Cognitive Impacts of COVID-19

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4TH MAY 2022

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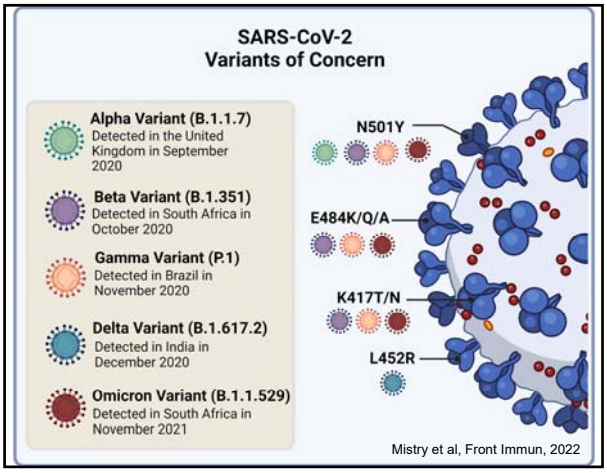
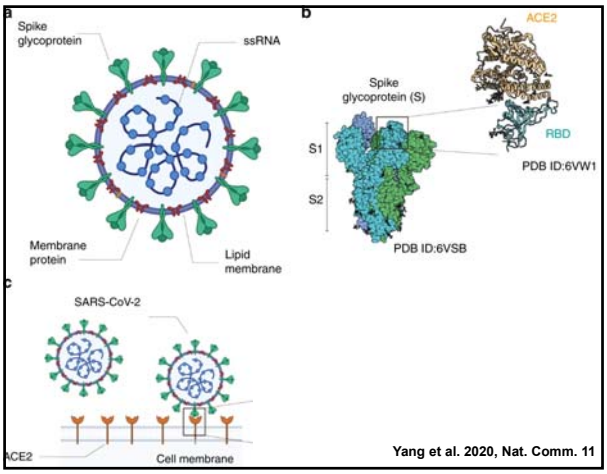
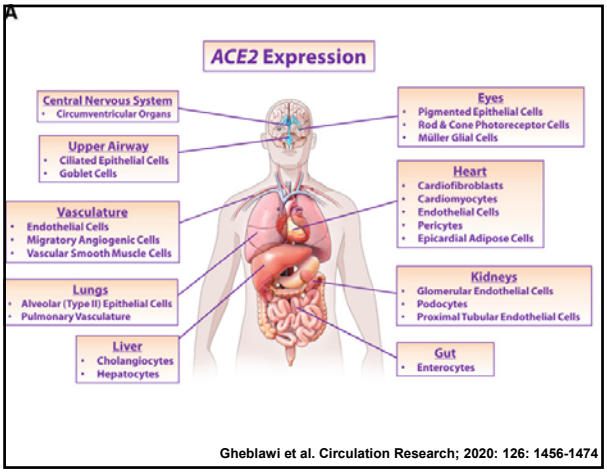
Learning Objectives

- Know the mechanisms associated with SARS-CoV-2 neuroinfection.
- Understand the resulting biological and anatomical CNS changes associated with neuroinfection.
- Recognize that mental impairments persist months after infection recovery and may accelerate cognitive decline.

