



Review

Family Context, Parenting and Child Development: An Epigenetic Approach

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Abstract: This paper presents an essay that uses an epigenetic approach to attain an inclusive and in-depth understanding of the influence of family context and quality of parenting on children's psychological development. Based on the identification of a key developmental process in which interactions are continuously internalised, the approach draws attention to the bidirectional and systemic nature of intrafamily and parenting interactions and highlights the multiple factors that influence them, which are linked to the developmental history of the species, the individual characteristics of both the child and their parents, and contextual variables. In response to these internalised interactions, the body activates epigenetic mechanisms, such as DNA methylation, which may affect the phenotypic expression of the genome. Theoretical and methodological implications are discussed in light of the current process of identifying the biological profiles underlying negative and positive parenting practices. Some insights are offered regarding the challenges and opportunities that parents and policymakers should address in the 21st century in connection with the promotion of positive parenting, taking into account the epigenetic processes triggered by adverse environments for children and their families.

Keywords: parent–child interactions; parenting; early childhood development; epigenetics



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1. Introduction

The main objective of this essay is to support the use of an epigenetic approach as a means of gaining an inclusive and in-depth understanding of the influence of family context and quality of parenting on children's psychological development. New evidence in the field of neuroscience suggests that one way of taking different influences on children's psychological development into account may be to conceptualise it as an epigenetic process. Within this approach, factors that influence the quality and quantity of the family interactions experienced by the subject, which in turn stem from individual child and parental variables, as well as from contextual variables such as exposure to neurotoxins, stress and poverty, may give rise to molecular processes around DNA which, while not actually mutating its structure, nevertheless regulate the activity of the genome, configuring the human phenotype in a multitude of different ways (Nilsson et al. 2018). These phenotypes may even be transmitted through inter- and/or transgenerational inheritance (Yeshurun and Hannan 2019).

The main breakthrough of recent years is the identification of molecular factors and processes around DNA that regulate genome activity independently from the DNA sequence (Nilsson et al. 2018). Of these molecular processes, DNA methylation is the one that has been studied most; it consists of the addition of a molecule or methyl group near or inside the gene promoter or in sites where gene transcription is initiated. Methylation alters the regulatory regions of the genes, which in turn triggers their untimely activation or deactivation, thereby giving rise to disorders and diseases (Yeshurun and Hannan 2019). As Nilsson et al. (2018) pointed out, other epigenetic processes include histone modification,

RNA noncoding and RNA methylation, the complex integration of epigenetic modifications into gene disposition that results in what is called the epigenome.

Once the general foundations of the epigenetic approach are introduced, the key to understanding the proposal made by this essay is to bear in mind that the interactions occurring inside the family system are influenced by many different variables, including parents' and children's individual variables, which will be discussed in Section 2, and contextual variables, which will be discussed in Section 3. Given the extensive literature published recently showing the links between family context, parenting and epigenetic processes, Section 4 will be devoted to exploring the findings reported in that field. Finally, in Section 5, the theoretical and methodological implications of the proposed epigenetic approach will be discussed, paying special attention to opportunities and challenges for parents and parenting science in the 21st century. Figure 1 provides a schematic outline of the essay's organisation, rationale and structure.

