‘Every beginning is difficult, holds in all sciences’ Marx on the Economic Cell Form of the Capitalist Mode of Production

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Abstract: Marx and Engels followed the natural sciences closely and held that there was only one science: history, embracing nature and society. This contribution notes the influence of Darwinism, thermodynamics and cell biology in Marx’s critique of political economy and examines the least-discussed of these influences: cell biology. For Marx eventually settled on the value-form of the commodity, described as the economic cell form of the capitalist mode of production (CMP), as the starting point for *Capital*. At stake here is Marx’s deep interest in the natural sciences and the role of analogy and metaphor as sources of scientific inspiration in a period when major advances were being made in cell biology among other scientific fields. It then asks whether the discussion of the methods of political economy adumbrated in the 1857 «Introduction» adequately anticipates Marx’s method in *Capital.* It does not: cell biology suggested another method. Accordingly, it identifies six parallels between cell biology and Marx’s analysis of the CMP and explore the heuristic and epistemological implications of beginning with the commodity as the elementary form of the capital relation. Nonetheless, these parallels affect the process of discovery more than the substantive focus of Marx’s research or the order of presentation, where Hegelian influences remain. The contribution also reflects on the theoretical and political limits of metaphors drawn from the natural sciences in the critical analysis of social formations and their social transformation. It ends with some general conclusions on discovery, methods, and the logical-historical method of presentation.

Keywords: Capital; Cell Form; Commodity; Metaphor; Method.

1. Introduction

Writing on 19th-century scientific developments, Engels noted that Feuerbach (1804-1872) «had lived to see all three of the decisive discoveries

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1 Pradip Baksi sent me relevant historical material as I was preparing this article; it was also stimulated by reading Han (1995). I discussed the ideas with Moishe Postone at a colloquium on Marx’s *Capital* at 150 years in York University, Toronto, May 2017. Riccardo Bellofiore careful reading of the first draft led me to clarify some points. Remaining errors are mine.

– that of the cell, the transformation of energy, and the theory of evolution named after Darwin» (Engels 1990, 372). The same holds, of course, for Karl Marx (*1818-†1883) and all three are taken up in his analysis of the capitalist mode of production in the first volume of *Capital*.

The most discussed of these three discoveries in commentaries on Marx's work is Darwin's theory of evolution. In the *Preface* to the first German edition of *Capital I*, Marx described how «the evolution of the economic formation of society is viewed as a process of natural history» (Marx 1996, 10; cf. Afterword 1996 to the second German edition, 18). He proceeded to identify analogies between natural selection and the evolution of tools and technology in the division of labour (Marx 1996, 346; cf. 489-491). And he interpreted competition as a crucial mechanism of natural selection in relations among those «hostile brothers», individual capitalists, in whose competition, «one capitalist always kills many» (Marx 1998, 252 and 1996, 750).

Thermodynamics and energetics became an important influence in Marx's critique of political economy. According to Anson Rabinbach (1990), Marx appropriated the concept of «*Arbeitskraft* (labour-power)» from the physicist Hermann von Helmholtz (e.g., 1847). This was a key innovation in Marx's analysis of labour-power as well as machinery, especially of human labour and machines as alternative forms of motive power (Marx 1996, 378 ff.). Moreover, as John Bellamy Foster and Paul Burkett note, thermodynamics also provided the foundations for an ecological economics (2008, 3).

The significance of cell biology is the least discussed of the three scientific above-mentioned discoveries in relation to Marx's work. This could be because commentators are less familiar with its background, especially as, apart from an explicit reference in his magnum opus to the commodity as the economic cell-form of the capitalist mode of production, clues are scattered in published correspondence and dispersed among other metaphors and analogies in relevant preparatory and published texts. Cell biology also tends to be subsumed into Marx's more general interest in physiology and its relevance to anthropology and land economy[2] and, as far as metabolism (*Stoffwechsel*) is concerned, could be conflated with the influence of thermodynamics, which took the term over from cell biology. Moreover, his interest in cell theory belongs more to the *discovery* phases (the role of analogies and metaphors as heuristic devices) than to the more systematic *re-*

2 For example, Schleiden and Schmid (1850), annotated by Marx, considered, *inter alia*, the relevance of plant and animal physiology to land economy.

