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Comparative Study of SARS-CoV-2 Infection and Virulence in the United Kingdom, Germany, and Europe

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On May 5, 2020, the United Kingdom became the country in Europe with the highest number of deaths due to SARS-COV-2 infections. The United Kingdom also had higher IP 10000 or Number of Individuals infected with SARS-COV-2 Per 10000 Population and DP 10000 or Number of Deaths Per 10000 Individuals Infected with SARS-COV-2 than Germany and Group B Countries, including Finland, Russia, Iceland, Norway, Denmark, Estonia, Latvia, Lithuania and Germany. It was previously shown that there was no correlation between Infectivity and Virulence but there were reverse correlations of Infectivity and Virulence, and Temperature, Humidity and Far Infrared Radiation. The inability of the United Kingdom to mount an effective response strategy to combat SARS-COV-2 infections and prevent deaths due COVID-19 can be partly explained by environmental factors and also by a systematic faulty response strategy of both the political and scientific leaderships of the United Kingdom. Rectification of the United Kingdom's response strategy to SARS-COV-2 infections is urged. As demonstrated in Germany and Group B countries, infections within a population do not correlate with virulence and deaths can be avoided with an effective response strategy. There is currently a protocol that can be implemented in a relatively short time.

Introduction.

COVID-19 is associated with high mortality [1,2]. The etiologic agent of COVID-19 is SARS-COV-2 [3-6]. It has been argued that SARS-COV-2 most probably emerged from its latency induced by low Temperature, low Humidity and low Far Infrared Irradiation [2,7]. On May 5, 2020, the United Kingdom became the top country in Europe with respect to the total number of individuals infected with SARS-COV-2 and the total number of deaths due to SARS-COV-2 infections. It is therefore legitimate to inquire as to why in comparison to Finland, Russia Iceland, Norway, Denmark, Estonia, Latvia, Lithuania, and Germany (Group B countries), and the other 6 European countries, including Spain, Italy, France, Belgium, Netherlands and Sweden (Group C countries), the United Kingdom occupied the top position in total number of deaths due to SARS-COV-2 infections in Europe, and also very high IP 10000 (high Infectivity) or high Number of Infected Individuals Per 10000 Population and very high DP 10000 (high Virulence) or high Number of Deaths Per 10000 Individuals Infected with SARS-COV-2. It was previously demonstrated that there were reverse correlations of Infectivity and Virulence of SARS-COV-2, with Temperature, Humidity and Far Infrared Radiation [2] but no correlation between infectivity and virulence of SARS-COV-2 [7]. We queried whether low temperature, low humidity and low far infrared irradiation during the months of December 2019, January 2020, February 2020, March 2020 and April 2020 can account for the high number of deaths due to SARS-COV-2 infections in the United Kingdom and the very high IP 10000 (high Infectivity) and very high DP 10000 (high Virulence) of SARS-COV-2 registered in United Kingdom.

Here, the IP 10000 (Infectivity) and the DP 10000 (Virulence) of SARS-COV-2 for the United Kingdom were analyzed and compared with those of Singapore, Malaysia, Thailand, Hong Kong, Taiwan, Australia, New Zealand, Bangladesh and India (Group A countries), Finland, Russia, Iceland, Norway, Denmark, Estonia, Latvia, Lithuania and Germany (Group B countries), and 6 other European countries, including Sweden, Italy, Spain, France, Belgium and Netherlands (Group C countries). United Kingdom can be classified as part of Group C countries

which include Sweden, Netherlands, Belgium, France, Italy and Spain, due to its association with low temperature, humidity and far infrared radiation during December 2019, January 2020, February 2020, March 2020 and April 2020. However, low temperature, low humidity and low far infrared irradiation during the months of December 2019, January 2020, February 2020, March 2020 and April 2020 cannot by themselves account for the high number of deaths due to SARS-COV-2 infections, and the very high IP 10000 (Infectivity) and very high DP 10000 (Virulence) of SARS-COV-2 calculated for United Kingdom. Other factors are discussed.

Methods.