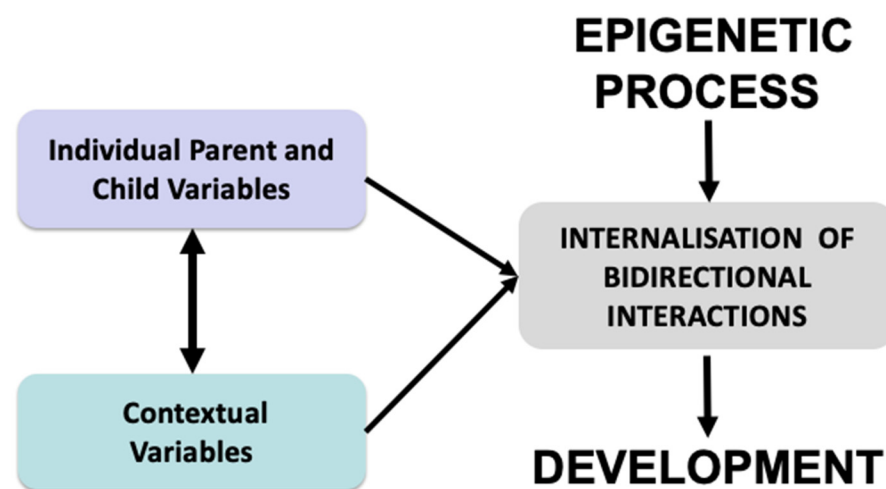


Figure 1. Representation of the epigenetic approach to understanding psychological development as a product of internalised interactions, which are influenced by individual parent and child variables, as well as by contextual variables.

2. Individual Parent and Child Variables That Contribute to Family Bidirectional Interactions

The influence of family bidirectional interactions can be analysed within the framework of the law of double formation of higher psychological processes (Vygostky 1962), which posits that all higher psychological functions appear twice: first in the social field, at an interpsychological level, and later at the intrapsychological individual level. Within this approach, psychological development is viewed as the result of the internalised interactions that make up every human being's individual profile. It is important to highlight the fact that these interactions may also be the consequence of self-regulation processes, which are based on the exchange of information between different parts of the family system and are characteristic of complex systems (Von Bertalanffy 1968; Minuchin 1988). The systemic self-regulation process that takes place in the family context, which is obviously bidirectional in nature, is illustrated, for example, by parents' efforts to ensure exclusive interaction moments with their firstborn child as a means of compensating for the jealous behaviour that said child may exhibit in response to the birth of a new sibling.

The classic systemic approach has evolved towards a complex model of understanding development, which was termed "development systems theory" by Griffiths and Stotz (2018). These authors identify epigenetics and developmental dynamics as key concepts for understanding development as a process of change that continues throughout the life cycle, rather than as a mere set of interactions between influencing variables. Guralnick (2011) sums up the dynamic developmental systems model by formulating the existence of family patterns of interaction that foster children's comprehensive

development, and which in turn depend on the accommodations made within the family system to adapt to the child's developmental peculiarities and behaviours, thereby generating ongoing bidirectional interactions. In the following paragraphs, evidence linked to variables that influence the interactive process outlined above will be explained. These variables may be generic-anthropological in nature, i.e., characteristic of all members of the species, or they may be specific to each individual and indicative of the diversity observed among both children themselves and their parents or principal caregivers.

In relation to generic-anthropological variables, it is important to highlight the immaturity specific to the human species (*sapiens-sapiens*). As Bruner (1972) points out, it is precisely upon the immaturity of newborn humans that the possibility for education depends, since this immaturity results in a neurological plasticity open to the constant establishment of new neural connections as a consequence of diverse experiences, learning and interactions. One example of this is the conceptualisation of the types of attachment described by the scientific literature (Bowlby 1962; Ainsworth 1979) as differential phenotypical outcomes resulting from different interactive processes, which eventually lead to the crystallisation of secure, insecure or disorganised attachment types.

The idea outlined in the previous paragraph is compatible with a key approach in our current understanding of psychological development, namely evolutionary developmental psychology. Bjorklund (2018b) argues that our long period of immaturity, which he describes as the invention of childhood by the species *sapiens sapiens*, lies at the heart of those cognitive skills considered to be exclusively human. Given the developmental importance of this period of immaturity and plasticity, which is so characteristic of the human species, it could be said that the genetic inheritance of each member of that species is exactly the opposite of genetic determinism, since it reflects their neurological openness to the influence of contextual variables, which leave their mark on each individual's epigenome through the interaction internalisation process. Bjorklund (2018a) also points out the potential of the epigenetic approach as a conceptual framework that brings together all our accumulated knowledge about children's psychological development.