search or logical-historical *presentation* phases[3] of his developing critique of political economy; and, in this regard, the relevant excerpt notebooks have not yet been published in the *Marx-Engels Gesamtausgabe* (*MEGA²* IV-10, IV-18, and IV-22/23). The volume of excerpts and marginalia is also smaller than for mechanics, chemistry, agriculture, etc. (Griese and Sandkühler 1997). Another possible reason for neglect of the influence of cell biology is that Marx more often refers to the commodity as the «elementary form» of the capitalist mode of production (CMP). While this evokes the idea of the cell form as the elementary unit of organic life, it is less explicit and therefore easily overlooked. Further, given that Marx also employs many other analogies, similes, and metaphors drawn from the natural sciences, humanities, and literature, the role of cell theory as a heuristic device and extended metaphor can disappear among a plethora of other references. An example is «metabolism». This concept figures in agronomy and is vital to Marx's account of metabolic rift (Foster 2013). But it originated in cell biology (Pawelzig 1997 and Angus 2018) and Marx applied it in this sense to industrial production and the circuits of capital. This dual use obscures its important links to cell biology.

2. Method in Political Economy

In the *Preface* to the first German edition of *Capital, Volume I*, Marx (1996, 7) wrote: «every beginning is difficult, holds in all sciences». This refers in the first instance to the difficulties that he anticipated that his readers might have with the opening chapters (1996, 7), which he reworked several times and across different editions. It could also refer indirectly to the difficulties that the Physiocrats and their opponents found in establishing the starting point of political economy. For, as Marx observed in the *Grundrisse*:

> The crucial issue was not what kind of labour creates *value* but what kind of labour creates *surplus value.* They were thus discussing the problem in a complex form before having solved it in its elementary form; just as the historical progress of all sciences leads only through a multitude of contradictory moves to the real point of departure. (1987b, 297)

Marx's quest for an entry-point also involved many contradictory moves. Thus, his comment could also refer to his own difficulties in finding

3 These phases are not sequential and linear but overlap and interact.

the right starting point for his critique of the categories, practices, and dynamic of political economy.

These challenges pervaded not only the method of research but also the method of presentation that was appropriate for reproducing the real-concrete as a concrete-in-thought. *A fortiori*, this also concerned the interweaving of phases of research, drafting, and final editing. Marx discussed method in political economy in the 1857 *Introduction*, which juxtaposes two approaches that ultimately do not seem to figure in *Capital*.

The first approach starts with a real and concrete precondition of production that remains an empty phrase, amounting to a chaotic conception of the «whole», until it has been decomposed into its simplest determinations and then recomposed, this time as «a rich totality of many determinations and relations» (Marx 1986a, 37). This approach corresponds to the «descending» method of political economy in the 17th century and is illustrated by William Petty's *Political Arithmetyk* (1690)[4]. «Early Political Economy» took population as its «comprehensive» starting point in the real world – a category that was the most visible form in which the object of national economics appears. It then aimed to reproduce this «real starting point» in thought «as a synthesis of many determinations» (Marx 1986a, 38). While focusing on political economy, Marx took the opportunity to criticize Hegel's phenomenology. Specifically, he attacks its idealist premises that take the real starting point as the product of the thinking mind rather than as having an existence «outside the mind and independent of it» (Marx 1986a, 38-39).

The second approach takes the simplest (or most abstract) element of a specific mode of production as its point of departure. It then explores the historical presuppositions of this element (its «concrete substratum»), the historical development of this elementary form into its most abstract expression; and its articulation with other elements to form more complex moments of production. It may also seek to show how more complex moments can be derived logically, with due recognition of historical contingencies, from the simple, elementary form that is chosen as the starting point. This «ascending» approach is characteristic of Classical Political Economy, as exemplified in Adam Smith's synthetic method in *The Wealth of Nations*. While praising Smith's theoretical breakthroughs, Marx also criticized his treatment of bourgeois categories as universal or transhistorical and, relatedly, his emphasis on the formal rather than material aspects of capitalist production. He nonetheless proposed to

