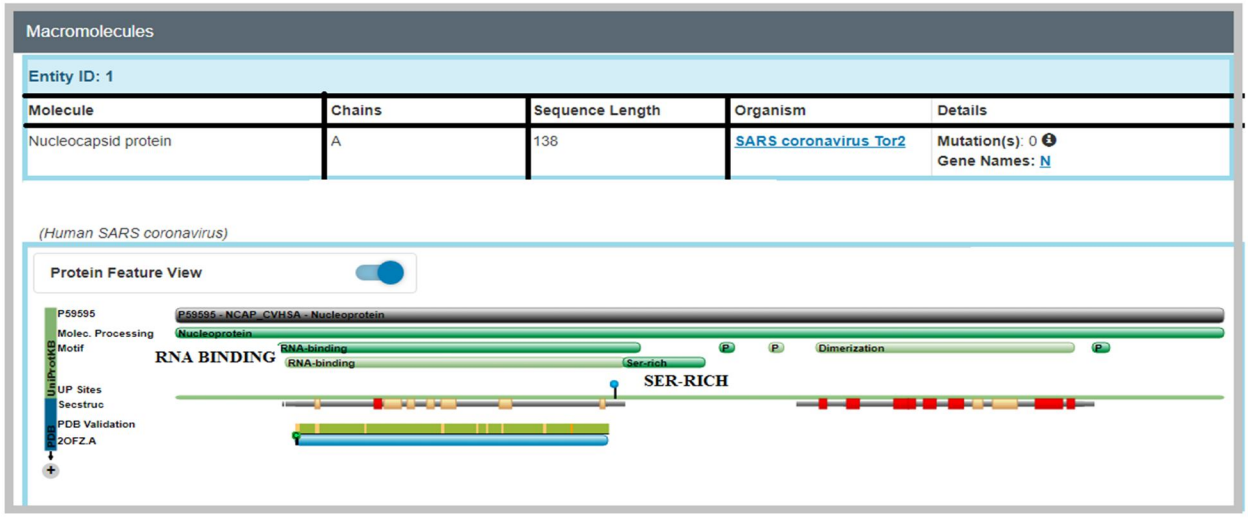


Figure 11 RNA binding site present in N-protein,serotonin rich

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V. RNA BINDING REGION

RNA-binding proteins (RBPs) are highly involved in various regulatory processes, e.g. gene splicing and localization, and provide important functional information for patient care.(www.biomedcentral.com) RBPs have crucial roles in various cellular processes such as: cellular function, transport and localization.

VI. SEROTONIN

Serotonin is a chemical that has a wide variety of functions in the human body. It is sometimes called the happy chemical, because it contributes to wellbeing and happiness. The scientific name for serotonin is 5-hydroxytryptamine, or 5-HT. It is mainly found in the brain, bowels, and blood platelets.(www.who.int)

VII. LIGAND

In protein-ligand binding, the ligand is usually a molecule which produces a signal by binding to a site on a target protein. 1, 2-ETHANEDIOL is a ligand that interacts with the target protein nucleocapsid protein which is related to corona virus(Severe Acute Respiratory Syndrome).

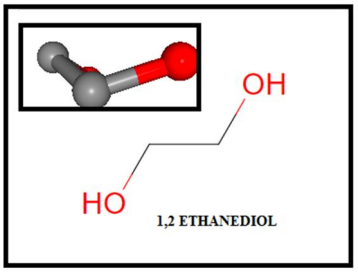


Figure 12 Ethanediol structure

Using CHEMBL database nine drug compounds were found for 1,2 ethanediol ligand which binds with nucleocapsid protein.