Data for the total number of individuals infected with SARS-COV-2 and total number of deaths due to SARS-COV-2 infections for each country was curated from the World Health Organization, Department of Health of each countries. IP 10000, a measure of Infectivity is defined as the Number of Individuals Infected with SARS-COV-2 Per 10000 Population. DP 10000, a measure of Virulence is defined as the Number of Deaths Per 10000 Individuals Infected with SARS-COV-2. IP 10000 and DP 10000 were calculated based on the total number of individuals infected with SARS-COV-2 and total number of deaths due to SARS-COV-2 infections.

Temperature, Humidity and Far Infrared Irradiation values were curated from the Meteorological Readings and forecasts of each country.

Data was analyzed for correlations by the Pearson method [8,9]. Differences between groups were determined by the student t-test [10,11] or One Way Anova test [12,13] with $p < 0.05$ accepted as statistically significant.

Results.

The total number of Individuals Infected with SARS-COV-2 (Figure 1A), the total number of deaths due to SARS-COV-2 infections (Figure 1B), and IP 10000 or Number of Individuals Infected with SARS-COV-2 Per 10000 population (Figure 1C), and DP 10000 or Number of Deaths Per 10000 Individuals infected with SARS-COV-2 (Figure 1D) in each of the 9 European countries studied are shown in Figure 1. The IP 10000 is a

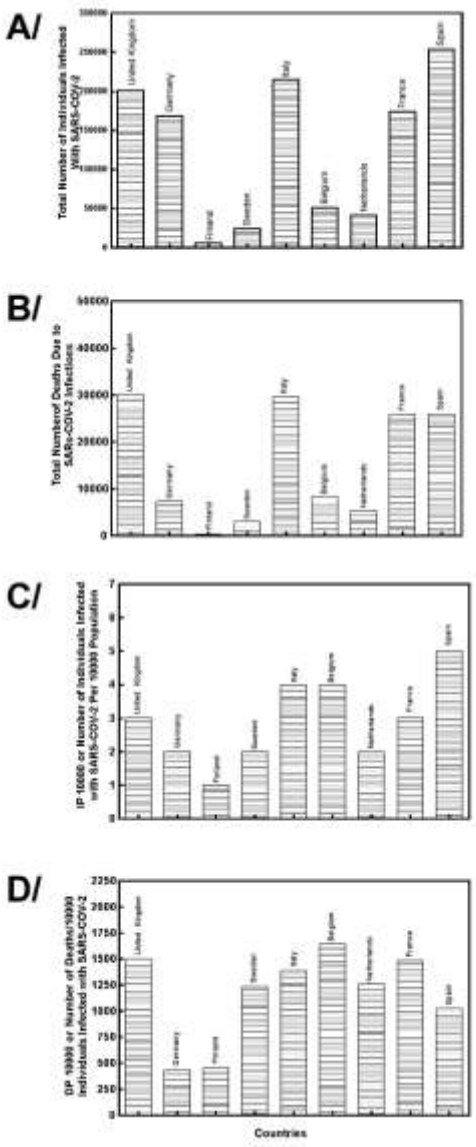

Figure 1. Comparison of Total Number of Individuals Infected with SARS-COV-2 for each country (Panel A), Total Number of Deaths for each country (Panel B), IP 10000 or Number of Individuals Infected with SARS-COV-2 Per 10000 Population (Panel C), and DP 10000 or Number of Deaths Per 10000 Individuals Infected with SARS-COV-2. Data was curated from the World Health Organization (WHO) and Each Country's Department of Health. The values are for May 6, 2020.

measure of Infectivity while the DP 10000 is a measure of virulence. A plot of DP 10000 (Virulence) v. IP 10000 (Infectivity) reveals that there is no correlation between Virulence and Infectivity (Figure 2).