4 Marx 1986a, 37

adopt the ascending approach in his critique of political economy. He aimed to identify the historical *differentia specifica* of the CMP vis-à-vis the elements common to production in general (a rational abstraction). He illustrated this approach from Hegel's analysis of possession as the simplest legal relation as the starting point for Hegel's philosophy of law. Referencing Smith, he then considers *labour* (not, be it noted, labour-power) as the simplest element identified in classical political economy and comments on the historical conditions in which «labour as such» (rather than specific kinds of labour) can become an abstract starting point for the analysis of modern political economy as labour becomes «a means to create wealth in general» (Marx 1986a, 39-42). Thus, after presenting the general abstract determinations that characterize all forms of society, attention must turn to «the categories which constitute the internal structure of bourgeois society and on which the principal classes are based» (Marx 1986a, 45). Next comes a progressive movement from more abstract-simple to more concrete-complex categories, culminating in the world market.

While Marx indicated his preference in the «Introduction» for the second method of inquiry, he did not follow this method to the letter in subsequent texts on capital. Instead he chose the commodity as the simple, elementary, or most abstract starting point for his analysis rather than «labour» or other core categories mentioned in the «Introduction». Commodities are mentioned only once in the 1857 *Introduction* and in relation to commodity prices rather than the commodity form. In contrast, money is referenced 11 times, capital in different forms appears 28 times, and labour and wage-labour together figure around 50 times (Marx 1986a, 17-44). The *Grundrisse* (1857-1858) manuscripts begin effectively with Chapter 2, on money, which ends rather than begins with some remarks on the commodity, which rehearse the arguments in the *Poverty of Philosophy*, and then move to Chapter 3, on capital, which is ten times longer than that on money. In contrast, the commodity as the «elementary existence» of the capitalist form of wealth is the first topic of chapter 1 in *Contribution to the Critique of Political Economy* (1859), followed by a chapter on money, with the expected chapter on capital being absent from the published version.

	1857 «Introduction»		***Kapital I* <1867>**
	Method 1	**Method 2**	**Marx's Method**
Example	Early Political Economy	Classical Political Economy	Critique of Political Economy
Starting point	Chaotic conception of the «whole» as it appears at first sight to a naïve observer	Decomposition of the whole by an informed theorist into analytically distinct but connected parts	Identify the ultimate morphological element that is also the nucleus of all further development
Initial object	The real-concrete	Several abstract-simple elements	The simplest element
Method	Descending analysis into constituent elements to better grasp the whole	Ascending synthesis to create rich totality that reproduces real-concrete as a concrete-in-thought	Logical-historical analysis of dialectical relations between the simplest element as both presupposition and posit of the whole

Table 1: From the 1857 «Introduction» to Das Kapital*, Vol 1 (1867)*

Table 1 suggests that Marx adopts a third method in *Capital* compared with the various preparatory manuscripts. This method is indebted to the example of cell biology, which led Marx to take the simplest element of the CMP as his starting point: this does not mean that Marx employed the cell metaphor or analogy slavishly in a pseudo-scientific transfer of its concepts and mechanisms to the capital relation. But his reading of cell biology does

seem to have affected the *substance* of his argument as well as its starting point. The substance is, of course, an unfolding of the *value form* of the commodity as the presupposition and posit of the unfolding dynamic, contradictory character, and inherent crisis-tendencies of the capital relation. As Roberto Fineschi notes, the commodity provides the ideal starting point because it is not abstract content but a unity of form and content. Specifically:

> 1) […] the economic cell must at the same time express *the universal character of the content and the formal determinacy it assumes in the capitalist mode of production*. The commodity seems to respond to this need: this is the criterion for choosing it [as the starting point]. 2) Its ability to represent at the most abstract level possible the unity of material content and social form is not, however, enough to characterize [the commodity as] the economic cell: *it must contain, potentially, in itself, the exposition of the whole theory of capital*. (Fineschi 2001, 44; italics in original)[5]

This excludes both the one-sided descending and one-sided ascending methods of Early and Classical Political Economy. It requires a unique combination of (1) logical analysis based on «the force of abstraction» (Marx 1996, 8) to identify the simplest social relation of the CMP that can be linked *in potentia*, by virtue of its inherent contradictions, to other bourgeois social relations; (2) historical analysis of the genesis of specific economic and social forms and their changing significance in different contexts; and (3) attention to the empirical details of relevant contemporary examples of the CMP to identify emergent tendencies and/or demonstrate the plausibility of logical arguments. This can be described, controversially perhaps because of its negative connotations in other theoretical contexts, as a «logical-historical method»[6].

