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# Science and Suspicion: Maxim Gorky's *Children of the Sun* as a Critical Mirror in Times of COVID-19

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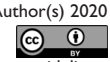
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## Abstract

From a contemporary perspective, the current COVID-19 pandemic is undoubtedly an extraordinary event, but historically speaking pandemics are periodically recurring phenomena and intimately connected with socio-economic processes of globalisation. Therefore, history may serve as a backdrop for coming to terms with the present, by comparing current challenges with previous events that are both sufficiently similar and sufficiently different. In this article, the COVID-19 crisis will be assessed from a humanities perspective, using a pandemic drama entitled *Children of the Sun* (written by Russian novelist and playwright Maxim Gorky in 1905) as a critical mirror. In Gorky's play, the pandemic as a disruptive event reveals a number of tensions and divides, between science and society first of all, but also between socio-economic classes and subcultures, which become interconnected through globalisation but evolve at an uneven pace. Thus, Gorky's drama addresses a number of themes that are still relevant for COVID-19 controversies, such as the relationship between basic and applied research, global competition and vaccine development, science and suspicion, and the socio-economic unevenness between the global North and the global South.

## Keywords

COVID-19, virology, Maxim Gorky, science and literature, philosophy of science, Dialectical materialism

## I. Introduction

Whereas from a contemporary perspective the current COVID-19 pandemic is undoubtedly an extraordinary event, historically speaking there are many telling precedents.

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Pandemics are periodically recurring phenomena and intimately connected with socio-economic processes of globalisation. Therefore, history may serve as a backdrop for coming to terms with the present. In this article, the COVID-19 crisis will be assessed from a humanities perspective, using a pandemic drama written by Russian novelist and playwright Maxim Gorky (1868–1936) more than a century ago (in 1905) as a critical mirror or point of reference. The aim is to understand COVID-19 via 'triangulation': a methodological technique that examines a current phenomenon by comparing it to something else that is both sufficiently relevant *and* sufficiently distant.[1] Via triangulation, the entanglement between us (the subject, the researcher) and the phenomenon at hand is opened up, allowing us to zoom out as it were, studying the phenomenon from a broader perspective, while drama as a genre provides a sufficient level of detail. The COVID-19 pandemic and the interaction between viroscience and society will thus be studied via a literary detour.

Gorky's drama entitled *Children of the Sun*[2] is set during a cholera epidemic that struck Russia in 1862. Cholera, originating in India, has been named the 'classic epidemic disease of the nineteenth century', intimately connected with colonialism, global capitalism and the accompanying ideology of liberalism and progress.[3,4] This particular epidemic (one in a series of seven) affected Russia with a death toll of more than a million. At the same time, it is clear that cholera serves as a backdrop for addressing contemporary events: the tumultuous year 1905 in which the play was written. Maxim Gorky, a Marxist author (whose adopted surname means 'bitter'),[5] uses cholera to address issues such as globalisation, technological innovation and the multiple tensions involved in uneven ('non-simultaneous') socio-economic development. He wrote his play while being imprisoned in the Peter and Paul Fortress (Saint Petersburg) during the 'first' (abortive) Russian Revolution in 1905, charged with inciting the people to revolt. In other words, in a dramatic manner, *Children of the Sun* explores and reflects not only the pandemic experience as such, but also the various similarities between biomedical and ideological 'pandemics': between the spread of infectious biological agents and the proliferation of political ideas, while also highlighting various political efforts to contain them (quarantine, imprisonment, segregation, etc.). Thus, although the drama allegedly narrates events that happened in 1862, the play's atmosphere is remarkably 'Chekhovian' and fin-de-siècle-like.

1. H. Zwart, *Psychoanalysis of Technoscience: Symbolisation and Imagination* (Berlin/Münster/Zürich: LIT Verlag, 2019).
2. M. Gorky, *Children of the Sun*, adapted by Andrew Upton (London: Faber & Faber, 1905/2013).
3. C. Rosenberg, "Cholera in Nineteenth-Century Europe: A Tool for Social and Economic Analysis," *Comparative Studies in Society and History* 8 (1966), 452–63.
4. D. Arnold, "Cholera and Colonialism in British India," *Past & Present* 113 (1986), 118–51.
5. Maxim Gorky, author and political activist, was a founding representative of social realism. In 1905, he joined the ranks of the Bolshevik faction in the Russian Social Democratic Labour Party. He befriended prominent Bolsheviks Vladimir Lenin and Alexander Bogdanov, and tried to reconciliate them during a famous meeting on Capri, arranged by Gorky, who lived there during his exile (W.I. Lenin, "Letter to Maxim Gorky," *Lenin Collected Works* 35 (Moscow: Progress, 1913/1976), pp. 69–72).

In terms of conceptual framework, I will opt for a dialectical materialist reading of Gorky's play. While cholera was symptomatic for the global disruptions entailed in nineteenth-century capitalism and colonialism, COVID-19 challenges and questions current processes of globalisation and the neo-liberal ideology supporting them. Therefore, although the current pandemic is caused by a virus (the SARS-CoV-2 virus) while cholera was caused by a microbe (the Vibrio Cholerae bacterium), from a critical (dialectical) humanities perspective, some striking parallels may nonetheless be noticed between these disruptive events, and triangulation (a historical and literary detour) may help us to come to term with the socio-cultural impact of the current COVID-19 crisis.

