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1 **Theorising Women's Health and health inequalities: shaping processes of the 'gender-**  
2 **biology nexus'**

3

4 Short running title: gender, biology and health

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20

21 **Theorising Women’s Health and health inequalities: shaping processes of the ‘gender-**  
22 **biology nexus’**

23  
24 **Abstract**

25  
26 Since the theoretical frameworks and conceptual tools we employ shape research outcomes  
27 by guiding research pathways, it is important that we subject them to ongoing critical  
28 reflection. A thoroughgoing analysis of the global production of women’s health inequality  
29 calls for a comprehensive theorization of how social relations of gender and the biological  
30 body mutually interact in local contexts in a nexus with women’s health. However, to date,  
31 the predominant concern of research has been to identify the biological effects of social  
32 relations of gender on the body, to the relative neglect of the co-constitutive role that these  
33 biological changes *themselves* may play in ongoing cycles of gendered health oppressions.  
34 Drawing on feminist and gender theoretical approaches, and with the health of women and  
35 girls as our focus, we seek to extend our understanding of this recursive process by  
36 discussing what we call the ‘shaping processes’ of the ‘gender-biology nexus’ which call  
37 attention to not only the ‘gender-shaping of biology’ but also the ‘biologic-shaping of  
38 gender’. We consider female genital mutilation/cutting as an illustration of this process and  
39 conclude by proposing that a framework which attends to *both* the ‘gender-shaping of  
40 biology’ *and* the ‘biologic-shaping of gender’ as interweaving processes provides a fruitful  
41 approach to theorising the wider health inequalities experienced by women and girls.

42  
43 **Introduction**

44 As Raewyn Connell recently explains, ‘in an ontological sense, gender is the way human  
45 reproductive bodies enter history, and the way that social process, unfolding through time,  
46 deals with biological continuity’ [1, p.341]. Social relations of gender interact with the

47 biological body to shape the experiences of health of men and women, boys and girls, in  
48 numerous ways in manifold geographic contexts worldwide. The aim of this theoretical  
49 exposition is to analyse how, within this context, feminist and gender theorists have made  
50 biological 'sex' and social 'gender' legible, with the specific object of identifying lacunae in  
51 their expression in a nexus with health. We begin by suggesting that the principal theoretical  
52 contribution to date has been to identify how the biological body is shaped by social  
53 relations of gender, or what we conceptualise here as 'the gender-shaping of biology'. We  
54 then propose that, notwithstanding calls to re-examine biology in feminist terms [e.g. 2, 3,  
55 4, 5, 6], the matter of how the biological body may, by its turn, express and contribute to  
56 social gender dynamics in a nexus with health—or what we term the 'biologic-shaping of  
57 gender'—is underexplored. Taking the 'gender-biology nexus' as our object, we put forward a  
58 theoretical approach which emphasises two co-constitutive 'shaping processes': the  
59 'gender-shaping of biology' and the 'biologic-shaping of gender' as they operate with  
60 respect to the health and health inequalities of girls and women. To explore and illustrate  
61 this in a preliminary way, we take the example of female genital mutilation/cutting. In what  
62 follows we acknowledge the various meanings given to the terms 'health' and 'illness', but,  
63 given our expository purpose, we generally use the term 'health' inclusively to cover both  
64 positive and negative dimensions of experience.

65

### 66 **The 'gender-shaping of biology'**

67 As extensively rehearsed, the sex/gender distinction introduced into feminism in the 1970s  
68 [7] had a strong and timely purpose; to challenge the pejoration of the binary script which  
69 has fashioned woman's being as analogous to the biological body, itself conceived as  
70 inferior to that of man. This roused the compelling argument that the causes of health/ill-