Piaget's genetic epistemology theory (Piaget 1976) also fits into the context of generic-anthropological variables, due to the mechanism of adaptation through play and imitation. Piaget (1976) viewed these two mechanisms—play and imitation—as a *modus operandi* specific to our species that influences children's interactions with the surrounding environment and is part of our genetic blueprint and highly sensitive to environmental influences. When this author refers to "assimilation" as a component of the adaptive process, he suggests that it is behaviourally represented through play, understood as a repetitive, reassuring activity designed to consolidate cognitive and pleasure structures. "Accommodation" is behaviourally represented through imitation, an activity that seeks to integrate new ideas and is flexible by nature and vital for triggering developmental crises within the cognitive structure. In relation to play, the clinical report published by the American Academy of Pediatrics (Yogman et al. 2018) is worth mentioning, since it highlights the role of play in cognitive development. With regard to imitation, research into its impact on cognitive development continues to be a relevant field of study today (Heyes 2016).

A further level of analysis, which was mentioned earlier in the introduction to this second section, refers to the influence of children's individual characteristics on parenting interactions. These influences enable us to understand why, when exposed to experiences that may alter the source of development (such as poor parenting), some individuals achieve normalised development while others develop maladaptive symptoms over time. In this sense, Calkins et al. (2013) propose that responses to exposure to certain experiences may be influenced by the human genotype. Children's individual characteristics include temperament, understood as an individual's degree of reactivity (Rothbart et al. 2000); child temperament is an individual characteristic that has a clear impact on parental reactions to their children's behaviour. In this sense, Armour et al. (2018) found that, during early childhood, children's irritability and fear were associated with parental coercion (external control) and overprotection, respectively. The influence of temperament is also

evident in a study by [Xuan et al. \(2018\)](#), who found that among children with a strong temperament, characterised by high negative emotionality, parental stress was more likely to have a negative effect on development. For their part, [Joussemet et al. \(2008\)](#) found that having a reactive temperament and being a boy were two variables associated with a greater use of physical aggression by parents, and [Baker and Milligan \(2016\)](#) also observed gender differences in relation to parental treatment. In this second study, the authors found that girls benefited from a greater time investment by parents in learning activities such as reading. These findings support the idea that some characteristics, such as sex or temperament, may act as filters that influence and moderate parenting practices during the developmental process, and reveal the bidirectional nature of the influences working within the family system.

In relation to the individual parental variables that may affect the quality of bidirectional interactions, one factor to bear in mind is the possible epigenetic transmission of parenting practices. Childhood experiences may cause disruptions in certain neural circuits, which are later necessary during adulthood in order to enable the individual to respond appropriately to their child's signals. These experiences may therefore result in modifications to the epigenome that may be transmitted to offspring ([Feldman 2017](#)). In this sense, [Lomanowska et al. \(2017\)](#) highlight the fact that adverse experiences during early childhood may alter the development of the executive functions required for the self-regulation of parenting behaviour during adulthood.

Another study worth mentioning is that carried out by [Riem et al. \(2012\)](#), who used functional magnetic resonance imaging to show that, in response to infant crying, adults with insecure attachment representations had heightened amygdala activation, felt more irritated and gripped a handgrip with more force than those with secure attachment representations. The authors concluded that the hyperactivation of the amygdala may explain why people with insecure attachment patterns experience feelings of aversion and anger in response to infant crying, responding inconsistently to infant signals and failing to engage in behaviours that would facilitate the establishment of secure attachment. This same pattern of behaviour was also observed in the study by [Martin et al. \(2018\)](#), who found that those who had experienced higher levels of maternal sensitivity during the first three and a half years of life made fewer negative causal attributions about infant crying three decades later, and exhibited greater right-cortex reactivity in response to the stimulus, thereby permitting the activation of a response to infant distress. These findings seem to suggest that the quality of interactions during early childhood may predict parenting abilities during adulthood, a behavioural cycle that may repeat itself again in the following generation ([Feldman 2017](#); [Kundakovic and Champagne 2015](#)). In other words, parents' sensitivity levels may depend on epigenetic changes that they inherited from their own parents, contributing (for better or for worse) to the quality of care they provide to their offspring ([Lomanowska et al. 2017](#)).