## II. Gorky's Drama in Outline

Gorky's drama[6] is set in a stately mansion: the home of a wealthy amateur chemist named Pavel Protasov, who lives there with his wife Jelena and his sister Lisa. Pavel is firmly convinced that progress in chemistry will bring about a better world and that he himself is on the verge of a major breakthrough in understanding the biochemical principles of life. When a cholera epidemic breaks out, however, suspicion quickly spreads among villagers that the disease was either caused by physicians or originated in Pavel's home-made laboratory (as chemical run-off from an unsafe storage tank polluted the water supply). The play ends with an angry mob storming the Protasov mansion, as a local stronghold representing the lifestyle and views of a self-centred, privileged, bourgeois elite.

The drama evolves in a force field consisting of (at least) two dividing lines, separating two cultures from one another, namely the gap between science and society, in combination with an even deeper gap between rural (village) culture and bourgeois civilisation – a topic to that Gorky devoted one of his political essays.[7] As a bourgeois scientist, Pavel Protasov, the main protagonist, is positioned precisely along these two divides. On the one hand, he is completely obsessed with his research and insensitive to what is happening in his immediate environment. On the other hand, we see him struggling with power relationships evolving between himself (as a local Enlightened gentleman) and the uneducated country folk.

Compared to the current COVID-19 crisis, Gorky's drama is both sufficiently relevant and sufficiently different, I will argue, providing the optimal mixture of similarity and contrast required for triangulation. In both cases, the backdrop is a major disruptive event closely entangled with socio-economic processes (e.g. globalisation and technological progress), even if cholera is caused by a microbe and COVID by a

6. This edition of Gorky's play (Gorky 1905/2013) is an adaptation, not a translation, by Andrew Upton, and several significant differences can be noticed between this version and the original one, notably towards the end. More literal translations are available on the Internet, however. I notably consulted the Gutenberg version: *Kinder der Sonne: Drama in vier Aufzügen*, translated by Alexander von Huhn; https://www.projekt-gutenberg.org/gorki/kindsonn/titlepage.html.
7. M. Gorky, "Two Civilisations" (Source: Marxists Internet Archive, 2007). *The Communist International* 2 (1919), 175–78.

virus. Due to these global disruptive events, a series of looming tensions and contradiction suddenly rise to the surface. This notably involves tensions related to what, in Marxist discourse, is known as 'uneven development' or 'the simultaneity of the non-simultaneous' ('Gleichzeitigkeit des Ungleichzeitigen').[8,9,10] Not all people exist in the same Now, not all lifestyles adhere to the same pace. Although virtually all inhabitants of today's global village are interconnected, not all lifestyles adhere to the same developmental pattern. The cholera epidemic revealed, as Maxim Gorky phrased it, the co-existence of incompatible 'civilisations', increasingly close to one another, and yet evolving along diverging paths: the local world of rural existence and the global world of bourgeois civilisation. The topological setting of Gorky's play exemplifies the non-simultaneity of these colliding worlds, and COVID-19, I will argue, likewise emerges in a setting that combines hyper-connectivity with unevenness, thereby revealing and reinforcing profound socio-economic and socio-cultural tensions and contradictions.

## III. Cast and Setting of Gorky's Play

The stately mansion is a 'chronotope':[11] a privileged bourgeois clearing in a small-town, rural ambiance. As indicated, it is the home of the Protasov family and their relatives/acquaintances: a bourgeois inner circle of civilised, well-educated individuals. The place is haunted by the ghost of the father, however, a stern general who once held sway over the local community (the local human herd) as an authoritative father figure, in a top-down manner, whereas the new generation endorses a fairly liberal regime. Once a stronghold of the establishment, the mansion is now remarkably hospitable to a train of invited and uninvited, expected and unexpected visitors. The topology of the play continues to reflect tacit segregation: bourgeois civilisation residing inside the mansion, while rural culture enters the stage from outside the premises. Although everyone speaks Russian, on closer consideration, the representatives of these two cultures do not share the same language nor do they adhere to the same ethos or logic. Due to the open-door policy of the Protasov family, their home becomes a 'heteroglossic' soundscape,[12] where multiple 'languages' are exposed to one another and interact with one another. And yet, the divide remains noticeable, and is bound to resurge in times of crisis (especially in Act IV, when the play reaches its dramatic climax).

In his essay, Gorky describes the unevenness between both worlds as follows. Rural culture (village culture) is cyclical and dominated by physical, hands-on, artisanal labour:

8. M. Gorky (1919); E. Bloch, *Erbschaft dieser Zeit* (Frankfurt am Main: Suhrkamp, 1932/1977).
9. F. Jameson, *Postmodernism, or the Cultural Logic of Late Capitalism* (Durham: Duke University Press, 1991).
10. H. Zwart, "Emerging Viral Threats and the Simultaneity of the Non-Simultaneous: Zooming Out in Times of Corona," *Medicine, Health Care & Philosophy: A European Journal* 23 (2020a), 589–602. doi: 10.1007/s11019-020-09970-3.
11. M. Bakhtin, *The Dialogic Imagination: Four Essays* (Austin: University of Texas Press, 1988).
12. M. Bakhtin, *Problems of Dostoevsky's Poetics* (Ann Arbor: Ardis, 1973).

an existence of interminable toil, a permanent struggle for survival.[13] Bourgeois civilisation, on the other hand, is progressive and exemplified by technical artefacts (neo-things) such as trains, telephones, scientific instruments (microscopes, thermometers, etc.), art works and the like – entities that not only materialise technoscientific ideas but also signify global connectivity (intercontinental mobility and communication). Whereas rural culture is relatively stable, bourgeois civilisation a rapidly proliferating. And whereas village culture (village folklore and poetry) is regional, bourgeois culture (modern arts and sciences) is cosmopolitan. According to Gorky (a Marxist), this unevenness, this contradiction can only be overcome by large-scale technification, mechanisation and collectivisation of agriculture, building on the massive production of machinery.