71 health globally are predominantly social and an effect of women's inequality within the  
72 dominion of men. Of course the argument has never been that 'biological sex' and 'social  
73 gender' bear no relationship, but rather that 'the aura of naturalness and inevitability that  
74 surrounds gender-differentiation' comes [...] from the beliefs people hold about it', rather  
75 than from presumed biological characteristics [7, p.189]. Even so, research has been, and  
76 generally still is, targeted above all towards an examination of the influence of gender as a  
77 social factor on women's bodies and their health [8]. From the 1970s onwards, ground-  
78 breaking social science and public health research raised two far-reaching concerns: the  
79 generally higher prevalence of ill-health globally of women and girls (compared to men and  
80 boys) at the individual and collective levels, and their adverse access to, and treatment in,  
81 healthcare settings [e.g., 9, 10]. Anthropologists Nancy Scheper-Hughes and Margaret Lock  
82 [11] have encouraged researchers to consider not only the individually experienced 'body-  
83 self', but also the representational symbolic power of the 'social body' to define how nature  
84 and culture are thought about in a society—for our interest here, in gendered terms—and the  
85 'body politic' which, through healthcare (including lay healing) and other systems such as  
86 kinship, regulates both the social body and individual bodies. Stressing that gender itself is  
87 global, sociologist Connell [12,1], referred to earlier, has sought to capture the relations of  
88 power, production, emotion, and representation that establish the 'gender order' and the  
89 institutions (e.g., healthcare) that constitute the 'gender regime' of a society. She contends  
90 that as both agents and objects in reflexive practices, bodies cannot be conceived as *either*  
91 biologically *or* socially determined. Here 'gendered social embodiment' occurs in a  
92 structured interplay with the 'reproductive arena' where 'the reproductive possibilities of  
93 human bodies are historicized; that is, given specific social forms' [13] as both '*objects of*  
94 social practice and *agents in social practice*' in a 'loop, a circuit, linking bodily processes and

95 social structures' [12, p. 67, emphasis original]. These theoretical contributions, amongst  
96 others, have been effective and influential broad steers for a wealth of powerful empirical  
97 research on 'gender and health' internationally [see, for example, 14, 15, 16, 17]. However,  
98 while the biological body is clearly a point of reference in these and other theoretical  
99 contributions, it is mostly tacit. In Connell's work, for instance, bodily capacities primarily  
100 appear to be 'a site where something *social* happens', such as the creation of the categories  
101 'women' and 'men' [12, p 68, emphasis added]. Her illustrations of anorexia and HIV  
102 transmission [13], for example, address the transformation of bodies in social embodiment,  
103 but she does not intend to take up the associated biological processes *in* the body. Recently  
104 intersectionality has gained theoretical traction as a counter to universal depictions of the  
105 experiences of social groups (such as women), pointing to matrices of domination that arise  
106 from complex interactions of other social structures such as age, race, class, and citizenship  
107 with gender [18]. For example, with reference to global health, Anuj Kapilashrmai and Olena  
108 Hankivsky [19, p.2589] have recently argued that an intersectional approach goes beyond  
109 the examination of what they identify as individual factors, such as biology, socioeconomic  
110 status, sex, and gender, to explore the impact that interactions among these factors have  
111 upon health in a specific context. As they argue, this advances understanding of health  
112 inequalities by drawing attention to differences amongst what tend to be seen as relatively  
113 homogenous population groups, such as 'women', and by highlighting the interacting  
114 influence of different 'multiple sites and levels of power', such as laws, institutions, and  
115 structures of discrimination like sexism on health [19, p.2589]. Yet, significant though their  
116 points are, and although referring to the interacting role of biology, their attention in  
117 illustrations of cardiovascular disease and migration is on the influence of interacting *social*  
118 factors with the body. Also taking an intersectional approach, but with a thoroughgoing

119 focus on gender, Kristen Springer and colleagues justly question the positing of sex and  
120 gender as distinct domains, explaining instead that ‘the vast majority of male-female health  
121 differences are due to the effects of the irreducibility of entangled phenomena of  
122 “sex/gender” and therefore that this entanglement should be theorized, modeled, and  
123 assumed until proven otherwise’ [20, p.1818]. Again, the foremost concern is with the  
124 ‘material effects on the body’ of ‘gendered life experiences’ as they ‘*show up*’ in ‘biologically  
125 based “sex differences”’ [20, p.1818, our emphasis]. They cite existing research on matters  
126 such as the effects of social interaction and status differentials on neuroendocrine function  
127 and psychosocial stress on cardiovascular disease, but they do not intend to detail the  
128 biological processes that may be at work.