5 «1) […] la cellula economica deve allora esprimere al tempo stesso il *carattere universale del contenuto* e *la determinatezza formale che esso assume nel modo di produzione capitalistico*. La merce sembra rispondere a queste esigenze, questo è comunque il criterio per la sua scelta. 2) Rappresentare al livello più astratto possibile l'unità di contenuto materiale e forma sociale non è tuttavia sufficiente per caratterizzare la cellula economica: *essa deve contenere, potenzialmente, in sé, l'esposizione di tutta la teoria del capitale*» (Fineschi 2001, 44, italics in original).

6 I am using «logical-historical» in an idiosyncratic way to capture the essence of the three elements combined in Marx's method. This usage differs from at least four other currents of interpreting Marx's method: (1) economic categories should be introduced in terms of the sequence in which they were historically decisive, an approach explicitly rejected by Marx in the 1857 «Introduction» in favour of presenting them in terms of their organic relations in modern bourgeois society (Marx, 1986a, 44); (2) a claim that Marx opted for a logical method of presentation over an historical narrative but this is «nothing but the historical method, stripped of interfering contingencies» (Engels 1980, 475), a view dismissed by Albritton (1986, 15) as assuming that «a hyphen would allow

3. The Commodity as Starting Point

So, what happened between 1857 and 1867 to prompt Marx to begin *Capital* with the «commodity» rather than one or more of the economic categories that received far more attention than this one in the 1857 *Introduction*: «wage-labour», «value», «money», «price», «capital», and so forth? In addition to occasional remarks in correspondence and hints in the excerpt notebooks, we have four main sources for explaining this choice: Marx's *Preface* to the first German edition (1867); different editions of *Volume I* (1867-1883); the initially unpublished Chapter 6: *Results of the Direct Process of Production* (1864), which was the intended bridge at the end of *Volume I* to *Volume II*; and Marx's «Marginal Notes on Adolph Wagner's *Lehrbuch der politischen Oekonomie*» (1875).

Let us begin with clues in the Marx-Engels correspondence. Specifically, on 14 July 1858, Engels wrote to Marx:

> One has no idea, by the way, of the progress made in the natural sciences during the past, 30 years. Two things have been crucial where physiology is concerned: 1. the tremendous development of organic chemistry, 2. the microscope, which has been properly used only during the past 20 years. This last has produced even more important results than chemistry; what has been chiefly responsible for revolutionising the whole of physiology and has alone made comparative physiology possible is the discovery of the cell – in plants by Schleiden and in animals by Schwann (about 1836). *Everything consists of cells. The cell is Hegelian 'being in itself' and its development follows the Hegelian process step by step right up to the final emergence of the 'idea' – i.e. each completed organism*. (*MECW* 40, 326)

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us to slide easily from the theoretical to the historical and back» and Arthur (1998, 447) as conflating the historical dialectic and systematic dialectic; (3) the *Ableitung* approach, which seeks to unfold all concepts through logical derivation, and the systematic dialectic (e.g., Arthur, 1998), which progressively interlinks economic categories with a view to showing at each successive step how more concrete-complex analyses reveal more aspects of the organic totality that is the CMP; and (4) the philosophy of internal relations, which lacks the sophisticated presupposition-posit approach of systematic dialectics, and focuses on the internal connections of all categories within an organic totality. The third approach ignores the fact that, as the analysis moves from abstract-simple derivation towards concrete-complex articulation, the real relations among categories and their actual links become more contingent – they could have been otherwise – with forms shaping without determining development in a dynamic without a telos that is co-determined by class struggle and other forms of agency. And the fourth approach mistakes a contingent and potentially reversible process of totalization for an already achieved and stable organic totality. For me, while «logical» is close to systematic dialectic and to Fineschi's interpretation of Marx's search for the right starting point, «historical» does not refer to a historical dialectic but the role of historical investigation in the approach to research and the role of historical and contemporary evidence to illustrate arguments and/or prove that abstract possibilities can become overdetermined concrete events and processes.