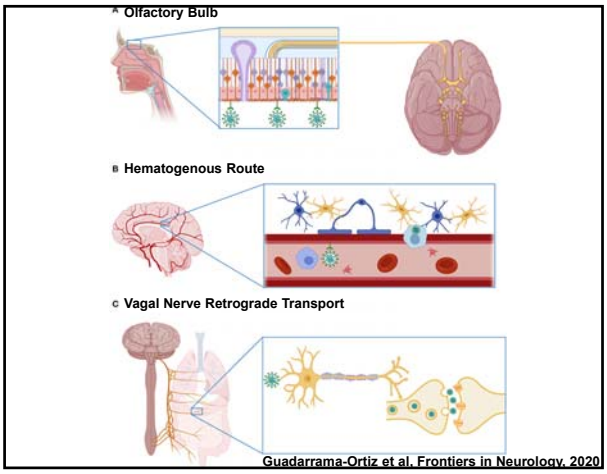




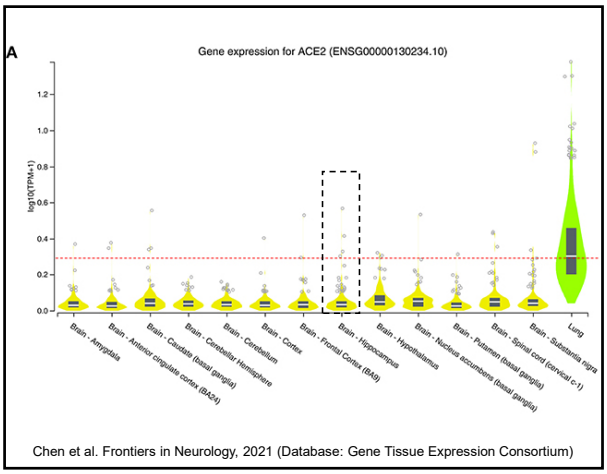
Yang et al. 2020, Nat. Comm. 11



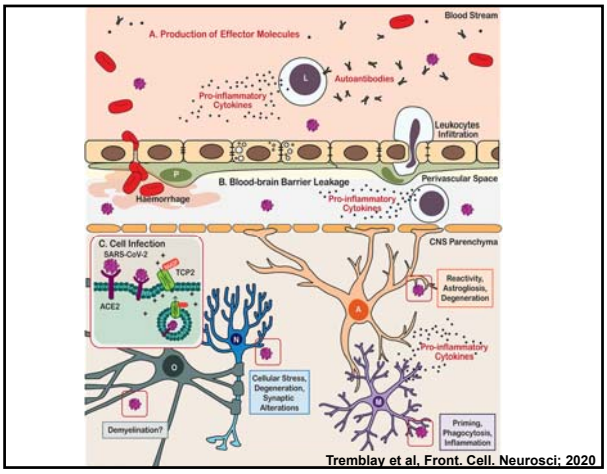
Gheblawi et al. Circulation Research; 2020: 126: 1456-1474



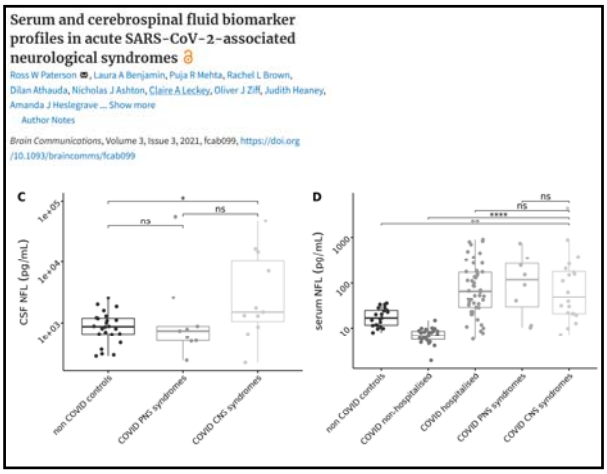
Guadarrama-Ortiz et al. Frontiers in Neurology, 2020

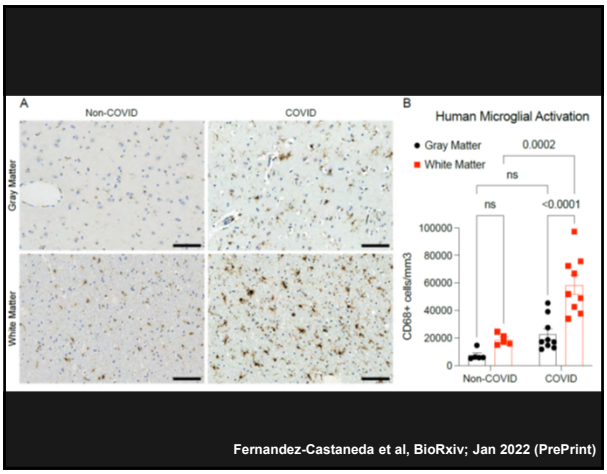


Chen et al. Frontiers in Neurology, 2021 (Database: Gene Tissue Expression Consortium)