Parents' mental health is also a variable that may influence parenting interactions and, therefore, children's wellbeing. Studies have shown that parents' depressive symptoms, stress and anxiety are associated with their offspring's cognitive development level, internalising problems and behavioural problems during early childhood ([Keyser et al. 2017](#); [Reupert and Maybery 2016](#)). Similarly, during the teenage years, parents' psychopathological symptoms have also been linked to adolescents' substance abuse ([Burstein et al. 2012](#)) and low levels of social competence ([Vallotton et al. 2016](#)). In general terms, psychiatric disorders may inhibit adult carers' ability to respond appropriately to their children's signals and provide learning opportunities to foster healthy psychological development in diverse fields.

3. Contextual Variables That Contribute to Family Context and Parenting Interactions

This section describes the two conceptual frameworks most widely accepted by the scientific community in the field of developmental psychology for classifying contextual variables. The first is Bronfenbrenner's bioecological theory ([Bronfenbrenner 2001](#)), which

posits that development occurs as a result of interactions between an active individual and their most immediate context, called the microsystem. This process may also be affected by the relationships established between this most immediate environment and broader contexts, conceived as four interconnecting rings: the micro, meso, exo and macro systems. The family microsystem is the context in which parenting interactions take place in a stable and sustained manner. During the early years of life, the brain is particularly sensitive to these interactions, which may influence those brain circuits that enable cognitive development, language, self-regulation and social competence (Nelson et al. 2019; Lomanowska et al. 2017; Kundakovic and Champagne 2015).

Since children's first experiences take place in the family environment, parenting competence is a key variable in the sensitive periods that occur during diverse developmental (cognitive, linguistic, emotional and social) processes (Zheng et al. 2018). Nevertheless, bidirectional interactions may also occur in other microsystem contexts, such as at school with one's teacher and peer group. In this sense, the next ring is the mesosystem, which refers to the relationship between two or more microsystems, such as the relationship between the family and the school or the peer group. One example would be the type of relationship that exists between parents and their child's teacher. A high level of engagement in this sense may result in fewer behavioural problems and better academic results (Sheridan et al. 2019). The mesosystemic analysis of the family–school relationship is essential, for example, in diagnosing and intervening in cases of school bullying (Šmigelskas et al. 2018).

The third ring described in bioecological theory is the exosystem, defined as all those contextual variables in which the individual does not actively participate. This level includes variables that are not purely interactive in nature but affect the quality of the parenting interactions to which the individual is exposed. When characterising the exosystem, it is important to highlight the existence of variables that influence psychological development through different pathways. For example, stress is a variable that may affect development directly, such as in cases in which children are exposed to poverty, live with a substance-abusing adult, have no responsible caregiver able to respond to their needs and/or are witnesses to ongoing situations of violence (Shonkoff 2015). Furthermore, a stressful situation experienced by a parent, whether it be in the family environment or in an external context such as at work, may indirectly affect the quality of parenting interactions, resulting in the use of coercive discipline, hostility, less sensitivity to the child's signals and/or less engagement in learning activities, among others.

While being qualitatively different, both of the situations described above nevertheless generate epigenetic changes in the epigenome that in turn affect gene expression. This situation may cause disruptions in the brain, affecting neurone structure, and consequently, psychological development (Chen and Baram 2016). The exosystem ring may include even more qualitatively different variables, such as those that directly affect development, e.g., exposure to neurotoxic contaminants in the air, water or food (Gascon et al. 2017); or others, such as parents' education level or socioeconomic status, which while not being strictly interactive in nature nevertheless affect the quality of relationships indirectly (Meyrose et al. 2018).

The next ring in the bioecological approach is the macrosystem. This level encompasses those variables located within the institutional context in which the individual lives, and includes culture, beliefs, values, religion and the political, social and education systems. The macrosystem covers child protection policies and positive parenting initiatives aimed at fostering conditions that could have a significant effect on the psychological development process. Some such measures include Recommendation 19 of the Committee of Ministers of the Council of Europe (2006) to member states on policy to support positive parenting, measures adopted at a local level to assess family contexts and design prevention programmes focusing on positive parenting, work–life balance measures, breastfeeding support plans, promoting the use of green spaces (which has been linked to better mental health and cognitive development) and the control of environmen-

tal pollutants, among others (Gascon et al. 2017). Thus, the model which understands development as an epigenetic process complements Bronfenbrenner's bioecological theory, while at the same time proving consistent with reality, since it is an open model that aims to recognise all those variables identified in the literature as having an influence on children's psychological development.