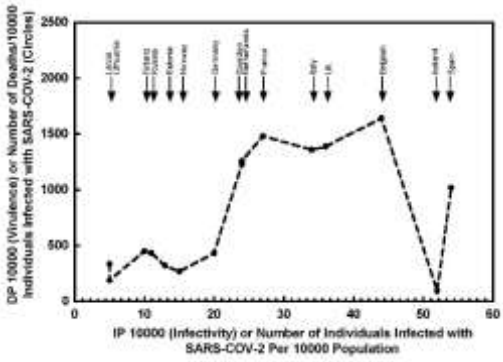

Figure 2. No Correlation between Infectivity and Virulence. IP 10000 or Number of Individuals Infected with SARS-COV-2 Per 10000 Population (X Axis) and DP 10000 (Virulence) or Number of Deaths Per 10000 Individuals Infected with SARS-COV-2 (Y Axis) for each country. The data for IP 10000 and DP 10000 for each country was calculated from Figure 1. (p = > 0.05)

Figure 3 shows a comparison of IP 10000 (Infectivity) (Panel 3A) and DP 10000 (Virulence) (Panel 3B) in United Kingdom, Germany, Group B Countries (Finland, Russia, Iceland, Norway, Denmark, Estonia, Latvia and Lithuania) and Group C Countries (Sweden, Italy, Spain, France, Belgium and the Netherlands, and United Kingdom).

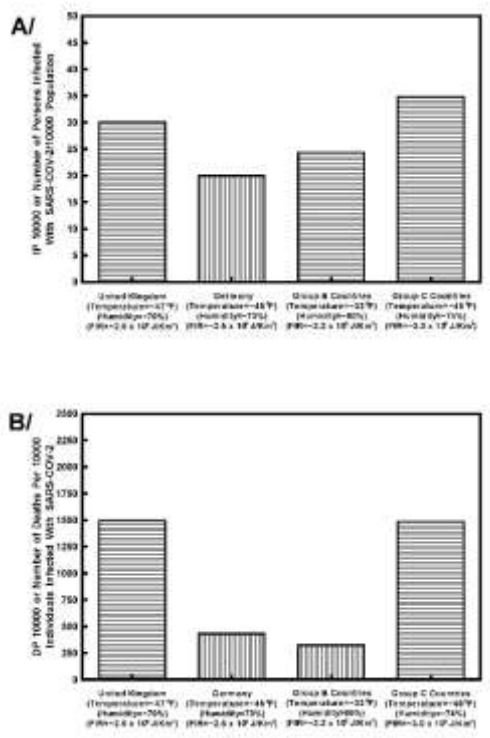

Figure 3. Comparison of IP 10000 and DP 10000 Between United Kingdom and Germany, Group B and Group C Countries. IP 10000 or Number of Infected Individuals Per 10000 Population (Panel A) and DP 10000 or Number of Deaths Per 10000 Infected Individuals (Panel B) for United Kingdom, Germany and Group B Countries (Finland, Russia, Iceland, Norway, Denmark, Estonia, Latvia, and Lithuania), and Group C countries (Sweden, Netherlands, Belgium, France, Italy, and Spain) were determined for each country. IP 10000 (Panel A) and DP 10000 (Panel B) for Group B countries and Group C countries are Mean Values.

United Kingdom had IP 10000 and DP 10000 of 30 and 1496 respectively. Germany had IP 10000 and DP 10000 of 20 and 433 respectively. Group B Countries had IP 10000 and DP 10000 of 23 and 268 respectively while Group C Countries had IP 10000 and DP 10000 of 34 and 1337 respectively. The difference of IP 10000, a measure of Infectivity between Kingdom and Germany and Group B countries is quite remarkable (30 for United Kingdom, 20 for Germany and ~24 for Group B countries excluding Germany) The difference of DP 10000 between United Kingdom and Germany and Group B countries is quite striking (1496 for United Kingdom, 433 for Germany and ~325 for Group B countries excluding Germany).

Figure 4 shows a comparison of of IP 10000 (Infectivity) (Figure 3A) and DP 10000 (Virulence) (Figure 3B) in United Kingdom, Germany, Group B countries, Group C countries and Group A countries which include Singapore, Malaysia, Thailand, Hong Kong, Taiwan, Australia, New Zealand, Bangladesh and India, all located in Asia and all experiencing high Temperature, high Humidity and high Far Infrared Irradiation. The difference in IP 10000 (30 versus. ~6) and DP 10000 (1496 versus ~146) between United Kingdom and Group A countries is even more striking. The results in Figure 5 also show that during the months of December

2019, January 2020, February 2020, March 2020 and April 2020, (i) United Kingdom had average (i)