Let me now introduce the characters in more detail. As indicated, Pavel Protasov is a self-styled chemistry adept for whom the future belongs to Enlightenment and science. He is convinced that only scientific rationality can put an end to poverty, addiction, superstition and ignorance. While old Protasov had been an autocratic general, his son is both reluctant and incapable of playing such a role (governing the local human herd). The two characters most close to him are Jelena (his attractive and well-educated but idle and neglected spouse) and his younger sister Lisa (a patient suffering from a mysterious illness, nicknamed Cassandra because of her gloomy premonitions concerning emerging threats). Lisa is both a prototypical Victorian hysteric and a visionary, and, in fin-de-siècle literature, hysterics often play this role of medium and seeress. She is convinced that the rural masses, full of hatred and anger, are about to revolt against bourgeois culture. She suffers from mass phobia as it were, horrified by the spectre of angry crowds, whose hatred will one day turn against upper-class intelligentsia. The privileged Protasov family inhabits a clearing, she predicts, but one day the malice of the masses will rain down upon them.[14]

Besides chemistry proper, some 'erotic chemistry' is going on as well. Boris (a local vet) is courting Lisa, Vagin (a former science student who deflected to painting) is courting Jelena (and painting her portrait) and Melaniya (a rich widow) is courting Pavel. These liaisons give rise to various comical misunderstandings and *double entendres*. For instance, when Melaniya professes her willingness to do anything for Pavel, the latter indicates that he is in fact desperately in need of fresh eggs (a daily supply of albumin for his experiments), to which Melaniya replies: 'My eggs are yours'.[15]

Beyond this inner circle of individuals who do not have to work for a living, there is a second circle consisting of rural, mostly uneducated characters. Antonovna is Protasov's and Lisa's former Nanny, who tries to keep up the old standards, while closely looking after their health. Yegor is the local blacksmith, but also an alcoholic who harasses his wife. Roman is a servant who notably acts as porter, Feema and Loosha are illiterate maids and Yakov is an alcoholic railway station assistant who happens to drop by. These and other characters are continuously walking in and out of the mansion, so that multiple fragments of storylines interfere with one another. Indeed, Pavel complaints that their once so stately home has become a 'train station'.[16] Beyond this everyday mayhem, a

13. M. Gorky (1919) "Two Civilisations" (Source: Marxists Internet Archive, 2007). *The Communist International* 2: 175–78.
14. Gorky 1905/2013, p. 45.
15. Gorky 1905/2013, p. 14.
16. Gorky 1905/2013, p. 3.

disruptive threat is looming. Notably, bourgeois science is raising suspicion. Many locals are convinced that Pavel is poisoning them and that all physicians are experimenting on them, using them as research subjects.[17] At a certain point, it is discovered that, due to an improperly constructed tank, chemical waste from Pavel's lab is leaking into the water supplies, precisely at the moment when cholera arrives on the scene. Although Yakov (the railway employee) seems to have acted as carrier, the local villagers draw a different conclusion and decide to storm the mansion. The hateful crowd is suddenly battering doctors or anyone else with glasses. This also affects the topology of the scene: the gates are suddenly closed, symbolising the return of the divide that segregates bourgeois civilisation from rural discontent, but the violent upsurge proves difficult to contain. As Protasov is beaten to the ground by Yegor, Jelena brandishes a revolver, facing both Yegor and the advancing crowd. As the curtains drop, gun shots are heard, but the outcome is uncertain. Let this suffice as a concise summary of Gorky's play. To what extent are the dynamics at work in it still relevant today? What lessons can be drawn from Gorky's play?

## IV. Extrapolation Towards the Present (Methodology)

What can we learn from the vicissitudes of the Protasov household when speaking about the present? How to bridge the (apparently quite substantial) distance between cholera in pre-revolutionary Russia and COVID-19 today?

First of all, according to the logic of dialectics – developed by Hegel and taken up by Marx and Engels, who initiated the materialist turn – three levels of analysis should be distinguished:

a) the level of *concrete* details (where words or gestures, seemingly idiosyncratic, may nonetheless prove symptomatic for what is actually at stake);
b) the level of *particular* circumstances (a disruptive event emerging in Russia in a fin-de-siècle ambiance); and finally
c) the *general* level: the basic dialectical dynamics of disruptive challenges.

Although we are primarily interested in how the *general* dynamics of the dialectical process is fleshed out in Gorky's drama, some of the more *concrete* details ('Einzelheiten') of the play may nonetheless prove significant, while the *particular* circumstances must always be kept in mind.

On the basic (general) level, a dialectical pattern can be discerned. Here, the dramatic action evolves from a situation of relative stability (the first moment), via an episode of growing tension and collisions (the second moment: the 'negation'), towards a position of regained stability, on a higher level of complexity (the 'negation of the negation'). According to Pavel Protasov, this 'third moment' (the reconciliation stage) can only be achieved with the help of science. Thanks to science, it will be possible one day to produce clothes from wood fibres

17. YEGOR: 'My wife is very sick. . . She's been vomiting all morning'. BORIS: 'Call a doctor. . ..'. YEGOR: 'No doctors. Doctors are the problem, experimenting on us all' (Gorky 1905/2013, p. 59.).

and all diseases can be cured. But this is still something for the future, and not attainable as yet. In other words, Pavel's idea of progress is framed along decidedly utopian lines.