The second conceptual framework often used to classify the contextual variables influencing the interactions that contribute to the epigenetic process stems from the field of behavioural genetics and is known as nonshared environments (Plomin 2014). Unlike the opposite concept of shared environments, nonshared environments refer to all those exclusive interactions that take place with each family member. One example of this exclusive type of interaction is that provided by Jenkins et al. (2016), who propose the existence of differential parenting, which stems from both parent effects and child effects and is defined as the different treatment received by siblings within the same family system. The findings reported in their study suggest that the creation of different spaces within the family context may lead to clearly different development pathways. Discriminatory differential treatment, based on favouritism and comparisons between siblings as a parenting resource, is negatively associated with children's wellbeing (Zheng et al. 2018). Moreover, siblings who are subject to discriminatory differential treatment report a higher level of negativity in the quality of their sibling relationships (Jenkins et al. 2016).

The concept of nonshared environments was consolidated by studies with identical twins, which found that epigenetic influences in DNA structure can be attributed to the different experiences to which each twin is exposed within the same family environment (Plomin 2014). In a recent study involving 4718 twins aged between 7 and 12 years, Zheng et al. (2018) identified six subgroups with different cognitive development patterns (verbal and nonverbal intelligence). The authors found that the influence of nonshared environments was particularly strong among those groups whose cognitive skills had been observed to improve. These results are consistent with those of the longitudinal study carried out by Franić et al. (2014) with a sample of 1748 twins aged between 5 and 18 years. The authors observed that while the stability of cognitive abilities over time was mainly due to genetic factors, nonshared environments were the main factor responsible for changes in cognitive ability (both verbal and nonverbal).

4. Family Context and Parenting Interactions That Contribute to Epigenetic Processes

As it was highlighted in the introduction, epigenetic processes are critical to enabling organisms to respond to their environment through changes in genome expression, and constitute a key part of normal biology (Nilsson et al. 2018). Today, there is general acceptance of the concept of "behavioural epigenetics" (Bjorklund 2018b), which contains a marked developmental element. The analysis carried out by Cirulli (2021) highlights some interesting evidence that shows the contribution made by parenting to DNA methylation processes and complements the above-mentioned behavioural epigenetics approach. So-called "harsh parenting" is a variable that has a strong influence on methylation processes; as Bueno (2021) points out, adverse childhood environmental conditions, such as those generated by harsh parenting, contribute to epigenetic modifications that may affect cognitive and socioemotional development. These findings are also supported by the work of Lewis et al. (2021), which highlights the influence of harsh parenting on DNA methylation (an influence that is similar to that of other adverse early experiences, such as abuse and neglect) and identifies the HPA diurnal function in NR3C1 gene methylation. It is also worth highlighting that, in the early stages of child development, factors influencing the foetus during its intrauterine development are grouped under the concept of "foetal programming". The most widely studied negative (teratogenic) influences are smoking, the consumption of alcohol and other drugs, stress and exposure to neurotoxins (Gascon et al. 2017). The effects of these variables are manifested in epigenetic mechanisms, which may result in low birth weight, delayed motor development and emotional and behavioural problems during childhood, among others (Woodward et al. 2018).