129

130 What we refer to as ‘gender-shaping’ also underlines psychosocial stress research. Often  
131 taking its cue from endocrinologist Hans Selye’s [21, p.692] definition of stress as ‘the non-  
132 specific response of the body to any demand made upon it’ (such as emotional upsets on  
133 processes such as blood pressure and body temperature), research has addressed the  
134 effects (implying stress arousal) of gendered life and working conditions in the biological  
135 body. For example, Marianne Frankenhaeuser and colleagues [e.g., 22] have researched the  
136 importance of gendered conditions in unpaid work for the differences in stress hormone  
137 response between men and women in white-collar occupations. In her influential depiction  
138 of ‘embodiment’, social epidemiologist Nancy Krieger [23, p.350] explores what bodies tell  
139 us about lives by the marks left on them by the body politic through, for instance, food  
140 insecurity, economic and social deprivation. To depict how biological sex and social gender  
141 are, ‘inextricably woven’, she introduced (with Sally Zierler), the lexicon ‘biologic expression  
142 of gender’ to characterise the incorporation of social expressions of gender into the body–

143 such as the effects of underfunding of girls' athletic programs on 'body build and exercise  
144 patterns' [24, p.42, p.43] – and the companion concept, the 'gendered expression of  
145 biology' 'to show 'how biologic processes influence gender roles, relations, and conditions'  
146 (such as when the ability to get pregnant is used to restrict women's employment in  
147 typically male and well-paid jobs, even when less well-paid jobs can be more hazardous to  
148 health) [24, p.41]. Here the focus is on biological *expression*, or how our understandings of  
149 the biological body are filtered through a gender lens. Subsequently Krieger [25] has drawn  
150 attention to the potentially synergistic relationship between what she dubs 'sex-linked  
151 biology' and 'gender relations' in health outcomes. The former depicts the reproductive  
152 system, including chromosomal sex, secondary sex characteristics, pregnancy, and  
153 menopause. Her proposition that 'sex-linked biological characteristics can, in some cases,  
154 contribute to or amplify gender differentials in health' [25, p.653] is instructive. Her  
155 examples, such as women's higher exposure to intimate partner violence—where 'sex-linked-  
156 biology' is set out as a determinant of strength and stamina, in interaction with 'gender  
157 relations', such as men's greater likelihood of using physical violence—are astute, but it is not  
158 her goal to explore the actual biological processes at work.

159

160 This summary, which for reasons of space cannot do justice to the now sizeable body of  
161 writing from gender and feminist thinkers on women's health within the social sciences, has  
162 highlighted how enlightening research on what we refer to as the 'gender-shaping' of the  
163 biological body has been. However, in this loosely grouped corpus of research, biology has  
164 not so much been ignored as left tacit; more tacit, we would argue, than it should be if we  
165 are to move towards a more comprehensive understanding of ongoing cycles of women's  
166 health oppressions. In a somewhat separate body of writing, feminist biologists have (as we



167 would expect) given biology a more visible analytic presence. For example, Anne Fausto-  
168 Sterling [26, 27] deftly explores the interweaving of bodies, disorder and culture under the  
169 rubric of 'life course systems theory'/'dynamic systems theory'. She observes that since  
170 social experience produces new biosocial formations, 'nothing in the body' is 'permanent  
171 and unchanging' [28, p.63]. She rightly argues that temporal changes draw attention to  
172 alterations both in individual biological bodies as they grow and age and the transformation  
173 of social groups as experiences of earlier generations are embodied in offspring. For  
174 example, in an analysis of the skeletal system and osteoporosis, she conjectures that a  
175 complex of factors, including physical exercise, diet, drugs, hormones, and biomechanical  
176 effects on bone formation interact through the lifecycle to influence bone density and  
177 fractures, negatively affecting more women than men. She explicitly acknowledges that we  
178 know relatively little scientifically about how these processes and mechanisms occur, but  
179 emphasises that they transpire within 'the experiences of growing, living, and dying in  
180 particular cultures and historical periods and under different regimens of social gender' [26,  
181 p.1510]. She hypothesizes, for instance, that women's more frequent dieting to lose weight  
182 during their lifetime may contribute to lower peak bone density in adulthood compared to  
183 men and hence to fractures. As this indicates, her focus is squarely upon the 'gender-  
184 shaping' of biology. This is further illustrated through her example [29] of the facility to  
185 chose from amongst the social features of gender to embed new bodily habits, such as the  
186 capacity, through practice, to alter voice register, tonality and cadence to correspond with  
187 that of a typical man or woman and the embodiment of this new habit in the sensorimotor  
188 (neuromuscular) system. In a landmark analysis, biologist Lynda Birke chastens fellow  
189 feminists for conceptualising the body as 'the malleable surface of an internally stable  
190 corporeality' [2, p.137]. Following neuroscientist Steven Rose [29], she argues that although

191 bodies are ‘self-organising and self-determining’ and sometimes ‘outside of our willed  
192 control’ [2, p.169, p.85], we should conceptualize them not as ‘simply *being*, but rather as  
193 *becoming*’ in two-way processes throughout our lives [30, p.45, emphasis in original]. She  
194 guides us very effectively to the fleshy, material body, but, again, we are primarily led  
195 towards what we call the ‘gender-shaping of biology’ through changes within the body  
196 resulting from social engagement [6].