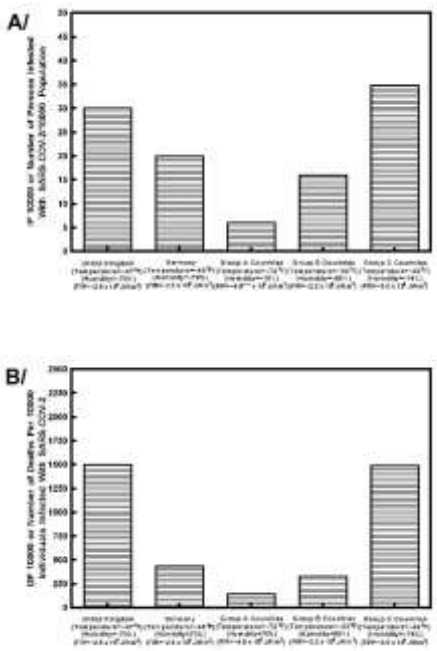

Figure 4. Comparison of IP 10000 and DP 10000 Between United Kingdom and Germany, Group A, Group B and Group C Countries. IP 10000 or Number of Infected Individuals Per 10000 Population (Panel A) and DP 10000 or Number of Deaths Per 10000 Infected Individuals (Panel B) for United Kingdom, Germany, Group A Countries (Singapore, Malaysia, Thailand, Hong Kong, Taiwan, Australia, New Zealand, Bangladesh and India), and Group B Countries (Finland, Russia, Iceland, Norway, Denmark, Estonia, Latvia, and Lithuania), and Group C Countries (Sweden, Netherlands, Belgium, France, Italy, and Spain) Were Determined for each country. IP 10000 (Panel A) and DP 10000 (Panel B) for Group A Countries, Group B Countries and Group C Countries are Mean Values.

Temperature of 47 ^{O}F, (ii) 70 % Humidity, and (iii) Far Infrared Irradiation approximating 2.5 x 10^{8} Joules/Km^{2} that were similar to Group C countries, but dissimilar to Germany, Group A countries and Group B countries

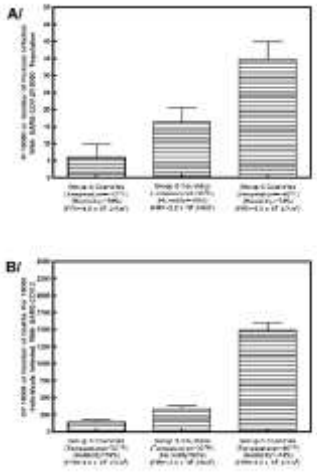

Figure 5. IP 10000 and DP 10000 Associated with Group A, Group B and Group C Countries. IP 10000 or Number of Infected Individuals Per 10000 Population (Panel A) and DP 10000 or Number of Deaths Per 10000 Infected Individuals (Panel B) for Group A Countries (Singapore, Malaysia, Thailand, Hong Kong, Taiwan, Australia, New Zealand, Bangladesh and India), and Group B Countries (Finland, Russia, Iceland, Norway, Denmark, Estonia, Latvia, Lithuania and Germany), and Group C Countries (Sweden, Netherlands, Belgium, France, Italy, Spain and United Kingdom) Were Determined for each country. IP 10000 (Panel A) and DP 10000 (Panel B) for Group A Countries, Group B Countries and Group C Countries are Mean ± SEM (n= 7-9). Differences between Groups were determined by the one way Anova test with $p < 0.05$ accepted as statistically significantly. There are significant differences between the means of Group A countries, GroupB countries and Group C countries ($p = < 0.05$).