This observation could have been a trigger, especially as Marx acknowledges in a letter written on 4 July 1864, that, in the natural sciences, Engels is always ahead of him and «I always follow in your footsteps» (*MECW* 41, 546).

This exchange occurred in the year following the penning of the 1857. It may explain why, in contrast to the 1857 *Introduction* with its focus on *method in political economy*, the 1867 *Preface* highlights *method in the natural sciences*. This analogy concerns their capacity to drill down to the micro-foundations of macro-level phenomena. Specifically, in an allusion to the newly burgeoning field of histology and its accompanying cell theory or cell doctrine, Marx mentions the role of microscopy and chemical reagents (staining agents for making tissue structures more visible):

> The value-form, whose fully developed shape is the money-form, is very elementary and simple. The human mind has for more than 2,000 years sought in vain to get to the bottom of it all, whilst on the other hand, to the successful analysis of much more composite and complex forms, there has been at least an approximation. Why? *Because the body, as an organic whole, is more easy of study than are the cells of that body*. (Marx 1996, 8; my italics)[7]

Marx then presents «*mikrologische Anatomie*» (where micrological refers to the analysis of phenomena at a microscopic scale and is translated in Italian as *anatomia microscopica*) as the model for his point of departure, with a view to moving from the commodity as the economic cell-form of the CMP through the process of cell formation, differentiation, repetition (simple reproduction), and growth (expanded reproduction or accumulation) to provide a complete account of the whole organism formed by a social formation dominated by the CMP. Since microscopy cannot be applied in the analysis of social forms, it must be replaced by «the force of abstraction» (Marx 1996, 8). Abstraction is not a purely logical procedure. It is guided by the English case as the closest parallel to physicists' observation of natural processes where they exist in their most typical (*prägnateste*) form with the least external disturbance and/or to their conduct of experiments in conditions that isolate the normal case (in German, *rein* or pure) (Marx 1996, 8). Later, Marx will show growing interest in the USA

7 Kölliker's *Gewebelehre* (*Histlogy*) opens with two remarks: microscopic anatomy (*mikroskopische Anatomie*) is now just as much one of the foundations of medicine as the anatomy of the organs and systems; and a basic study of physiology and pathological anatomy is impossible without exact knowledge of the most minute form relations (Kolliker 1852, iii, my translation). His book surveys the elementary parts (*Elementartheile*) of the body and the finer construction (*Bau*) of organs (Kolliker 1852, iii).

as a site of even more advanced forms of the capital relation regarding the enterprise form and finance.

I now present six key propositions in cell theory that could have inspired Marx. These propositions draw on texts in cell biology, physiology, histology, and so on, that Marx and Engels were likely to have known directly or indirectly:

1. All living organisms – plants and animals alike – are composed of one or more cells (Schwann 1847). Or, as Virchow (1858, 3 and 1860, 3) put it: «the cell is really the ultimate morphological element in which there is any manifestation of life, and […] we must not transfer the seat of real action to any point beyond the cell».

2. Following from this, the cell is the most basic unit (*Elementarteil*) of life (Schwann 1847).

3. Cells lead independent lives that, at least in animals, are shaped by the life of a larger organism of which they are part (Schwann 1847).

4. *Omnis cellula e cellula*, i.e., *«all* cell arises from other cells»[8] (Virchow 1855, 23 and 1860, 27)[9].

5. Cellular reproduction depends on metabolic exchanges with the environment (including other cells) that convert food/fuel into energy to run cellular processes, create the building blocks for cell formation, and eliminate waste.

6. Embryonic cells can – but need not – differentiate into other kinds of cell, generating the higher order forms (specialized tissues, organs) that comprise a functioning organism[10].

8 Raspail (1825, 224 and 384) was the first to state that *omnis cellula e cellula* (Harris 1999, 33).

9 This phrase, introduced in Virchow's 1855 article, is not in the first German edition of his book, although the idea is present (Virchow 1858, 25); it appears as an interpolation in the second edition, from which the English translation cited here was made (Virchow 1860, 27).

10 Schwann, for example, identified five types of human tissue that could emerge from an embryonic cell.

These points find parallels, conscious or unconscious, in Marx's analysis of the «commodity», the «circuits of capital», and the differentiation of different moments of the «value-form» and other categories of the capital relation. Here I draw on the preparatory works to *Capital*, different editions of *Capital*, and the comments on Wagner. Thus:

1. The living organism or *Gesellschaftskörper* (social body) of the CMP depends on the dynamic arrangement of the value form and its cognate forms into concrete-complex relations (Marx 1987a; 1996).