197

198 Clearly the work of feminist biologists is very important. But we still have some way to go if  
199 we are to move beyond the analysis of gendered narratives and representations to grasp  
200 empirical data *about* the body which, as Margaret Lock and Vinh-Kim Nguyen recently put it,  
201 remain black-boxed, obscuring ‘the pernicious, embodied and long-term consequences of  
202 social inequalities’ [32, p.329]. As argued more generally by Thomas Lemke [33, p. 87],  
203 amongst others, there is hesitancy amongst many feminists to engage directly with  
204 ‘biological data and corporeal materiality of the body’. This hesitancy is explained by the  
205 understandable desire to shun the hoary and truculent patriarchal equation of women and  
206 girls with a defective biology which has justified women’s inequality through time [ 8]. Thus  
207 it to some extent understandable that, ‘feminist-biologists’ (as we conceptualise them) and  
208 other researchers we have discussed seem to grapple primarily with how social processes  
209 (variously conceptualised) become embodied and (potentially) generate change in the  
210 biological body—itself a thorny, and certainly important, matter—to the relative neglect of  
211 the even bristlier and challenging concern of the interacting role that biological changes  
212 themselves might play in *shaping gender* in the nexus with health. But, as we now go on to  
213 argue, further steps are needed to develop a theoretical framework that tightens up the  
214 ‘gender-biology nexus’ in relation to health.

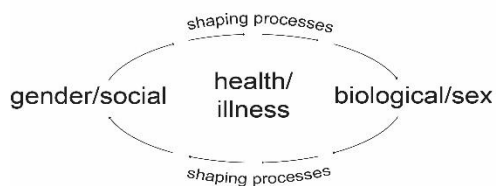
215

216 **The ‘biologic-shaping of gender’**

217 Though our conceptualization of the ‘gender-shaping of biology’ resonates with present  
218 ways of thinking (as described above), the ‘biologic-shaping of gender’ is outwardly less  
219 obvious in its meaning. It is therefore important to emphasise that we are not saying that  
220 biology has a *determining* role, but rather that cyclical and highly complex ‘*shaping*  
221 *processes*’ are likely to be in play whereby biological changes—which have themselves been  
222 ‘gender-shaped’ (in the manner depicted by the existing research as discussed)—recursively  
223 shape women’s gender-related experiences of health (‘the biologic-shaping of gender’).  
224 Hence it should also be noted that we are not suggesting, or intending to identify, a linear  
225 ‘input-output’ model whereby the ‘inputs’ of socially gendered experiences generate  
226 biological changes which then ‘output’ to effect gendered health experiences anew, but  
227 rather an imbricated and recursive process. This process is represented diagrammatically in  
228 the Figure.

229

230 *Figure: Shaping processes of the ‘gender-biology nexus’*



231

232 With the advent of ‘new materialist’ feminism [e.g., 6, 34, 35] over roughly the last decade,  
233 attention has turned more directly to the materiality of the body as ‘itself an active,  
234 sometimes recalcitrant, force’ [34, p.4]. Samantha Frost [36, p.71], for example, argues that  
235 if feminists wish to grasp the interaction of culture and biology as ‘complex, recursive, and