During the second moment (of collision or negation), a number of tensions or dividing lines become noticeable, which were already discernible from the very beginning but in a fairly subdued and implicit manner. As indicated, I will focus on two dividing lines already outlined above: first of all, the tension (estrangement) between science and society, and second, the tension between rural ambiance and bourgeois civilisation. As Gorky's drama is emphatically open-ended, the 'third moment' after the climax (the moment of reconciliation and denouement) remains a question mark.

(a) *Concrete* details of the play (phrases, gestures, personal affinities and antipathies, idiosyncratic character traits)
(b) *Particular* circumstances (time and place, Russia during the fin-de-siècle era
(c) *General* dynamics (dialectical pattern: a disruptive event reveals implicit divides/areas of conflict, estrangement and collision, e.g. between science (chemistry) and society, as well as between rural culture and bourgeois civilisation, evolving into a climax (the anti-bourgeois/anti-science revolt)

On the basis of this methodological scheme, the extrapolation towards the present will consist of three steps. First of all, focussing on Pavel Protasov (the main protagonist of the play), I will start with exploring the *concrete details* of his research practice. From the point of view of contemporary research, I will argue that Pavel's tinkering with eggs, algae and boiling water is not as weird and misguided as it initially may seem. Subsequently, I will focus on one *particular aspect* of the science–society interaction that is explicitly played out in Gorky's drama (and still highly relevant for viroscience today), namely the relationship between basic and applied research. Finally, I will discuss the *general message* of the play, the relationship between science and suspicion, using Gorky's drama as a mirror to further our understanding of the COVID-19 pandemic. But first, I will zoom in on Pavel's laboratory work.

## V. Protasov's Research: Some Telling Details

Protasov is first of all a gentleman-scientist, as we have seen, incessantly tinkering with formulae, technical neologisms and glass retorts. Having transformed his study into a laboratory, he still needs more space for his work, so that the living room is gradually turned into a laboratory as well, filling up with Bunsen burners, obnoxious smells and unhealthy fumes. He is obsessed with what he refers to as 'pure' science. When a local merchant proposes a plan to establish a chemical factory for producing perfumes and soaps, Protasov is not interested at all, stating that applied research is boring. His objective is to understand the principles of life as such, although he is convinced that, eventually, the benefits of his work will 'trickle down' into society somehow.[18] Somewhere in

18. Gorky 1905/2013, p. 47.

the future, waistcoats and underwear will be made out of pinewood fibres, as a result of his enquiries.[19]

As indicated, Protasov is an outspoken protagonist of liberalism and Enlightenment. He considers all human individuals as rational responsible subjects and treats all individuals as equals. This endorsement of democratic tendencies is very much against the will of Antonowna, who complains that in the past, real gentlemen did not even speak to their servants: they only gave orders. Although, in terms of ethical super-structure, Pavel presents himself as a *disinterested* researcher and a supporter of Enlightenment, a socio-economic base (a *power* dimension) is nonetheless at work. The 'material' power dimension of his research is clearly noticeable in Pavel's relationship with Yegor, a blacksmith and violent alcoholic. Antonowna urges Protasov to scold Yegor for mistreating his spouse, but Protasov feels uneasy about playing such a role. Telling right and wrong is not his profession, he explains. Instead of calling him to order, it soon becomes clear that Protasov is highly dependent on Yegor's artisanal skills. He direly needs a new storage tank, with a copper lining to contain the run-off from his experiments, and only Yegor has the dexterity to produce this. Their relationship parodies Hegel's dialectic between Master and Servant. Although formally speaking, the Master is in charge of the situation, he actually becomes increasingly dependent on the know-how of the servant, who becomes increasingly powerful as a result. And the day will come when the Servant will ask himself why Masters are needed at all. At that point, the emancipatory process will be completed, and revolution will be imminent.

Pavel Protasov is presented as an idealist, completely devoted to furthering science, but also as someone who is completely insensitive to what is happening to others. While Melaniya (his devotee) adores his 'purity of character', others interpret his absent mindedness as selfish. He is fully absorbed in his work, seeing all other human beings either as service provides for his projects or as disturbing factors. Or he sees them as research subjects (providing opportunities for studying the effects of alcohol on the brain, for instance). For Protasov, a failed experiment is a much bigger tragedy than either adultery or a cholera outbreak.

What exactly is Protasov doing in his laboratory? At first sight, it is not at all clear what he is up to, although we are told that he is interested in disclosing the secret of life. In his own words, he wants to understand how, billions of years ago, under the warming rays of the sun, an inconspicuous, shapeless lump of proteins developed into life and multiplied. In short, he is interested in producing artificial life in his laboratory. He wants to understand how a chemical process at a certain point becomes self-sustaining. He wants to find out how the decisive move was once made from chemistry to biochemistry. As to his ingredients, we are told that he needs daily supplies of fresh eggs (albumin) and boiling water, and that he is studying simple life forms under the microscope (notably

19. Gorky 1905/2013, p. 44. Pavel's 'utopian impulse' (F. Jameson, *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions* [London & New York: Verso, 1991]) has evolved from utopia to science, as wood fibres are currently used for the production of sustainable textiles (J. van Dam, "Environmental Benefits of Natural Fibre Production and Use," *Proceedings of the Symposium on Natural Fibres* (2009) http://www.fao.org/3/i0709e/i0709e03.pdf).