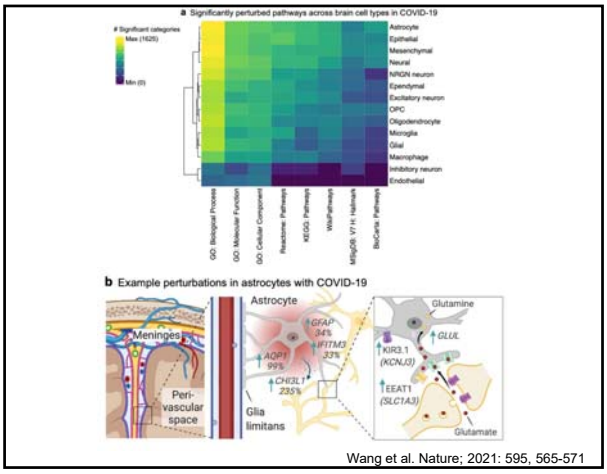


Tremblay et al. Front. Cell. Neurosci; 2020





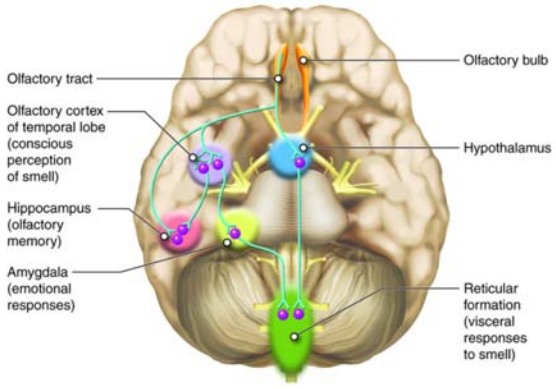
Fernandez-Castaneda et al, BioRxiv; Jan 2022 (PrePrint)



Wang et al. Nature; 2021: 595, 565-571

Neurological symptom	Affected region (reference)	Percentage (reference)
Acute cerebrovascular disease	Cerebral vessels[59,60]	2.8%[34]
Meningitis/encephalitis	CSF[33,84]	Case report[287]
Acute hemorrhagic necrotizing encephalopathy	Temporal lobe[288]	Case report[288,289]
Posterior reversible encephalopathy syndrome	Cortex[87,290,291]	Case report[87,290,291]
Demyelinating lesion	Spinal cord[292]	Case report[292]
Seizure	Left temporoparietal lobe[293,294,295]	0.5%[34]
Ischemic stroke	Cortex[34]	2.8%[34]
Dizziness	Whole brain[296]	9.4%[297] 16.8%[34]
Headache	Whole brain[34,298,299]	3.4%[300] 6.5%[297] 13.1%[34]
Ataxia	Whole brain[34]	0.5%[34]
Impaired consciousness	Whole brain[34]	7.5%[34]
Brain edema	Brainstem[301]	Case report[301]
Anosmia	Olfactory neurons[126]	5.1%[34]
Ageusia	Tongue nerves[106,107,302,303]	5.6%[34]
Dysopia	Optic nerves[34]	1.4%[34]
Guillain-Barré syndrome	Peripheral nerve demyelination[304,305,306,307,308,309,310]	Case report[310,311]
Miller Fisher syndrome	Whole brain[312,313]	Casa report[312,313]
Myalgia-muscle pain	Neuromuscular junction[214,215]	Case report[214,215]
Rhabdomyolysis	Muscle[216]	Case report[216]

Wan et al, Signal Transduction and Targeted Therapy; 2021: 6



https://courses.lumenlearning.com/austincc-ap1/chapter/special-senses-smell-olfaction/

Article | Published: 07 March 2022

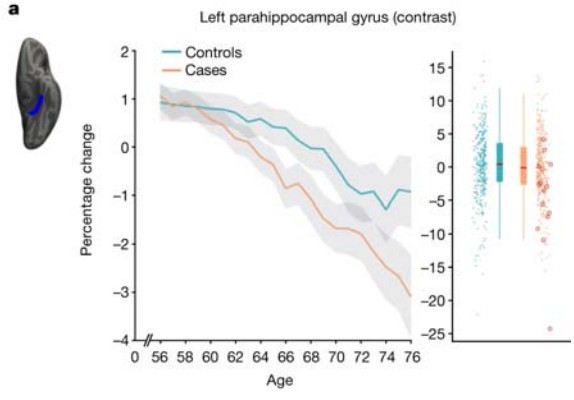
SARS-CoV-2 is associated with changes in brain structure in UK Biobank