2. The elementary unit (*Elementarteil*) of the value form is the commodity (Marx 1996, 45), which is also the economic cell form (*Zellenform*) of the CMP (Marx 1996, 8).

3. Commodities lead independent lives that are shaped by the life of the CMP of which they are a part – they are both presupposition and posit of both simple and expanded reproduction (see below).

4. *Omnis merx e mercibus,* i.e., every commodity from commodities[11]. This can take the form of simple commodity circulation, i.e., C-M-C, or of the circuit of capital, with the potential for expanded reproduction, i.e., M-C-M'). As Marx wrote, «[i]n capitalist production of products as commodities, on the one hand, and the form of labour as *wage-labour,* on the other, becomes absolute» (Marx 1989b, 445, italics in original; cf. Marx 1989b, 375).

5. Production, distribution, and exchange are analysed as metabolic processes, examining how different elements are converted into each other and how a «metabolic rift» can produce pathological effects in the overall production process as it unfolds in time-space (see especially Foster 2000 and Saito 2017).

6. Embryonic contradictions in the commodity as cell form (or germ form) of the value relation generate further developments in the capital relation. These include the initial two special commodities (labour-power and money as universal equivalent), the price form, money as capital, and so on. For example, the commodity form of value «is a mere germ form (*Keimform*), which must undergo a

11 Cf. Sraffa's analysis (1960) of production of commodities by means of commodities.

series of metamorphoses before it can ripen into the price form» (Marx 1996, 72)[12]. More generally, contradiction is the generative mechanism that drives the metamorphosis of the value form and of capitalist societalization.

While the first two points need no elaboration here, the other four points do merit discussion.

Ad 3, the simple commodity is the presupposition of distinctive capitalist forms. Marx (1975, 544) therefore proceeded from «the simplest social form in which the product of labour presents itself in contemporary society, and this is the '*commodity*'». On this basis, Marx could then explore the «double life» of the commodity: as a commodity (which nonetheless presupposes that other commodities exist) and as an integral part of the CMP's overall logic. As he wrote in the *Grundrisse*:

> If in the fully developed bourgeois system each economic relationship presupposes the other in a bourgeois-economic form, and everything posited is thus also a premiss, *that is the case with every organic system*. This organic system itself has its premisses as a totality, and its development into a totality consists precisely in subordinating all elements of society to itself, or in creating out of it the organs it still lacks. This is historically how it becomes a totality. Its becoming this totality constitutes a moment of its process, of its development. (Marx 1986b, 208)

Similar arguments are presented in the original draft of the chapter on money for *Contribution to the Critique of Political Economy* (Marx 1987c, 497). In addition, in the *1861-63 Manuscript*, Marx writes:

> It is as such a prerequisite that we treat the commodity, since we proceed from it as the simplest element in capitalist production. On the other hand, the product, the result of capitalist production, is the commodity. What appears [*erscheint*] as its element is later revealed to be its own product. Only on the basis of capitalist production does the commodity become the general form of the product and the more this production develops, the more do the products in the form of commodities enter into the process as ingredients. (Marx 1989a, 301; cf. Marx 1996, 376)

Ad 4, regarding the proposition that every commodity stems from commodities, Marx argued in the unpublished Chapter 6 (written in 1864) that:

> *Commodities,* i.e. use value and exchange value directly united, emerge from the [labour] process as *result,* as product; similarly, they enter into it as constituent

12 Cf. McCarthy on the commodity as the «simplest category», the «*Keimform*» (or germ form), that «contains within itself the totality of all forms of capitalist social structure and their contradictions of the capital relation» (McCarthy 1988, 115-116).

elements. But *nothing at all can ever emerge from a production process without first entering into it in the form of the conditions of production*. (Marx 1989b, 387-388, final italics mine)