algae and yeast). And we are also told that he just finished an experiment involving cyanic acid in the mixture.[20]

If we consider these hints from the point of view of contemporary science, they are sufficient to solve the puzzle. Although cyanide is a deadly poison, many origin-of-life researchers are nowadays convinced that hydrogen cyanide (HCN) played a decisive role in prebiotic chemistry.[21,22] According to contemporary experts, HCN was once involved in synthesising amino acids and nucleobases, the building blocks of proteins and nucleic acids. Indeed, cyanide (a lethal poison) was probably an essential compound for building the molecules of life. Reactions between water and HCN (also known as Prussian acid) may have created the forerunners of RNA. Pavel is trying to find out how albumin emerged out of prebiotic chemical reactions. In the 1870s and 1880s, Friedrich Engels already predicted that, one day, scientists will try to produce albumin artificially (in vitro) in their laboratories,[23] and this is exactly what Pavel aims for.

In 1953, the famous Urey−Miller experiments demonstrated that HCN may have been formed in the atmosphere of primal (Hadean) Earth, and this was the paradigmatic commencement of contemporary origins-of-life research.[24] According to the RNA World hypothesis, life on Earth originated from self-replicating ribonucleic acid (RNA) polymers, but it all began with aqueous HCN as an important component of prebiotic chemistry. In laboratories today, the Urey–Miller experiments are complemented and enhanced by computational approaches.[25] While traditional in vitro approaches (of the Urey–Miller type) can only study the synthesis and behaviour of a limited number of molecule types, prebiotic random chemistry scenarios are now studied with the help of computational methods, performing rapid, computer-based simulations of prebiotic evolution. Precisely this development inspired Dan Brown's recent novel *Origin*, by the way.[26,27]

One of the outcomes is that, as the primordial earthy atmosphere was both warm and fumy, life must have originated under the influence of thermochemistry (high temperature) rather photochemistry (sunlight). HCN may have created RNA-like components in water at a temperature close to, but not exceeding 100 °C. And this is where Pavel's boiling water come in. In Pavel's lab, the water should likewise be close to, but not exceed

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20. Gorky 1905/2013, p. 21.
21. T. Das, S. Ghule, K. Vanka, "Insights Into the Origin of Life: Did It Begin From HCN and $H_2O$?" *ACS Central Science* 5 (2019), 1532–40. doi: 10.1021/acscentsci.9b00520
22. C. Matthews, "The HCN World: Establishing Protein – Nucleic Acid Life via Hydrogen Cyanide Polymers" In: *Origins: Cellular Origin and Life in Extreme Habitats and Astrobiology* 6 (2004), 121–35. doi: 10.1007/1-4020-2522-X_8
23. H. Zwart, "Friedrich Engels and the Technoscientific Reproducibility of Life: Synthetic Cells as Case Material for Practicing Dialectics of Science Today," *Science & Society* 84 (2020b): 369–400.
24. S. Miller, H. Urey, "Organic compound synthesis on the primitive earth," *Science* 130 (1959), 245−51.
25. B. Shenhav, D. Lancet, "Prospects of a Computational Origin of Life Endeavour," *Origins of Life and Evolution of the Biosphere* 34 (2004), 181–94.
26. D. Brown, *Origin* (London: Transworld / Penguin / Random House, 2017).
27. H. Zwart, "From Decline of the West to Dawn of Day: Dan Brown's *Origin* as a Diagnostic of the Present." *Janus Head* 18 (2020c), 55–66.

the 100 °C. If the water starts to boil, the experiment miscarries.[28] In short, although from a dramaturgical perspective Pavel may seem a rather clumsy and comical figure (the stereotypical absent-minded, unworldly and unpractical professor), scientifically speaking he evidently knows what he is doing. In retrospect, he was on a promising track, studying the origin of life from three perspectives: (a) exploring the biochemical composition of albumin (proteins), (b) determining the composition and behaviour of simple life forms (yeast and algae) and, on top of that, (c) conducting Miller–Urey-like experiments *avant-la-lettre*, involving cyanide, fresh eggs, malodorous fumes and lots of boiling water.

Although all this is basic research, societal benefits are nonetheless expected to result from it somewhere in the future. Indeed, according to Pavel, illness, hunger and other afflictions will become something of the past, if only people would stop disturbing him and his work. Although his research does not immediately serve a purpose, benefits may 'trickle down' into society in the form of a plethora of medical advances or industrial applications.[29] In the next section, I will argue that this tension between basic and applied research is still very much alive in contemporary discourse. Dialectically speaking, it is one of the 'contradictions' of modern science that remains unresolved as yet.

## VI. Basic and Applied Research

Scientific research has evidently developed quite dramatically since the 1860s/the fin-de-siècle epoch in terms of pace and scale. Research, once conducted by solitary gentlemen such as Pavel, evolved into a global research enterprise, while Bunsen burners and glass retorts became marginalised by high-tech computational contrivances (in silico research). Pavel's amateurish efforts are obfuscated by global networks of laboratories currently involved in the search for the origins of life and other basic research programmes.[30]

And yet, besides distance, there is continuity and similarity as well. This notably involves the dichotomy between basic ('pure') and applied research as played out in Gorky's drama. Dialectically speaking, this dichotomy is posited, but also questioned and, to some extent, 'superseded' in *Children of the Sun*. On the one hand, Pavel vehemently claims to be solely interested in pure research concerning the building blocks of life. At the same time, paradoxically perhaps, he is convinced that, one day, these basic research efforts will prove more beneficial to society than anything 'applied' chemistry has to offer (perfumes and soap). Science will become a 'sun', providing humans with energy and life (hence the title of the play). And these future (utopian) prospects legitimise his investments.