excluding Germany. The results in Figure 5 indicate that United Kingdom can be

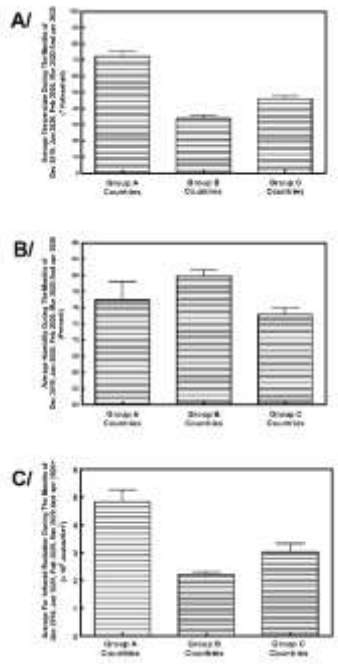

Figure 6. Temperature (Panel A), Humidity (Panel B) and Far Infrared Irradiation (Panel C) Were Curated and Calculated For Each Country. Each Bar represent Mean ± SEM (n=7-9). Differences between Groups were determined by the one way Anova test with p = < 0.05 accepted as statistically significantly. There are significant differences between Group A and Group B and Group C countries for Temperature (Panel A). There is no significant difference between Group A countries and Group B countries for Humidity but there is significant difference between Group A countries and Group C countries and between Group B countries and C countries for Humidity (Panel B). There are significant differences between Group A countries and Group B countries and Group C countries for Far Infrared Irradiation. There is also significant difference between Group B and Group C for Far Infrared Irradiation (Panel C).

assimilated within Group C countries and Germany forms part of Group B countries.

The differences of IP 10000 (Infectivity) DP 10000 (Virulence) described above could be due to the difference in Temperature, Humidity and Far Infrared Irradiation during the months of December 2019, January 2020, February 2020, March 2020. Figure 6 shows a comparison of IP 10000 and DP 10000 between Group A countries, and Group B countries and Group C countries. The results in Figure 6 show that (i) Group A countries which include Singapore, Malaysia, Thailand, Hong Kong, Taiwan, Australia, New Zealand, Bangladesh and India which are associated with high Temperature (~72 ^{O}F), high Humidity (~76%) and high Far Infrared Radiation (~4.93 x 10^8 Joules/Km^2) have the lowest IP 10000 (~6) and lowest DP 10000 (~145), (ii) Group B countries, including Finland, Russia, Norway, Denmark, Estonia, Latvia, Lithuania and Germany, all located in the Baltic sea (with the exception of Norway) which experienced low Temperature (~33 ^{O}F) and low Far Infrared Radiation (Radiation (~2.21 x 10^8 Joules/Km^2) but high Humidity (~80 %), have intermediate IP 10000 (~16) and DP 10000 (~337), and (iii) Group C countries, including Sweden, Netherlands, Belgium, France, Italy, Spain and United Kingdom

which are associated with low temperature (~46 ^{O}F) , low humidity (~73%) and low Far Infrared Irradiation (2.95 x 10^{8} Joules/Km^{2}) have the highest IP 10000 (~34) and highest DP 10000 (~1146).

Discussion.

The high IP 10000, a measure of Infectivity of SARS-COV-2 (Figure 3) and high DP 10000, a measure of Virulence of SARS-COV-2 (Figure 4) in the United Kingdom can be partially accounted for by being part of Group C countries which experienced low Temperature, low Humidity and low Far Infrared Irradiation during the months of December 2019, January 2020, February 2020, March 2020. There is evidence for reverse correlations between low Temperature, low Humidity and low December, and Infectivity (high IP 10000) and Virulence (high DP 10000) (Figure 5) [2]. Humidity level appears to be a significant factor in the determination of IP 10000 (Infectivity) and DP 10000 (Virulence). Finland, (part of Group B) countries which experienced low Temperature and low Far Infrared Irradiation but very high humidity, has much lower DP 10000 than United Kingdom. There is also evidence that the biochemistry (or molecular biology) of SARS-COV-2 may be distinct in various populations and locations [7, Tung, H.Y.L., manuscript in preparation]. However, low Temperature, low Humidity and low Far Infrared Irradiation and differential mutations in SARS-COV-2 alone, cannot explain the high IP 10000 and DP 10000 associated with United Kingdom. Germany with very similar Temperature, Humidity and Far Infrared Irradiation has much lower IP 10000 and DP 10000. The high level of SARS-COV-2 Infectivity (high IP 10000) and Virulence (high DP 10000) registered in United Kingdom are also explainable by the inability of the United Kingdom to mount an effective response strategy to combat SARS-COV-2 infections and prevent deaths due to a systematic paralysis of both the political and scientific leaderships of the United Kingdom. Rectification of the United Kingdom's response strategy to SARS-COV-2 infections among its population is urged. As demonstrated in Germany and Finland and elsewhere (Figure 2) [2,7], SARS-COV-2 infections within a population do not correlate with virulence and deaths can be avoided with an effective response strategy. As opposed to