In relation to the postnatal period, interindividual differences in phenotypic expression have mainly been studied in contexts of risk and adverse situations. In a recent study by [Ein-Dor et al. \(2018\)](#), carried out with a sample of 109 adults, the authors found a positive association between insecure-avoidant attachment and epigenetic modification in terms of oxytocin (OXTR) and glucocorticoid (NR3C1) receptor-gene methylation. Oxytocin has been associated with behaviours that foster the search for social contact as a buffering resource in stressful situations ([Smith and Wang 2014](#)), while glucocorticoid is involved in the functioning of the hypothalamic–pituitary–adrenal axis, which is also linked to the stress-related threat response. Insecure attachment, conflict and trauma are perceived as a constant threat during early or middle childhood. In such cases, the situation triggers the prolonged activation of physiological stress responses, which in turn may alter the expression of the genome involved in diverse brain areas, ultimately affecting the development process ([Chen and Baram 2016](#)). In the absence of a sensitive adult capable of blocking the secretion of stress hormones, children are unable to recover their normal physiological state and do not learn to distinguish between those situations which are truly threatening and those which are not ([Shonkoff 2015](#)). Consequently, the system ends up failing, becoming activated unnecessarily in response to minor events ([Andaloussi et al. 2019](#); [Xuan et al. 2018](#)).

Extant empirical evidence suggests that when stress is prolonged over time during critical developmental periods, its impact on brain structure is greater ([Chen and Baram 2016](#)). A good example of this is the research carried out by [Riem et al. \(2019\)](#), which found that unresolved trauma or loss during childhood and the existence of psychopathological indicators were all associated with reduced white matter in the corpus callosum. The authors point out that white matter is necessary for the correct transmission of information between neurons, and the corpus callosum is associated with general measures of intelligence, problem-solving and information processing. A large body of literature attests to the fact that the sustained secretion of cortisol, a hormone that is released in response to stressful situations, may affect the quantity and quality of the synaptic connections that take place in the prefrontal cortex—the hub of the executive functions and necessary for any type of learning, as well as for attaining the appropriate level of self-regulation in the cognitive, emotional and behavioural fields (see, for example, [Lomanowska et al. 2017](#); [Kundakovic and Champagne 2015](#); [Shonkoff 2015](#)).

It is important to highlight the fact that epigenetic modifications are not only the result of negative exposure to risk contexts; they are also affected by positive exposure to all high-quality interactions that take place in a normal family context ([Jensen and Champagne 2012](#)). All those stable interactions are translated into positive epigenetic mechanisms and serve as protective factors for healthy development ([Shonkoff 2015](#)). In this regard, it is worth noting the work of [Naumova et al. \(2016\)](#), who found that stable, high-quality mother–child interactions in nonrisk contexts, evaluated through offspring’s perceptions at three different stages of the development process (middle childhood, early adolescence and late adolescence), resulted in epigenetic changes that, during adulthood, were linked to individuals’ psychosocial adjustment. Similarly, [Kundakovic and Champagne \(2015\)](#) observed that the quality of parent–child interactions resulted in epigenetic changes in neurodevelopment that may eventually impact cognitive, emotional and behavioural functioning, affecting stress response and self-regulation systems. The review by [Provenzi et al. \(2020\)](#) also supports the protective role of maternal caregiving, as a key parenting interaction that is associated with variations in the DNA methylation of genes influencing socioemotional development and buffering the epigenetic processes linked to early adversity in children’s lives.

Other evidence that has emerged in epigenetic research is linked to changes that may be passed on to offspring, affecting descendants’ physical and mental health ([Nilsson et al. 2018](#)). Recent studies have found evidence that supports the idea of a possible cross-generational transmission of parenting ([Fujiwara et al. 2019](#); [Kundakovic and Champagne 2015](#)). The results reported to date suggest that experi-

ences that trigger epigenetic changes in the neurological system may also alter the genes of certain receptors such as oxytocin, serotonin and cortisol, which in turn may lead to poor parenting during adulthood (Fujiwara et al. 2019). For example, Mileva-Seitz et al. (2016) found that parents with an oxytocin deficiency are less likely to seek affective gratification with their children, thus giving rise to less sensitive interactions. This in turn affects the development of these children, who in adulthood may repeat this sequence, thereby disrupting subsequent generations also. In this sense, the work of Van Aswegen et al. (2021) supports transgenerational covariance in the methylation levels of genes related to maternal and offspring stress regulation.