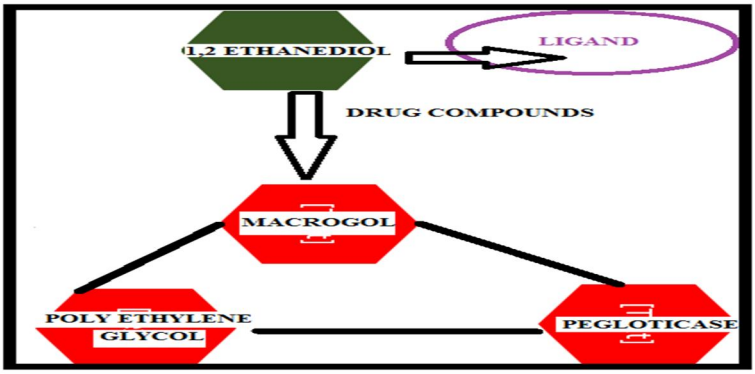
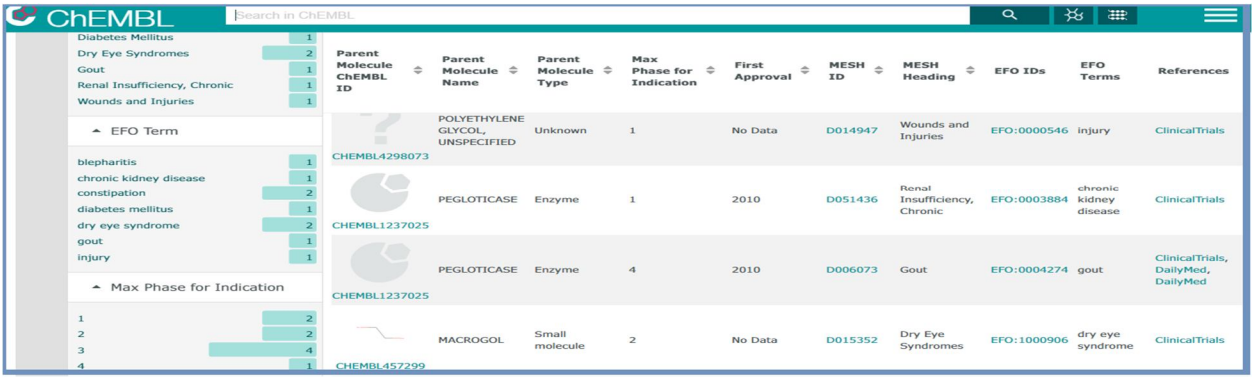


Figure13 Drug compounds

VIII. DRUG INDICATION

Drug indication refers to the use of that drug for treating a particular disease. For example, diabetes is an indication for insulin. Another way of stating this relationship is that insulin is indicated for the **treatment** of diabetes.



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Parent Molecule ChEMBL ID	Parent Molecule Name	Parent Molecule Type	Max Phase for Indication	First Approval	MESH ID	MESH Heading	EFO IDs	EFO Terms	References
CHEMBL457299	MACROGOL	Small molecule	2	No Data	D015352	Dry Eye Syndromes	EFO:1000906	dry eye syndrome	ClinicalTrials
CHEMBL457299	MACROGOL	Small molecule	2	No Data	D003248	Constipation	HP:0002019	constipation	ClinicalTrials
CHEMBL2108780	POLYETHYLENE GLYCOL 4000	Small molecule	3	No Data	D015352	Dry Eye Syndromes	EFO:1000906	dry eye syndrome	ClinicalTrials
CHEMBL2108780	POLYETHYLENE GLYCOL 4000	Small molecule	3	No Data	D001762	Blepharitis	EFO:0009536	blepharitis	ClinicalTrials
CHEMBL2108780	POLYETHYLENE GLYCOL 4000	Small molecule	3	No Data	D003248	Constipation	HP:0002019	constipation	ClinicalTrials
CHEMBL2108780	POLYETHYLENE GLYCOL 4000	Small molecule	3	No Data	D003920	Diabetes Mellitus	EFO:0000400	diabetes mellitus	ClinicalTrials

Figure 14 Drug indication.

Figure 13 represents the drugs and their uses from the above drug polyethylene glycol drug was selected.

IX. POLYETHYLENE GLYCOL+SURVANTA

Survanta (Beractant) Intratracheal is a lung surface acting agent, or "surfactant." It helps the lungs function normally. This medicine is similar to the natural fluid in the lungs that helps maintain effective breathing.

Survanta Intratracheal is used to treat or prevent respiratory distress syndrome (RDS) in a premature baby whose lungs have not fully developed. (www.drug.com) Polyethylene glycol when combined with survanta was used to treat breathing problem and respiratory disease.so, the patients who are affected with covid-19 can also be treated with the combination of these two drug compounds .when they have breathing problem and lung ailment .survanta was usually given to new born babies but in ongoing research they found that survanta when combined with polyethylene glycol can treat respiratory disorder in adults.