Germany and Finland which mounted an aggressive response strategy consisting of determining the extent of infections within its population, isolating and treating individuals infected with SARS-COV-2 at an early stage and ordering restrictions of population movement [14], the United Kingdom did not do so until after beginning of April, 2020.

Through very unscientific advice from its scientific advisors, the Government of United Kingdom adopted the strategy of "herd immunity" [15,16] which consists of not interfering with the infections of its population by SARS-COV-2 in the mistaken assumption that the population in the United Kingdom that have acquired immunity against SARS-COV-2 will protect those who did not. The assumption was wrong because in order to achieve "herd immunity", it is necessary to first have a vaccine to vaccinate a large proportion of the population. It is well documented that there is no vaccine for SARS-CAOV-2 and there will not be one in the foreseeable future. Hoping for a large proportion of the population to naturally acquire immunity against SARS-COV-2 was wishful thinking as it would have taken much time, suffering and deaths. This was a dangerous and unwarranted strategy in direct contradiction to the tenets of the Theory of Chaos [17] which states that without intervention, small but significant chaotic events will lead to complete and irreversible chaos in the form of death which is the ultimate end point of the Theory of Chaos pursuant to the second law of thermodynamics. With respect to SARS-COV-2 infections in the United Kingdom, on or around February 20, 2020, there was approximately 9 individuals infected with SARS-COV-2. However, on or around February 25, the number of total recorded SARS-COV-2 infections increased to 13. On or around March 1, 2020, approximately 36 cases of SARS-COV-2 infections were being recorded, a tripling of that recorded for February 25, 2020. On or around March 5, 2010, the number of total SARS-COV-2 infections was 116 and the total number of death due to SARS COV-2 infections was 1. On or around March 10, 2020, the number of SARS-COV-2 infections and deaths due to SARS-COV-2 infections went up alarmingly to 383 and 7 respectively. When there was a doubling of cases of SARS-COV-2 infections, the Scientific Leaderships in the United

Kingdom had the duty to implement drastic response strategy, including testing, isolating, hospitalizing and treating infected population, mass population control and isolation.

Pursuant to known characteristics of viral infections [15,16], even though the total number of individuals infected with SARS-COV-2 has apparently reached a plateau in the United Kingdom, unless there is an effective response strategy to prevent deaths due to SARS-COV-2 infections, it is projected that as many as double the number of current deaths due to SARS-COV-2 infections (if not more) is inevitable. There is currently no cure or protocols that will prevent deaths due to clinical complications of SARS-COV-2 infections. The use of Hydroxychloroquine in combination with Azithromycin, Remdesivir, and Famotidine have been touted by various so-called experts and pundits [18-24]. However, it is clear that they are not cures nor do they mitigate deaths as a result of SARS-COV-2 pathologies, including fatal pneumonia, diffuse alveolar damage and cardiac failure and arrest [25-37]. Nor do they provide any relief to symptoms of COVID-19, including fever, coughing, hypoxia, dyspnoea and fatigue. There is one protocol that is relatively easy to implement as all the requirements are currently available [2]. It consists of treating patients infected with SARS-COV-2 in an environment of elevated temperature and humidity, and constant far infrared irradiation, thereby mimicking the natural constraints of SARS-COV-2's viability, infectivity and virulence [2]. It was Lwoff and co-workers who first demonstrated latency in viruses [38,39]. The effect of elevated temperature on the viability, infectivity and virulence of various viruses, including SARS-COV and SARS-COV-2 is well established [2,41-50]. The effect of high humidity on the viability, infectivity and virulence of various viruses, including SARS-COV and SARS-COV-2 is also well established [2,49,50]. The effect of far infrared radiation on the viability of SARS-COV-2 is relatively well established [2,51]. The use of Far Infrared Radiation Therapy is not unlike Radiotherapy first discovered and demonstrated to be effective against cancer by Marie Curie. Protocol for the requirements for the above exists already and can be implemented immediately. United Kingdom has no excuse for its high

number of deaths due to SARS-COV-2 infections and high DP 10000.