One key question in relation to the possible transmission of good or poor parenting is whether or not it is possible to inherit an epigenome that is particularly susceptible to certain parental behaviours. Whatever the answer, it is important to bear in mind that the quality of parenting interactions will also be modulated by a series of family-context variables, such as parents' education level, economic situation, social support network, stress and the characteristics of the child themselves, among others (Jensen and Champagne 2012). For example, living under stressful conditions may have a more negative impact on those people with a certain degree of genetic susceptibility to the disruption of neural systems (Andaloussi et al. 2019; Mileva-Seitz et al. 2016). Nevertheless, other data suggest that thanks to the plasticity of the human brain, the consequences of an adverse experience during early childhood may be mitigated by good-quality experiences during later stages, which to a certain extent may compensate for earlier deficits (Jensen and Champagne 2012).

The updated epigenetic approach proposed in this essay is based on the theory of probabilistic epigenesis developed by Gottlieb (Johnston 2015), in which the term "probabilistic" illustrates the multiple phenotypic possibilities that may result from combinations of different variables. The concept of a psychological developmental phenotype has also been explored in the work of Cox (2013) and Milbrath (2013). The literature review revealed empirical evidence compatible with an epigenetic approach to fully describing the contribution of family context and parenting interactions to our understanding of human psychological development.

5. Conclusions

5.1. Parenting Science in the 21st Century: Theoretical and Methodological Implications

The first issue to resolve is whether the contents and reflections outlined in this essay truly support the proposal to use an epigenetic approach as a unifying theoretical framework for gaining a deeper understanding of the influence of family context and parenting on children's psychological development. If epigenetics aims to explain changes in development by taking genetic and contextual variables into account, then it is only logical to establish the interactions between the two influences as the basic unit of analysis. Moreover, once the object of analysis has been established, the next step would be to view the process by which interactions are internalised (according to Vygotsky's theory) as an active mechanism. Since everyone is exposed to exclusive interactions in different contexts throughout the course of their life, these interactions result in different individual phenotypic expressions. As Beach et al. (2016) point out, research into epigenetics as a mediator of the connections between family/community processes and a range of developmental outcomes is still a growing field; however, it is also true, as indeed highlighted by the above-mentioned authors, that the potential to develop important insights regarding mechanisms linking modifiable environments to biological processes and long-term health and developmental outcomes is already coming into view. There can be no doubt that this poses an important challenge that parenting science will have to deal with over the coming years.

While encompassing many different influences, traditional approaches such as bioecological theory nevertheless have difficulty including, in a specific ring, variables with very different qualitative significance, such as, for example, exposure of the embryo to

neurotoxins and children's exposure to destructive interparental conflict. The bioecological approach also has trouble explaining phenomena such as, for instance, the intergenerational transmission of parenting patterns. This transmission actually occurs and is fundamentally epigenetic in nature, meaning that it occurs independently of individuals' genetic makeup and takes place at an 'epi' level, i.e., a level above that of genes (Unternaehrer et al. 2021).

One point in favour of using the epigenetic approach as a unifying and inclusive framework for explaining the influences of family context and parenting on psychological development is that it effortlessly encompasses the concept of nonshared environments as a defining concept of all those specific interactions in an individual's life that together help explain the interindividual differences that are so characteristic of human beings, and which are manifested in each person's unique phenotypic profile. It is very important to highlight that recognising the impact of nonshared environments on children's development in no way negates the simultaneous impact of so-called shared environments, which also interact with the genetic blueprint throughout the development process. This is especially relevant when it comes to understanding and identifying parenting practices that are common to the entire family system and those that are specific to each brother or sister.

It is worth highlighting that the epigenetic approach proposed here is conceptually flexible, meaning that it is a model that admits epigenetic changes beyond those strictly linked to the main process of DNA methylation (Bjorklund 2018a). In this sense, two levels of epigenetic processes can be established: that pertaining to DNA methylation or histone modification processes, and that pertaining to changes in psychological development inferred through observation or behavioural assessment. One relevant example would be that which was previously given in this essay about types of attachment, for which we have both empirical evidence based on observation and certain indications of neurohormone correlates, such as high levels of cortisol in children with disorganised attachment. Another example would be the study by Ein-Dor et al. (2018), which demonstrates the relationship between insecure-avoidant attachment and the methylation of oxytocin and glucocorticoid receptor genes. Nevertheless, further research is required to replicate these findings, and the epigenetic profile of each attachment pattern described in the literature needs to be explored, along with those of psychopathological disorders and, in general, other conditions that may affect health outcomes.