As Friedrich Engels[31] already argued, from a dialectical perspective, the idea of disinterested ('pure') research (the *l'art pour l'art* approach to science endorsed by Protasov) is an

28. "BORIS: "your experiment is boiling!". PROTASOV: "It mustn't boil. . . It's spoiled! I'll have to start again" (Gorky 1905/2013, p. 7).
29. Gorky 1905/2013, p. 47.
30. https://www.origins-center.nl (accessed 2 August 2020).
31. F. Engels, *Herrn Eugen Dührings Umwälzung der Wissenschaft (Anti-Dühring). Marx Engels Werke XX* (Berlin: Dietz Verlag, 1878/1962), pp. 1–103.

ideological 'bourgeois' stance, obfuscating the extent to which 'pure' science is inherently driven by a will to control life and nature.[32] For Engels, the concept of 'pure' knowledge is a bourgeois fiction. Sooner or later, basic insights may have tremendous consequences for the metabolism between human society and nature, while 'applied' research, precisely because of its practical and interactive nature, may raise very fundamental questions in its own right.

In fact, virology as a discipline exemplifies this interaction (this 'interpenetration', as Engels calls it) between basic and applied research. On the one hand, virology emerged against the backdrop of the industrialisation of agriculture, where viruses (as invisible, rapidly evolving infectious agents) posed a serious obstacle to technological and economic progress. It is no coincidence that virology began with the discovery of the tobacco mosaic virus. In 1879, the German scientist Adolf Mayer, working in the Netherlands, began studying tobacco mosaic disease, which threatened tobacco crops, while similar enquiries were conducted by Dmitri Ivanovsky in Russia in the 1990s, resulting in the formal discovery of viruses by Martinus Beijerinck in Delft in 1898.[33] Likewise, 'phage' research (*bacteriophage* = bacterium-eating virus) began as an effort to develop vaccines against infectious microbial disease against the backdrop of World War I.[34]

Soon, however, viral research became detached from its practical context and was redefined as basic research par excellence. Bacteriophages proved the perfect laboratory model for 'disinterested' basic research into the molecular building blocks of life (by Max Delbrück and others), resulting in the emergence of molecular biology and the discovery of the structure of DNA in 1953.[35] And viruses also play a crucial role in contemporary origins–of–life research, where the 'virus-first hypothesis' claims that viruses evolved from proteins and nucleic before the first microbial cells appeared, thereby contributing significantly to the emergence of cellular life.[36] In other words, although the type of experimental practice conducted by Pavel became obsolete because of the current merger of computing and biology (resulting in bioinformatics or computational biology as an inevitable dialectical 'synthesis'), his research *questions* are still very much alive. Dialectically speaking: if we consider the dichotomy between 'pure' and 'applied' research from this perspective, we may safely conclude that *interpenetration* is its 'truth'. In the era of Next Generation Sequencing, viroscience quite easily shifts from basic research (e.g. origins-of-life research) to applied research (e.g. vaccine development) and back. The same technologies and paradigms are applicable in both arenas of inquiry. Funding *basic* viroscience is considered an indispensable part of strategies to foster anticipatory preparedness for the next pandemic.

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32. Engels (1878/1962); Zwart 2020b.
33. K. Scholthof, "Tobacco Mosaic Virus: The Beginning of Plant Pathology," *APS Net Features* (2008). doi: 10.1094/APSnetFeatures-2008-0408.
34. H. Zwart, "Phage–Ethics: Reading of Sinclair Lewis's *Arrowsmith*." In: *Tales of Research Misconduct: A Lacanian Diagnostics of Integrity Challenges in Science Novels* (Library of Ethics and Applied Philosophy 36. Dordrecht: Springer, 2018), pp. 119–40.
35. H. Zwart, "From Playfulness and Self-Centredness via Grand Expectations to Normalisation: A Psychoanalytical Rereading of the History of Molecular Genetics." *Medicine, Health Care & Philosophy: A European Journal* 16 (2013), 775–88.
36. L. Villarreal, *Viruses and the Evolution of Life* (Washington: ASM Press, 2005).

A similar argument can be made for a closely related discussion concerning science and society fleshed out in Gorky's drama, namely the idea that the accomplishments of basic research will eventually 'trickle down' to benefit society at large. This dispute is likewise still relevant today. Should global research be organised in such a manner that the science–society divide can be sublated and urgent societal challenges (such as disruptive viral pandemics) will be explicitly addressed? Or should funding agencies rather give carte blanche to the research performing organisations themselves, in the expectation that, somehow, social benefits will come from their work sooner or later, albeit often via unexpected and serendipitous pathways? Famous examples of unanticipated applications of basic research projects are the WorldWideWeb (which originated at CERN) and magnetrons (as a by-product of space research) – where CERN and space research obviously represent very expensive instances of 'pure' research. In short, the trickle-down theory of science, voiced by Pavel Protasov, is still defended today. Moreover, this theory is intimately linked with a socio-economic divide that defines the current global landscape, namely the divide between the global North and the global South. Against this backdrop, the trickle-down approach contends that, paradoxically, the best way to empower the global South in addressing its societal needs is to concentrate resources and facilities for research in the global North. This will produce the best science, whose results and impacts will then 'trickle down' to the global South. This view is becoming increasingly controversial, however. Critics[37] actually notice the opposite effect, namely that research priorities tend to focus on the needs of the North (addressing health challenges involved in cancer and aging for instance) while encouraging a brain drain of talented researchers from the global South to research environments in the North.