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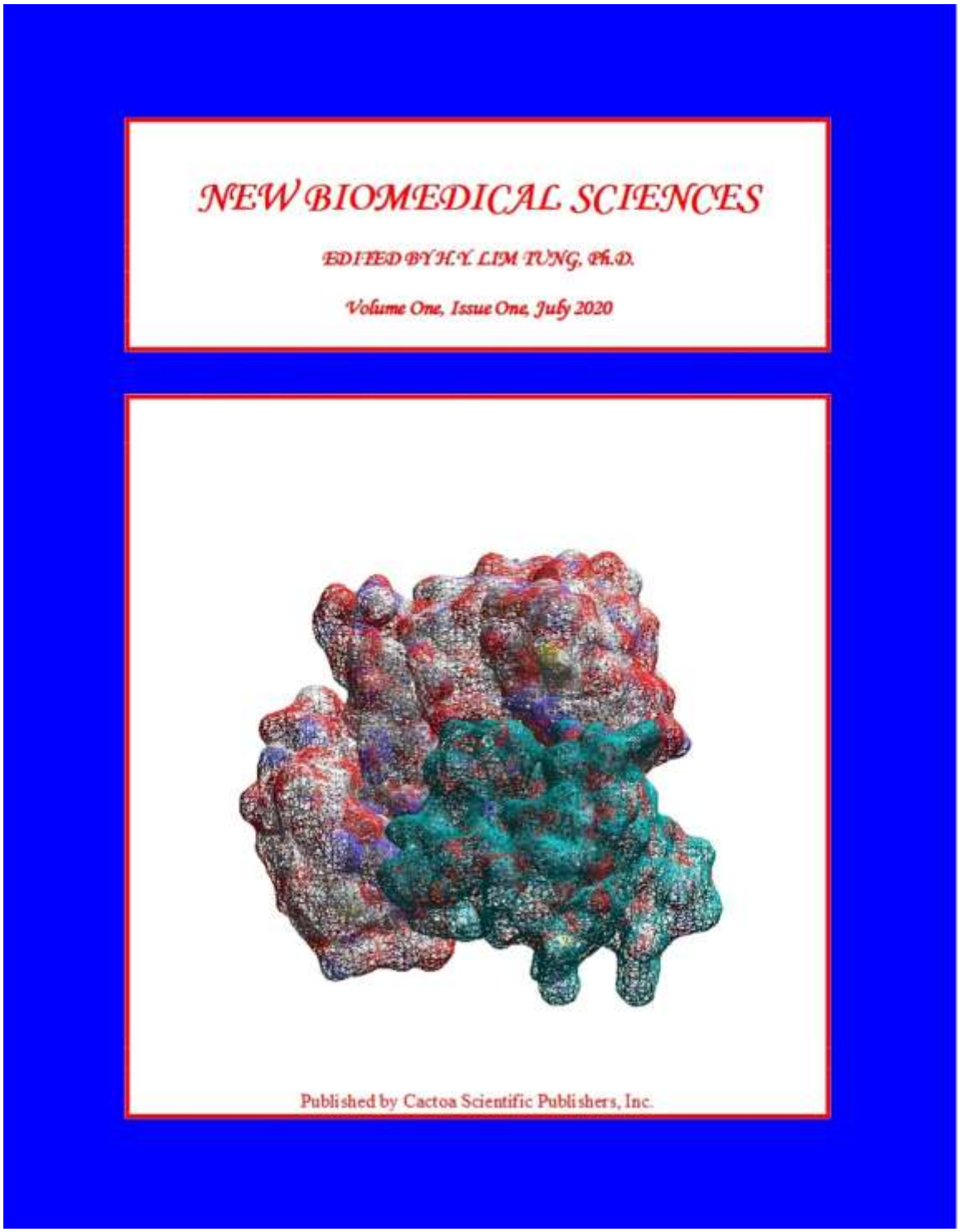
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