The next relevant conclusion that can be drawn in relation to our proposal is that parenting science in the 21st century is certain to face some serious methodological challenges. The epigenetic approach requires research designs that take into account the coinfluence of many different factors on the dependent variables being studied in each case, and this in turn requires analysis procedures capable of measuring the bidirectional processes described above, as well as the differential influence of different independent variables on specific dependent variables. One example would be the multiple-regression analyses provided by structural-equation modelling. The study of parenting is currently a highly interdisciplinary field, and it is now more necessary than ever to establish a common working framework and research map that renders experimental 'micro' studies compatible with cohort studies seeking to analyse the influence of many different variables simultaneously. At the same time, it is worth highlighting the fact that the epigenetic approach allows researchers to study psychological development at the intraindividual level, searching for diverse phenotypic pathways, as well as at the interindividual level, comparing sample groups belonging to different backgrounds. A common approach is vital if we are not to lose sight of the complexity of the process under study.

5.2. Challenges and Opportunities for Parents and Policymakers in the 21st Century

Probably the most important conclusion drawn by this essay is that the proposed approach has enormous potential in the field of applied science and family and parenting policies. In this regard, it is worth highlighting several of the challenges and opportunities for parents and policymakers that can be derived from this work. Firstly, the flexibility and openness to context of the epigenetic model opens the doors to multiple preventive and/or

therapeutic interventions in the social, educational and health fields. A complex understanding of parenting influences on developmental processes will enable more finely tuned interventions, based on the identification of general development laws. This is especially important when it comes to preventing the cycle of intergenerational transmission of poor parenting and early adversity, as [Lomanowska et al. \(2017\)](#) point out. This approach will also enable the design of customised parenting interventions based on each individual's unique epigenetic process.

Secondly, the analysis of the literature provided in this essay highlights the importance of paying attention to findings linked to the neurohormonal background of parenting. This is a relevant topic, since the science of parenting is making progress in building a biological profile of good and bad parenting consisting of biomarkers such as methylation indicators and hormonal correlates. This profile may prove very useful for screening the quality of family interactions in large family samples. Screening should be accompanied by an exhaustive assessment of the quality of family contexts, which would provide empirical support for the design of family policies adapted to the needs and deficiencies of different communities. As much as quality of family context assessment is essential to properly weight contextual influences, in no case can this approach be understood as a biological determinism.

A third relevant issue that emerges from the literature review is linked to the negative impact of toxic stress, both as an inhibitor of family interactive quality and as a trigger of epigenetic processes linked to cortisol segregation. Coping with stress is one of the great challenges faced by parents today, as seen especially during the COVID-19 pandemic that has affected all of humanity. Finally, family policymakers and parents themselves share the challenge of preserving the quality of parenting even in the most adverse situations, such as those faced by vulnerable families living, for example, in refugee camps or in situations of poverty and violence. A good example of an attempt to rise to this challenge is the UNICEF Care for the Children programme ([Lucas et al. 2018](#)), which combines psychoeducational parenting interventions with care and nutrition-focused ones. In the 21st century, mothers and fathers should have the opportunity to be adequately empowered to cope with family stress in a positive way, and to provide adequate cognitive and socioemotional scaffolding that promotes healthy child and adolescent psychological development.

In sum, following the latest international recommendations for the development of parenting policies, the 21st century should be the century of family-oriented policies that include universal services for the preventive evaluation of the quality of family contexts, community promotion, so-called social parenting and healthy psychological development. As [Perks and Cluver \(2020\)](#) state, the time is right for the widespread administration of a parenting vaccine through the implementation of positive parenting programmes.

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