This dispute is directly relevant for global viroscience, for instance in the context of disagreements concerning the Nagoya Protocol on fair and equitable use of genetic resources (including viral pathogens). The Nagoya protocol aims to promote fair and equitable sharing of benefits derived from the use of genetic resources. In December 2006, Indonesia challenged the fairness of global preparedness by refusing to share samples containing avian influenza viruses (H5N1), concerned that viral data would become an exploitable resource, so that wealthier countries would ensure access to vaccines while creating cost barriers for others. In other words, while global viroscience requires the monitoring, identification and sharing of viral samples on a global scale, Indonesia invoked sovereign ownership of viral samples that were procured in its territory.[38] Although formally this is a ('super-structural') debate over ethical and legal principles, we can only genuinely discern what is at stake when the socio-economic base (the power dimension) is taken into account. Viral bio-information may become subject to commodification, so that a limited number of global players may claim ownership over massive amounts of data produced by millions of individuals, who subsequently will have to buy the products of digital commodification on the global market.

37. D. Reidpath, P. Allotey, "The Problem of 'Trickle-Down Science' From the Global North to the Global South," *BMJ Global Health* 4 (2019), e001719. doi:10.1136/ bmjgh-2019-001719
38. L. Gostin, A. Phelan, M. Stoto, J. Kraemer, K. Reddy. "Virus Sharing, Genetic Sequencing, and Global Health Security," *Science* 345 (2014), 1295–96. doi: 10.1126/science.1257622

COVID-19 is evolving in a similar force field. While global competition initially focussed on the mouth masks as a scarce but relatively low-tech resource, the focus now shifts to the (scientific and legal) quandaries of vaccine development. Here again, normative ('super-structural') issues can only be adequately addressed if the interpenetration of knowledge, ethics and power (of normative super-structure and socio-economic base) is duly acknowledged. The means of knowledge production, more concretely, the means of *vaccine production*, are concentrated within companies and universities in the West, although China is becoming a formidable competitor on this front as well. Symptomatically, in the United States, the FBI and the Cybersecurity and Infrastructure Security Agency (CISA) recently claimed that Chinese hackers were attempting to steal 'valuable intellectual property' (i.e. coronavirus data on vaccines) from research performing organisation in the West.[39] Although global science allegedly benefits from an ethos of sharing and global collaboration[40,41] – i.e. the open house policy, in terms of Gorky's play – we notice an increase of tension, notably between the United States and China, resulting in a sudden closure of the fences, in the form of 'vaccine nationalism'. This latter policy, it is argued, may prevent vaccines (as a scarce resource) from being fairly distributed worldwide, so that low-risk people in rich countries may receive the vaccine while health care workers in the global south do not.[42] As soon as the first COVID-19 vaccines get approved, a staggering global need will be confronted with limited supplies. While laboratories in the global North are mobilising significant parts of their research capacity for vaccine development, allegedly to the benefit of humankind, why not allow the global South a more active role, not solely as future consumers, but also as developers and co-producers of vaccines?

## VII. The Dialectics of Suspicion

A third important lesson from Gorky's drama concerns the way in which science in general (and viroscience in particular) gives rise to both visionary (utopian) enthusiasm and chronic suspicion. Outside his privileged premises, Pavel's work (involving cyanide, chemical waste and hazy fumes) becomes an issue of concern, as we have seen. A link between Pavel's tinkering and the suddenly emerging cholera pandemic is easily made. Although it seems more plausible that Yakov (a wandering railroad employee) acted as carrier – railroads exemplify connectivity and acted as conduits for communicable

39. https://www.voanews.com/covid-19-pandemic/us-says-china-trying-steal-covid-19-vaccine-research US says China trying to steal Covid 19 vaccine research (2020) (accessed 2 August 2020).
40. https://www.oecdvoha.org/coronavirus/policy-responses/treatments-and-a-vaccine-for-covid-19-the-need-for-coordinating-policies-on-r-d-manufacturing-and-access-6e7669a9/ OECD, Treatments and a vaccine for COVID-19: the need for coordinating policies on R&D, manufacturing and access (2020). (accessed 2 August 2020).
41. https://www.who.int/news-room/detail/13-04-2020-public-statement-for-collaboration-on-covid-19-vaccine-development WHO, Public statement for collaboration on COVID-19 vaccine development (2020). (accessed 2 August 2020).
42. K. Kupferschmidt, "'Vaccine Nationalism' Threatens Global Plan to Distribute COVID-19 Shots Fairly," *Science* (2020, 28 July). doi:10.1126/science.abe0601

disease – rumours are quickly spreading that the epidemic originated in Pavel's home-made lab.

Similar instances of suspicion and discontent can be witnessed today. Mass protests against research facilities (allegedly established for the benefit of humankind) remains part of the mixture. Take, for instance, the fierce protests against the establishment of an Ebola screening facility in Macenta, Guinea, which was besieged by a hostile crowd in 2014.[43] The Macenta event likewise revealed a discrepancy between 'non-simultaneous' local and global understandings of health and disease. Whereas viral experts aimed to develop effective responses to what they perceived as global risks, local responses rather perceive international researchers as disruptive intruders and spreaders of disease.