236 multi-linear' they must 'acknowledge that matter and biology are active in their own right'.  
237 Humans, as Frost [38] relates, are 'biocultural' beings, or, as Karen Barad [35] puts it,  
238 formed by 'naturalcultural' practices. The living human body comprises a multitude of  
239 complex biological processes which bridge the inner body systems with the outer social and  
240 gendered context, for example, through perception and cognition. As Frost [38: p. 75-6]  
241 argues, bodies are responsive to their environments and 'quite literally rebuild themselves,  
242 constantly, in response to the molecular constituents of their habitats'. But they are not  
243 identical to their habitats since each body has been formed by its earlier biological and  
244 cultural (biocultural) interchanges as well as those of previous generations. For instance,  
245 research suggests that epigenetic processes may act as a channel through which social  
246 environmental influences affect the body by changing gene expressions (the phenotype)  
247 without changing the underlying DNA sequence (the genotype). Epigenetic changes may  
248 thus alter gene expressions and modify disease susceptibility in various ways through  
249 changes in the epigenome [39] which manifest in material physical form. Thus  
250 environmental epigenetics highlights not only the making and remaking of bodies by their  
251 environments, but also that bodies are, as Julie Guthman and Becky Mansfield argue,  
252 'always active in their own remaking' [40, p.499]. Recognising that bodies and  
253 social/material environments develop in relation to each other destabilises the  
254 conventionally conceived social/biology border and draws attention to biological plasticity  
255 [41]. Thus the body's external environments do not sit beyond it, but 'are themselves partly  
256 a consequence of the organism itself as it produces and consumes the conditions of its own  
257 existence' [42, p.108].  
258

259 Although this way of thinking is gaining recognition, as Jörg Niewöhner and Margaret Lock  
260 [43] instruct, there is a dearth of empirically-informed research in the health field to  
261 illustrate just how the biological body may be actively involved in this process. This is  
262 notably the case with regard to feminist work on health. As an illustration of how the  
263 processes by which the biological body might not only be *shaped by* gender but may itself,  
264 by turn, have a role in *shaping* women's experience of health/ill-health, we take female  
265 genital mutilation/cutting (FGM/C) as a case example to begin to examine the body's  
266 biological systems and health inequality. Given the state of current scientific knowledge, this  
267 case is offered in a preliminary and tentative fashion.

268

#### 269 **The case of FGM/C**

270 Identified by the United Nations as a human rights violation affecting girls and women  
271 worldwide, FGM/C is especially concentrated in a swath of countries from the Atlantic coast  
272 to the Horn of Africa, in areas of the Middle East, and in some countries of Asia. The WHO  
273 defines the practice as comprising 'all procedures that involve partial or total removal of the  
274 external female genitalia, or other injury to the female genital organs for non-medical  
275 reasons' [44]. By recognising that 'FGM is an act that cuts away equality' [45], the most  
276 recent UN-sponsored International Day of Zero Tolerance 2018 underscored the association  
277 of FGM and gender inequality. Worldwide, in countries where it is prevalent, 200 million  
278 girls and women alive today have been cut, with 3.2 million cut annually [45, 46, 47, 48].  
279 Prevalence varies considerably across countries. Secular trend analysis shows some  
280 significant shifts downwards in prevalence over the last twenty to thirty years in some  
281 regions, such as East Africa, which according to Demographic Health Survey (DHS) data, saw  
282 a reduction in prevalence from 71.4% in 1995 to 8.0% in 2016 [49]. However, UNFPA [47]

283 predicts (also based on DHS data) that due to underlying population growth in girls under  
284 age 25, the number of women affected will increase significantly by 2030 in countries where  
285 FGM/C is prevalent.

286 FGM/C is not only a practice, traceable back thousands of years, but also an object of  
287 political debate within contemporary feminism and beyond [e.g., 50], making it in Hilary  
288 Burrage's [51] words, a moral maze. UNICEF, for example, has employed both the more  
289 politically neutral FGM/C (female genital cutting) and FGM [46, 52]. Since we cannot do  
290 justice to political debates here, which, although important, are not essential to our  
291 purpose, we opt to use the broader term FGM/C. FGM/C is an expression of gender  
292 inequality and a form of violent abuse within patriarchal societies past and present[see e.g.,  
293 51, 53]. FGM/C's persistence is often associated with entrenched socio-cultural norms. As a  
294 cultural and political marker of inside/outsider status for girls and women, it often  
295 symbolises cleanliness, purity, an appropriate embodied femininity and entry into  
296 womanhood and is seen to improve fertility and marriageability [51, 54, 55]. Social  
297 exclusion, shame and stigma often result if a girl is not cut [50, 52, 56]. Associations are  
298 often drawn between FGM/C and the Islam since it is well-established in many  
299 predominantly Islamic societies (such as in sub-Saharan Africa), yet not all Islamic groups  
300 engage in the practice while many non Islamic groups do (it is practised amongst the  
301 Christian and Jewish faiths, for example). As Burrage [51] relates, FGM/C is axiomatic to no  
302 world religion, yet in various times and place various religious faiths have practised it and  
303 patriarchal religions arguably create the milieu which allow the practice to continue.