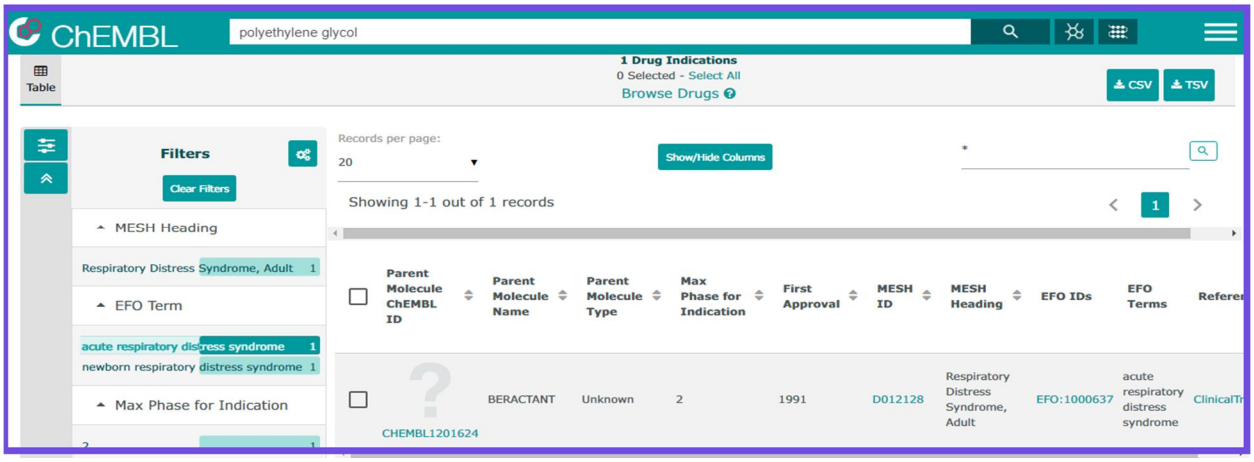


Figure 15 Survanta drug indication.

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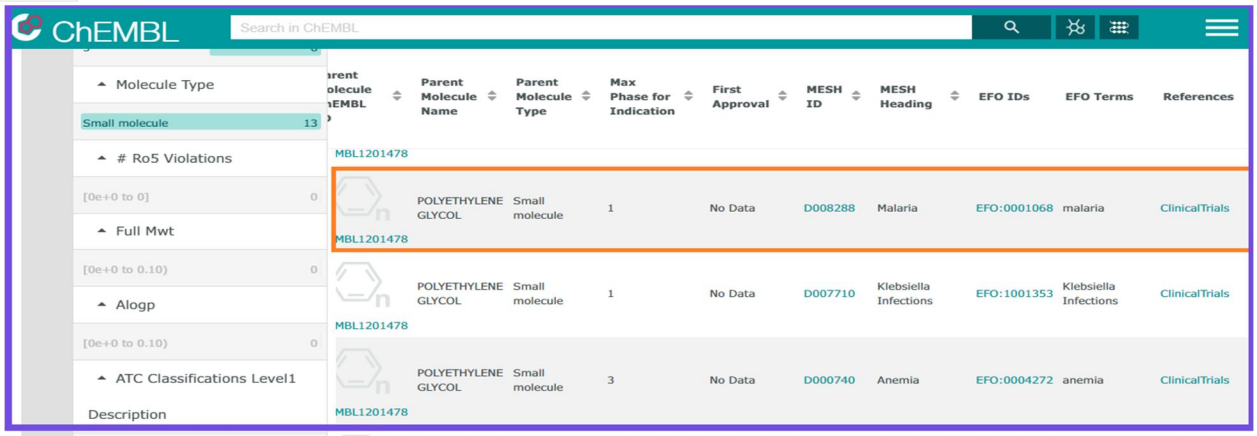


Figure 16 Polyethylene glycol drug indication.

In figure16 using chembl database it is shown that polyethylene glycol can be used to treat malarial fever but this compound is under clinical trial and no target protein was also found for polyethylene glycol.