An even more telling example, of course, are the suspicions directed as the Wuhan Institute of Virology (WIV), the *locus suspectus* where COVID-19 allegedly started, according to powerful public voices, including US President Donald Trump. Although experts consider the possibility that COVID-19 originated in Wuhan's virology lab 'improbable;, additional data may nonetheless 'swing the balance of evidence'.[44] According to the logic of suspicion, viral research (tinkering with lethal viral samples in test tubes) itself may have actually unleashed the pandemic. Although most experts are doubtful about this scenario, President Trump and a plethora of social media sources think otherwise. Like Protasov's mansion, the Wuhan lab is under siege. Shi Zhengli, the Chinese scientist whose group studied bat coronaviruses at the WIV, and therefore received the nickname 'Bat Woman', recently commented on theories that the novel coronavirus (SARS-CoV-2) originated in or was leaked from her lab. In an e-mail interview with *Science* (15 July 2020), Shi said that the virus was first detected by her lab in late 2019, in samples from patients who had a pneumonia of unknown origin. The claim that SARS-CoV-2 was leaked from her institute contradicts the facts, she said, while jeopardising the academic work of her team. Still, with WIV located in the city where the pandemic began, the theories have not been silenced. President Trump's first response to the corona pandemic was quite in line what happened in Gorky's drama: shut the fences and reaffirm the inside–outside (us versus they) topology.

Like Pavel Protasov, the current global neo-liberal elite may for a number of decades have believed that the future was theirs. The concept of uneven development does not necessarily entail that history moves in a linear direction, however, or that the triumph of neo-liberalism during the 1990s finally heralded the end of history.[45] In fact, in the wake of the corona crisis, neo-liberalism may actually become something of the past rather than the future. As Marx pointed out, global capitalism displays the tendency to impose simultaneity (synchronicity), seeing non-simultaneity as a *contradiction*: something which must be overcome. From a dialectical perspective, however, the pathway towards the future may take unexpected turns. In Gorky's drama, although bourgeois civilisation seemed the inevitable future (in contrast with rural discontent), developments were about

43. J. Fairhead, "Understanding Social Resistance to Ebola Response in Guinea (2015)." http://www.ebolaanthropology.net/evidence/1269/ (download 16 September 2015)
44. K. Andersen, A. Rambaut, W. Lipkin, E. Holmes, R. Garry, "The Proximal Origin of SARS-CoV-2," *Nature Medicine* 26 (2020), 450–55.
45. F. Fukuyama, *The End of History and the Last Man* (New York: Free Press, 1992).

to take a dramatic turn. In Act IV, the revolt of the masses envisions cholera as symptomatic for the logic of bourgeois existence as such. Something similar may apply to the current situation. Although from a neo-liberal perspective, hyper-connectivity and globalisation (in combination with viroscience as an immunisation device) may seem an 'inevitable' future, developments may take an unexpected turn and the future may actually look quite different. In response to COVID-19 and other erupting symptoms of crisis, local production, regional self-sufficiency and reduced mobility (in short: a massive shift towards sustainability) may prove a more likely scenario.

## VIII. Concluding Remarks

Although in times of crisis the overall tendency (among policymakers, academics and mass media) will be to *zoom in* on concrete challenges and solutions, critical reflection requires us to *zoom out* by considering the broader historical, socio-economic and political ambiance. In this paper, zooming out was achieved via triangulation, and Gorky's drama proved both sufficiently relevant *and* sufficiently distant for our purposes. Cholera and COVID-19 are symptomatic pandemics, reflecting processes of globalisation (colonisation in the nineteenth century; global neo-liberalism in the early twenty-first century), and both pandemics involve grave economic and political impacts, ranging from quarantine, lockdowns and other forms of societal freezing up to political disruption.

Both pandemics reveal dividing lines, as we have seen: between science and society, but also between global civilisation and local culture. Pavel Protasov enacts an epistemic divide separating 'pure' (basic) science from other forms of knowledge, notably practical (hands-on) know-how. His utopian (bourgeois) ideology entails the belief that, in the future, science and technology will allow us to solve all societal tribulations. Therefore, superstition and suspicion should by overcome by rationalism and Enlightenment. On closer inspection, however, rural suspicion is more rational than it seems (intuiting the intimate interconnectedness between bourgeois civilisation – mobility, colonisation, etc. – and the global pandemic), while Protasov's own convictions are less rational (more ideological and utopian) than he realises. Therefore, to bridge the science–society gap, rather than science communication (bent on fostering science literacy among the scientific illiterate) we need a *different kind of science*: more comprehensive and more sensitive to socio-cultural contexts – a science that acknowledges and addresses the social, cultural and political dimensions of research areas such as microbiology and virology.

Whereas science in general and viroscience in particular tend to present themselves as politically 'neutral', anti-science suspicion is symptomatic of the extent to which outsiders may see science as part of the current drive towards globalisation and global competition. Viroscience should not only address the symptoms, but opt for a more systemic and comprehensive approach. The socio-economic base (the global system of production and distribution) should be taken into consideration as well. Besides screening and vaccine development, viroscience should also reflect on its role from a historical, socio-economic and political perspective. Like cholera in the nineteenth century, COVID-19 is symptomatic of the tensions and contradictions of the current socio-economic system. Global society does not constitute 'one world'. Rather, viruses and viroscience co-evolve in a political force field defined by socio-economic divides. Therefore, a comprehensive

approach requires intense collaboration and mutual learning, between disciplines first of all (so that virologists, historians, philosophers, legal experts and others should learn to collaborate) but between science and society as well. Bridging the science–society divide is important, but it cannot be detached from considering the challenges involved in uneven development. Anticipating the socio-economic backdrop and impact of research should become an inherent dimension of scientific practice.