304

305 Although the genito-urinary effects of FGM/C, such as effects on sensibility and sexual  
306 pleasure, painful neuromas, micturition difficulties, menstrual, and obstetric complications

307 are fairly well-documented [e.g., 57, 58], in-depth studies of how these complications are  
308 embodied and experienced throughout the lives of women are few in number, undoubtedly  
309 because of the not inconsiderable practical challenge of conducting research on the matter.  
310 Long-term bodily consequences of FGM/C may extend beyond the reproductive system,  
311 involving, for instance, intestine and urinary bladder dysfunction and long-term pain and  
312 complications [59], as well as somatic complaints; that is, symptoms with no identifiable  
313 organic cause, such as aches and pains, and also significant mental health problems,  
314 including depression, anxiety, and PTSD [60, 61, 62].

315

316 To refer back to our Figure, throughout our discussion thus far we have focused primarily on  
317 one facet of the 'shaping process' within the 'gender-biology nexus'; namely, the 'gender-  
318 shaping of biology'. In the reciprocal process of 'biologic-shaping of gender' we attend to  
319 how the experience of women and girls may *alter* in complex embodied interactions with  
320 biological changes in the body. By definition, when referring to *female* genital  
321 mutilation/cutting, it is important that we include 'sex' because only the biological sex  
322 organs of girls and women i.e., the vulva (clitoris, labia majora, labia minora are exposed to  
323 trauma. While it can be noted that male circumcision (cutting of the prepuce, or foreskin)  
324 and can also carry health risks (though these are not high) such as haemorrhage and  
325 bleeding and erectile dysfunction [63], and that some argue that we should problematise  
326 male circumcisions as a routine practice and its association with understandings of the male  
327 body and masculinity [64], this is not addressed here as our focus is on women and girls.  
328 Though not referring to FGM/C, Jörg Niewöhner and Margaret Lock argue that bodily  
329 sensation and experience is 'in part *formed by* the material body, itself *contingent on*  
330 evolutionary, environmental, social and individual variables' [43, p.684, our emphases]. The

331 consequences of these ‘variables’, as Niewöhner and Lock express it, are illustrated in  
332 research by Anke Köbach and colleagues [60] with women in Jijiga, the capital of the Somali  
333 region of Ethiopia where FGM/C has been widespread. Their analysis is based on a  
334 convenience sample (without a control group) and comprises self-reported information  
335 gleaned from women in interview (with clinical psychologists) about FGM/C, including  
336 experience of the cutting, subsequent short and long-term physical complications, and  
337 validated measures of PTSD and other mental health problems. From their analysis the  
338 authors identified associations between the most severe kinds of cutting (types II and III)  
339 and psychopathological symptoms in adulthood, especially vulnerability to PTSD and  
340 shutdown dissociation. They also found higher hair cortisol concentrations (an indicator of  
341 hormone response to stress) in women who experienced FGM/C before their first year of  
342 age or had more severe forms of FGM compared to rest of the women, which indicates  
343 long-term neuroendocrinological consequences of FGM and trauma in general on the  
344 central stress system (the hypothalamic-pituitary-adrenal axis, or HPA). Since the HPA axis  
345 genes play an important role in regulating the impact of social and environmental stress,  
346 Köbach et al. draw attention to the possibility that the trauma from experiencing cutting  
347 may have epigenetic effects. That traumas during a critical age period of epigenetic  
348 plasticity in early life (as Köbach et al.’s [60] respondents’ experienced) may lead to  
349 epigenetic processes is suggested by animal studies [65] and has been proposed as a  
350 framework for epigenetic modifications in the biological integration of socioeconomic  
351 factors during life. Research indicates that early egregious trauma (such as abuse in  
352 childhood and other sorts of early-life stress among humans) may lead to dysregulation of  
353 the HPA axis and later life mental ill health [66] as well as other health problems, such as  
354 cancer and cardiovascular disease [e.g., 67, 68, 69]. Thus we can situate, albeit tentatively



355 (since, as noted, research is very limited at present), findings about FGM/C within the  
356 hypothesized associations between stress-induced epigenetic modifications located in early  
357 stressful life events during childhood and later life health inequalities in the manner  
358 suggested as possible for socio-economic differentials [see e.g., 68, 70]. In our case  
359 illustration, possible epigenetic effects reveal that the 'gender-shaping of biology' (taking  
360 FGM/C to be the effect of women's environmental and social inequality) appears to  
361 entangle with neuroendocrinological changes which 'biologically-shape' (but do not  
362 determine) the health of girls and women exposed to FGM/C, which can be conceptualised  
363 as a form of gendered health inequality. To explore this 'biologic-shaping of gender' in  
364 relation to FGM/C further, we draw now on the work of Gillian Einstein [71, 72], a biologist  
365 with a doctorate in neuroanatomy, who explores the neurobiological repercussions of  
366 FGM/C from a feminist perspective.