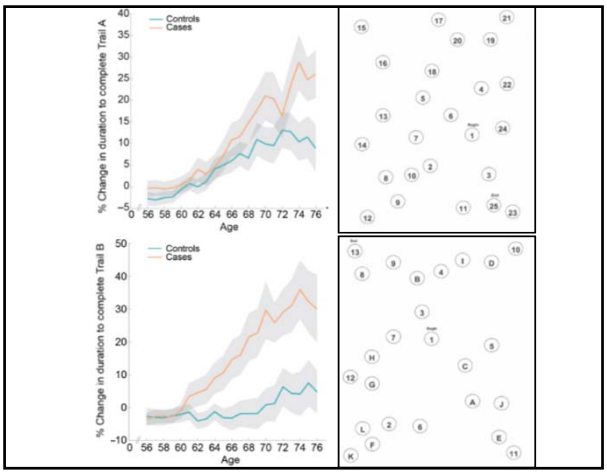
Gwenaëlle Douaud, Soojin Lee, Fidel Alfaro-Almagro, Christoph Arthofer, Chaoyue Wang, Paul McCarthy, Frederik Lange, Jesper L. R. Andersson, Ludovica Griffanti, Eugene Duff, Saad Jbabdi, Bernd Taschler, Peter Keating, Anderson M. Winkler, Rory Collins, Paul M. Matthews, Naomi Allen, Karla L. Miller, Thomas E. Nichols & Stephen M. Smith

Nature (2022) | Cite this article

	SARS-CoV-2	Control	P_{uncorr}
Number of participants	401	384	–
Age at scan 1 (mean ± s.d. (range))	58.9 ± 7.0 (46.9–80.2)	60.2 ± 7.4 (47.1–79.8)	0.15
Age at scan 2 (mean ± s.d. (range))	62.1 ± 6.7 (51.3–81.4)	63.3 ± 7.1 (51.3–81.3)	0.08
Sex (male/female)	172 (42.9%)/229 (57.1%)	164 (42.7%)/220 (57.3%)	0.96
Ethnicity (white/non-white*)	388 (96.8%)/13 (3.2%)	373 (97.1%)/11 (2.9%)	0.76
Years between scans 1 and 2 (mean ± s.d. (range))	3.2 ± 1.6 (1.0–7.0)	3.2 ± 1.6 (1.0–6.9)	0.98
Systolic blood pressure (mmHg)	130.3 ± 17.3	132.1 ± 17.6	0.16
Diastolic blood pressure (mmHg)	78.7 ± 10.6	79.0 ± 10.2	0.63
Diagnosed diabetes	18 (4.5%)	16 (4.2%)	0.82
Weight (kg)	76.4 ± 15.8	75.2 ± 14.4	0.65
Waist/hip ratio	0.87 ± 0.09	0.86 ± 0.09	0.37
BMI (kg m^{-2})	26.7 ± 4.4	26.6 ± 4.3	0.61
Alcohol-intake frequency (a.u.)	3.1 ± 1.3	3.0 ± 1.4	1.00
Tobacco smoking	0.61 ± 0.92	0.65 ± 0.89	0.87
Townsend deprivation index	−1.5 ± 2.9	−1.6 ± 2.9	0.65

Note: To date, this article has not completed peer review.





March 8, 2022

One-Year Trajectory of Cognitive Changes in Older Survivors of COVID-19 in Wuhan, China

A Longitudinal Cohort Study

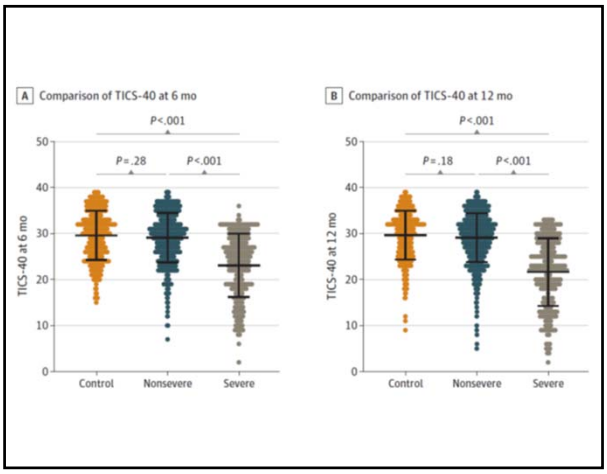
Yu-Hui Liu, MD, PhD[1]; Yang Chen, MD[1]; Qing-Hua Wang, MD, PhD[1]; et al