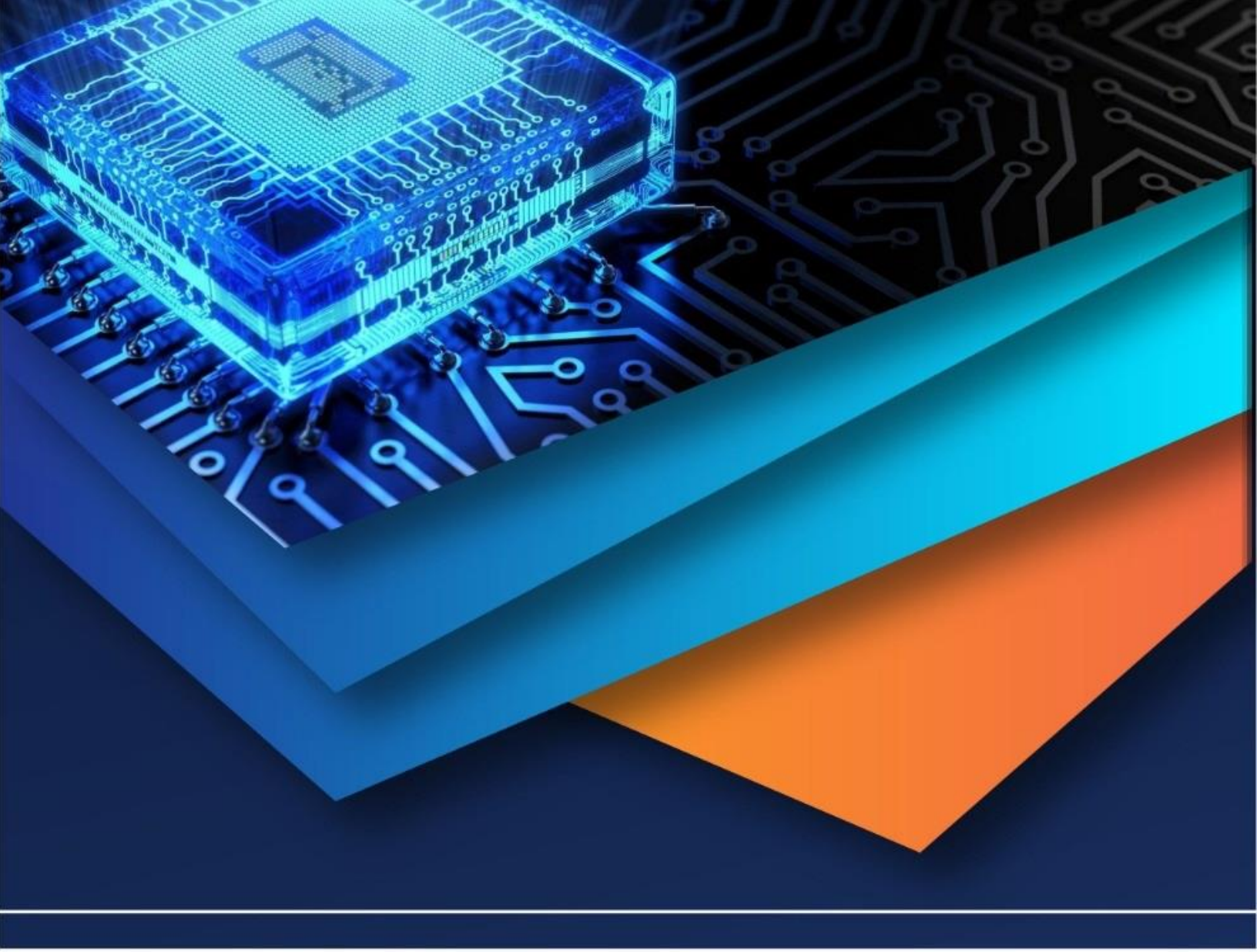
X. CONCLUSION AND SUMMARY

The nucleocapsid (N) protein of COVID-19 has nearly 90% amino acid sequence identity with SARS-CoV. The covid-19 protein and selected nucleocapsid protein have 90% of sequence similarity and good number of Rna binding site. The n-protein was also rich in serotonin which is called as a happy chemical and plays an important role in human body function. **1,2-ETHANEDIOL** is a ligand that interacts with the target protein nucleocapsid protein which is related to corona virus(Severe Acute Respiratory Syndrome).In conclusion the drug molecules polyethylene glycol and survanta can be used to treat respiratory syndrome and lung disease(Breathing problem)in patients affected by covid-19 virus.

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