The idea that every cell develops from other cells and that the simple cell can generate different kinds of tissue anticipates the idea of stem cell. Today, it is recognized that stem cells reproduce themselves through simple repetition but are also pluripotent, having the capacity to form very different kinds of cell with different properties and functions. As a dedicated follower of the latest developments in the natural sciences, Marx might have been tempted to describe the commodity as the «economic stem-cell form» of the CMP. For the value-form of the commodity can be seen from two perspectives: as the elementary unit of the capital relation that reproduces itself through the circuit of capital *and* as a pluripotent stem cell that can differentiate [logically and/or historically] into many other special forms of the capital relation that are often essential to its expanded reproduction. The first perspective concerns either simple commodity production, which takes the form of C-M-C, or the metamorphosis (metabolism) in the circuit of capital in the form of M-C-M'. The second perspective – the pluripotency of the commodity form – indicates how the elementary contradiction in the value-form of the commodity between use- and exchange-value leads to differentiation. In addition to wage-labour and money, Marx discusses other forms of the capital relation. These also have their own specific properties, contradictions, and impact on the expanded reproduction of capital and the character of capitalist social formations. While the stem-cell metaphor enables these arguments to be stated more clearly, they are already implicit in cell theory as it existed between 1857 and 1867, when Marx was drafting *Capital*. Thus, the heuristic power of the stem cell analogy depends less on its capacity to restate Marx's arguments but on their capacity to generate further insights. That is a topic for another paper.

Ad 5, highlighting metabolic conversion in the unpublished chapter 6, Marx wrote:

The *conversion* of money, which is itself only a *converted* form of the commodity, into capital only takes place once labour-power [*Arbeitsvermögen*] has been *converted* into a commodity for the worker himself. […] only then are all products converted into commodities, and only then do the objective conditions of each individual sphere of production enter into production as commodities themselves. (Marx 1989b, 359; my italics)

There are many similar comments in the preparatory and actual texts of *Capital*.

Ad 6, the commodity form is the common principle of development for other social forms and therefore provides its most elementary form. In this sense, the commodity contains the embryonic contradiction that becomes the germ form (*Keimform*) of other contradictions. All forms of the capital relation can be unfolded dialectically from the value-form of the commodity, considered as the unity of exchange-value and use-value, as a unity of (historical) form and (universal) content. So, Marx soon moves from the commodity to two of its special forms: first, labour-power (which also has a dual character as use-value and exchange-value and, in his later analyses, is further explored through its dual character as concrete labour and abstract labour) (cf. Marx 1975, 546); and, second, money as the universal commodity, which is later analysed in terms of its metamorphosis into capital. Later Marx will explore another special commodity: land as private property and forms of rent (Marx 1998). In these and other cases, the commodity is the simple *concretum* from which all other forms can be derived through a combination of logical reflection and historical analysis (a logical-historical approach) in order, eventually, to reproduce the real-concrete as a concrete-in-thought, as «a rich totality of many determinations and relations» (Marx 1987a, 37).

4. The Limits of Analogy

Ludwig Kugelmann tried to use the publication of Marx's *Capital* in 1867 to convert the cell pathologist, Rudolf Virchow, who was a vocal and influential German liberal, to scientific socialism. He informed Marx that he had sent Virchow a copy of the book:

> In making him aware of your work, I told him how you regard commodities as cells, [how you] analyse bourgeois society, etc., that you follow the same method in political economy as he does in medicine: that your *Capital* could therefore be dubbed the social pathology of bourgeois society, etc. (cited de Rosa 1964, 595)

Marx replied to Kugelmann on 17 April 1868:

> You have done me a great service with your lines to Virchow, though I doubt whether he will have the patience and time to immerse himself in a subject out of his line. I know it cost me a great effort to read his *Cellularpathologie [1858]* in Manchester, particularly because of the way it was written. (Marx 1988, 13)

More generally, pace Kugelmann, Marx and Engels opposed categorical political arguments based on analogies with biology and other natural sciences (Darwinism, society as a federation of cells, or the body politic). Such arguments were already criticized in the first German edition of *Das Kapital I*, when Marx noted:

> The weak points in the abstract materialism of natural science [*abstrakt naturwissenschaftlichen Materialismus*], a materialism that excludes history and its process, are at once evident from the abstract and ideological conceptions of its spokesmen, whenever they venture beyond the bounds of their own speciality. (Marx 1996, 375-376 fn.)