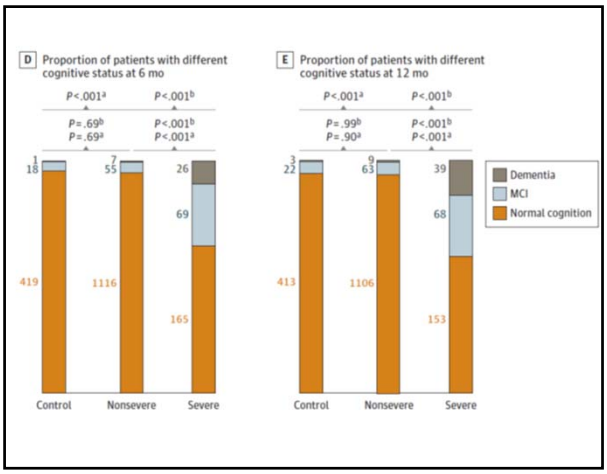
Author Affiliations | Article Information

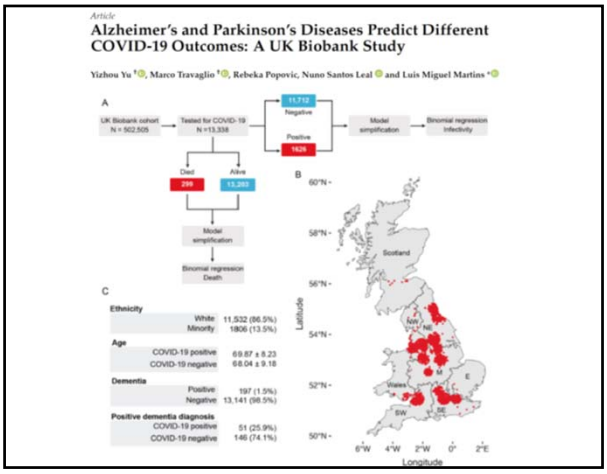
JAMA Neurol. Published online March 8, 2022. doi:10.1001/jamaneurol.2022.0461

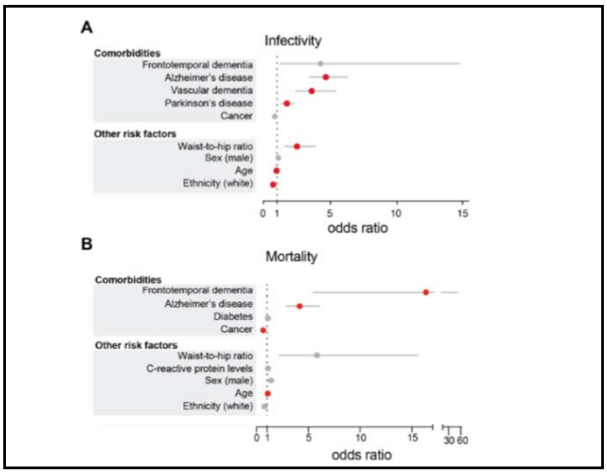
Table 1. Demographic and Baseline Information of Participants