367

368 Focusing on FGM/C type III (infibulation, excision of the external genitalia with closure of  
369 the introitus) [62], Einstein proposes that cutting of the efferents and afferents (nerve  
370 circuits) carried in the pudental, pelvic and hypogastric regions may affect the rest of the  
371 body via the central nervous system (CNS) which, along with others [e.g., 73], she describes  
372 as 'sensitive and malleable' [72, p.171]. She takes FGM/C's effects not in isolation and as  
373 affecting one part of the body (the reproductive system), but as 'owned by the entire body,  
374 or embodied through the interconnections of all body systems and the environment' [72,  
375 p.158]. In an expressly speculative analysis she suggests that since the tissue of the vulva is  
376 highly innervated, cutting the nerves which supply the skin and muscle will affect the feed-  
377 back processes of the central nervous system and rouse long-lasting, body-wide effects such  
378 as referred sensations, including pain (referred sensation means a sensation perceived at

379 another location than the site of the stimuli causing the sensation).The spinal cord and brain  
380 may respond to cutting with reorganization ('rewiring') of neural circuits by referred  
381 sensations (The neurological tissues can react to bodily losses akin to the way in which,  
382 upon the amputation of a leg, a person may still feel the sensation of parts of the lost leg or  
383 feelings of pain in the lost leg—a phenomenon called phantom sensation or phantom pain.  
384 Einstein [71] suggests similarly that women exposed to FGM/C may experience phantom  
385 sensations or clitoral pain.

386

387 Extrapolating from Einstein's arguments, while the (new) biological changes to the body  
388 may *shape* physical sensations after having been cut, we would not expect them to  
389 *determine* sensate experience in any simple or universal way because women's  
390 interpretations of and responses to biological change are situated in time and place and  
391 therefore formed by local expectations and practices. To deploy anthropologist Margaret  
392 Lock's [74] well-known concept of 'local biologies', the shaping processes that we highlight  
393 here are contingent and experienced in specific gendered environments. According to  
394 Einstein [71, 72], it is reasonable to argue that as it is affected by other bodily modifications,  
395 the CNS itself 'plays a role in the embodiment of culture' [72, p.155] with potential  
396 gendered consequences for both the bodies and minds of women and girls. Thus she  
397 proposes that cutting not only makes girls and women resemble their community physically  
398 (which is likely to be normatively valued), 'through its actions on the CNS it inscribes values  
399 of comportment and aesthetics' [71, p.94]. Thus she relates that FGM/C 'configures the  
400 ways in which a woman carries herself, walks, and experiences the world' [71, p.94]. By this  
401 we may infer that a new collective and individual mind-body is produced. First-person  
402 experiential accounts provide support for this. Waris Dirie [75] and Hibo Wardere [56], for

403 instance, explain how their physical bodies changed after cutting and the horrific pain when  
404 urinating and the nightmare of menstrual periods after being cut as young girls. Reflecting  
405 back on the impact of biological change on her life as a girl, Wardere laments, ‘no more  
406 running, skipping or jumping rope for me’ [56, p.223]. Similarly, in research by Morison and  
407 colleagues [76], Somalis living in London spoke of direct effects of cutting which involved  
408 walking and behaving differently to avoid opening up scars. This conjures political scientist  
409 Iris Marion Young’s [77] classic discussion of female comportment. Less open than men in  
410 gait and stride, Young argues that ‘modalities of female bodily existence’ are rooted in  
411 experience of the body as a ‘fragile thing, which must be picked up and coaxed into  
412 existence’ [77, p.39]. Perforce, women who have been cut may realise pain, distress, and  
413 constricted physicality, but as this usually is all they and those around them know, over time  
414 and through generations, as Einstein explains, experiential changes may become  
415 ‘instantiated as the “normal” (and perhaps, desirable) body’ [72, p. 151; see also, 78] and  
416 hence part of the experience of womanhood [56, 75]. Research with Somali-Canadian  
417 women, for example, has shown that wide-scale bodily pain and discomfort can be brushed-  
418 aside as normal-natural as women exhibit resilience through the desire not to let pain attain  
419 power over their lives [71, 72, 78]. Nevertheless, as Johansen [79] explores, the pain of  
420 infibulation has lasting effects, which Somali refugee women in her Norwegian study spoke  
421 of as ‘embodied memory’ carried with them as a burden and sense of loss. This then points  
422 to how shaping processes; the intertwined ‘gender-shaping of biology’ and consequent  
423 ‘biologic-shaping of gender’ through time, may produce a new collective and individual  
424 mind-body, as noted earlier.  
425