The principal limits to the analogy as developed above are presented in Table 2. In essence, whereas cells are the universal basis of organic life and operate through known universal chemical, physiological, and metabolic processes, the value form of the commodity as the economic cell-form of the capital relation is historically specific and its laws and tendencies are doubly tendential, in the sense that, they exist only to the extent that the contradiction-rife and crisis-prone capital relation is reproduced in and through social practices that are historically contingent and contested. Further, while the failure of cell replication and differentiation can lead to harmful or morbid developments in the organism, the mechanisms of cellular pathology have nothing in common with capital's crisis-tendencies, which must be grounded in the immanent logic of the capital relation and its instantiation in social formations dominated by the capital relation.

Cell Theory	**Economic Cell Theory**	**Limits of Analogy**
All living organisms are composed of cells	Social body of the CMP is composed of value forms	Not a universal truth but historically specific
Cell is most basic element of life (single cells can exist)	Commodity is the elementary unit of CMP	A single commodity without other commodities is irrational; commodities are always plural

Cells lead independent lives but are shaped by larger organism	Commodities circulate as commodities but are shaped by overall logic of CMP	Cell theory's ontological claim vs Marx's methodological use of presupposition and posit
Omnis cellula e cellula	Omnis merx e merce	Not automatic for CMP: it requires generalization of commodity or price form to all inputs into M-C-M'
Cellular reproduction involves fallible metabolism (hence cellular pathology)	Production, distribution, exchange involve fallible metabolism (hence crises)	Metabolism of CMP is internally contradictory, conflictual, crisis-prone
Embryonic cells may differentiate into other kinds of cell	Contradictions in basic cell form generate more developed social forms	Ontological statement vs logical-historical analysis of successive forms

Table 2: Some Limits of the Cell Analogy

5. Conclusions

This article explored the neglected role of cell biology as a paradigm-shifting scientific discovery in the natural sciences in Marx's critique of political economy. There are several good reasons why this influence has been neglected; but other good reasons for taking it seriously now. In particular, I suggest that there are at least six key foundational principles of cell theory that could have inspired Marx's profound shift in the choice of starting point for his critique of political economy between the 1857 *Introduction* and the 1867 first edition of *Das Kapital*. My argument is based only on the texts in cell theory with which Marx was acquainted, directly or indirectly, and on clues in Marx's relevant methodological texts, the economic manuscripts, and correspondence. Crucial here is the identification of the

nucleus (cytoplasts) in cell formation, differentiation, and reproduction. The analogy in the commodity is the nucleus (*Keimform*) of the contradiction between use- and exchange-values as two necessary moments of the value form of the commodity.

In addition, the idea that the commodity is the «economic cell-form» of the CMP provides an essential mediating link between the scientific presentation of Marx's critique of the CMP and the use of Hegel's *Logic* as a rhetorical device in unfolding this argument. Marx was aware of the limitations of taking arguments from the natural sciences beyond their appropriate field of application and criticized German «scientific materialists» for doing so, especially where they invoked natural science to critique the scientific socialism that he and Engels were developing in the 1870s and 1880s. This is why I present cell biology as having positive heuristic value in the *process of discovery* – being a source of inspiration and self-clarification along with other metaphors and analogies. In contrast, say, to thermodynamics, chemistry, or agronomy, it is not a crucial part of the research process in political economy, which focuses on the historically specific features of the CMP. Nor, given the limits of the analogy, could or should cell biology have played a major role in the presentation of Marx's scientific results in *Capital.* The influence of cell biology is more subterranean but no less important for that. For, during the discovery process, it seems to have suggested ways to link the commodity as its simplest morphological element to the logic of the CMP as an organic totality. Recognizing the limits of taking the logic of the natural sciences as a model for the social world (whilst noting the unity of the natural and social worlds), it would make little sense to derive and develop the analysis of the CMP through strict analogical unfolding will cell biology, thermodynamics, or the evolution of natural species. Here the method of presentation relies on a logical-historical method that owes more to Hegel than to the pioneers of cell biology. Yet it also goes beyond Hegel because of its emphasis on the contingently necessary development and dynamic of the capital relation and their mediation in and through social action. After all, human beings make their own history, but not in circumstances of their own choosing.

List of Abbreviation:

MECW = *Marx-Engels Collected Works*, London: Lawrence & Wishart.

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