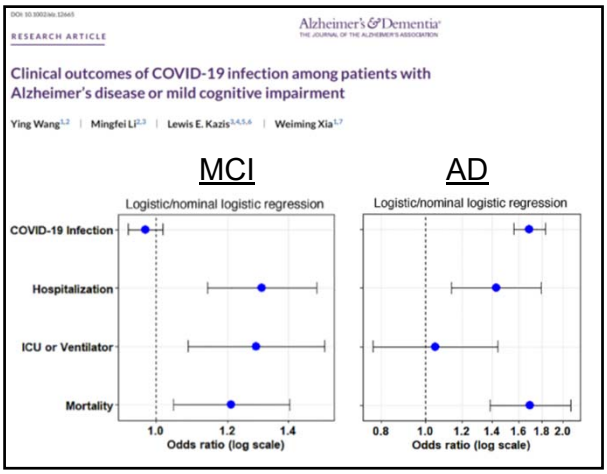
Variable	COVID-19 survivors			Uninfected control individuals (n = 438)	*P* value survivors vs control individuals	*P* value severe vs nonsevere cases
	Total group (n = 1438)	Severe cases (n = 260)	Nonsevere cases (n = 1178)			
Age, median (IQR), y	69 (66-74)	71 (67-79)	68 (66-73)	67 (66-74)	.30[a]	<.001[a]
Female, No. (%)	747 (51.95)	127 (48.85)	621 (52.72)	216 (49.32)	.35[b]	.27[b]
Male, No. (%)	691 (48.05)	133 (51.15)	557 (47.28)	222 (50.68)	.35[b]	.27[b]
Education, median (IQR), y	12 (9-12)	12 (6-12)	12 (9-12)	12 (9-12)	>.99[a]	.05[a]
BMI, median (IQR)	23.99 (22.54-25.38)	24.38 (22.90-25.64)	23.93 (22.44-25.33)	24.19 (22.51-25.69)	>.99[a]	.009[a]
Comorbidities, No. (%)						
Hypertension	561 (39.01)	133 (51.15)	426 (36.16)	151 (34.47)	.09[b]	<.001[b]
Diabetes	274 (19.05)	65 (25.00)	208 (17.66)	81 (18.49)	.84[b]	.01[b]
Hyperlipidemia	142 (9.87)	31 (11.92)	111 (9.42)	39 (8.90)	.58[b]	.25[b]
Stroke history	79 (5.49)	42 (16.15)	37 (3.14)	30 (6.85)	.29[b]	<.001[b]
Coronary heart disease	193 (13.42)	71 (27.31)	121 (10.27)	61 (13.93)	.81[b]	<.001[b]
COPD	142 (9.87)	43 (16.38)	99 (8.40)	41 (9.36)	.78[b]	<.001[b]
ICU admission, No. (%)	72 (5.01)	72 (27.69)	0	NA	NA	<.001[b]




D Proportion of patients with different cognitive status at 6 mo
P<.001a
P<.001b
P=.69b
P=.69a
P<.001b
P<.001a
1
18
7
55
26
69
419
1116
165
Control
Nonsevere
Severe
E Proportion of patients with different cognitive status at 12 mo
P<.001a
P<.001b
P=.99b
P=.90a
P<.001b
P<.001a
3
22
9
63
39
68
413
1106
153
Control
Nonsevere
Severe
Dementia
MCI
Normal cognition


Article
Alzheimer's and Parkinson's Diseases Predict Different COVID-19 Outcomes: A UK Biobank Study
Yizhou Yu, Marco Travaglio, Rebeka Popovic, Nuno Santos Leal and Luis Miguel Martins
A
UK Biobank cohort N = 502,505
Tested for COVID-19 N = 13,338
11,712 Negative
1625 Positive
Model simplification
Binomial regression Infectivity
Dead 296
Alive 15,393
Model simplification
Binomial regression Death
B
60°N
58°N
56°N
54°N
52°N
50°N
Scotland
NW
NE
M
E
Wales
SW
SE
Latitude
6°W
4°W
2°W
0°
2°E
Longitude
C
Ethnicity
White 11,532 (86.5%)
Minority 1806 (13.5%)
Age
COVID-19 positive 69.87 ± 8.23
COVID-19 negative 68.04 ± 9.18
Dementia
Positive 197 (1.5%)
Negative 13,141 (98.5%)
Positive dementia diagnosis
COVID-19 positive 51 (25.9%)
COVID-19 negative 146 (74.1%)


A
Infectivity
Comorbidities
Frontotemporal dementia
Alzheimer's disease
Vascular dementia
Parkinson's disease
Cancer
Other risk factors
Waist-to-hip ratio
Sex (male)
Age
Ethnicity (white)
0 1 5 10 15
odds ratio
B
Mortality
Comorbidities
Frontotemporal dementia
Alzheimer's disease
Diabetes
Cancer
Other risk factors
Waist-to-hip ratio
C-reactive protein levels
Sex (male)
Age
Ethnicity (white)
0 1 5 10 15 30 60
odds ratio



SARS-CoV-2 infection causes

- macroscopic, microscopic, and transcriptomic changes to CNS tissue.
- cognitive impairments that scale to disease severity
- worse outcome in MCI and AD patients.