426 To return explicitly to our Figure, while the origins of FGM/C are indisputably social and  
427 seated in localised social relations of gender ('gender-shaping of biology'), they may effect  
428 complex and perhaps far-reaching changes in the material biological body. The body  
429 becomes other than what it once was (or could have been); it is altered. Through our  
430 illustration, we have sought to open up black-boxed data about the body which obscures  
431 the harmful embodied and long-term consequences of social inequalities [43] by bringing to  
432 light the epigenetic and neurobiological processes through which changes may occur. These  
433 bodily changes by *their* turn entwine with (but do not determine) women's individual and  
434 collectively gendered bodily expressions and experiences (the 'biologic-shaping of gender')  
435 which are unlikely to be universal, but rather to vary by time and place. It is important to  
436 stress that by this argument we do not intend to say that the biological and the social are  
437 one and the same, collapsed into one another or, as noted earlier, that a linear 'input-  
438 output' process is in play, but rather that gender-suffused social milieu—which encompass,  
439 for example, the health, life and experiences of our illustration—become sedimented (but  
440 not ineludibly fixed) in bodily practices which concern women's health as individual and  
441 collective lives evolve in time.

442

### 443 **Implications for policy**

444 As remarked upon at the start, it is important that theoretical frameworks and conceptual  
445 tools are subject to ongoing critical analysis because they shape research outcomes by  
446 guiding research pathways. A thoroughgoing analysis of the global production of women's  
447 health inequality depends on a comprehensive theorization of how social relations of  
448 gender and the biological body mutually inform each other in local contexts. To pick up on  
449 the recent statement referred to earlier from UN Women [45] that 'FGM is an act that cuts

450 away equality', we argue that a comprehensive understanding of what this means for  
451 women's health calls for us to go beyond the common concern with how social and cultural  
452 practices shape the biological body—important though this, of course, is – to also attend to  
453 the recursive effects of the biological changes themselves on women's social lives and lived  
454 bodily experiences. Yet we very quickly reach the limits of our empirical knowledge when  
455 we try to develop this more comprehensive approach. A primary reason for this is the  
456 distinct lack of interdisciplinary research. While feminist and gender theorists have begun to  
457 explore the biological substance of the body as active, rather than passive, matter (such as  
458 in materialist feminism e.g., 35, 38], they have not directly engaged with health experiences  
459 associated with inequality for women and girls. Even in the field of FGM/C, for example,  
460 there is a paucity of in-depth qualitative research exploring embodied experience. Thus a  
461 recommendation made here, which accords more generally with those made in the wider  
462 context of women's health [e.g., 80, 81], is that research funding bodies and institutions  
463 recognise the value of interdisciplinary theoretical and empirical research in the field  
464 commonly known as 'gender and health' that addresses not only the 'gender-shaping of  
465 biology' but also the 'biologic-shaping of gender' and which avoids essentialist and  
466 reductivist thinking.

467

## 468 **Conclusion**

469 In this theoretical paper we have sought to explore how social relations of gender  
470 interrelate with the biological body to shape the experience of health in ways that may  
471 generate inequality for women and girls. Specifically we have analysed how feminist and  
472 gender theorists have made biological 'sex' and social 'gender' legible, with the specific  
473 object of identifying gaps in their expression in a nexus with health. We have argued that, to

474 date, most attention has been directed to what we call the ‘gender-shaping of biology’ to  
475 the relative neglect of the co-constitutive role that biological changes *themselves*—what we  
476 dub the ‘biologic-shaping of gender’—may play in ongoing cycles of gendered health  
477 inequality. FGM/C has been taken to explore in a preliminary way how these ‘shaping  
478 processes’ may occur. It is recognised, however, that we are limited in our capacity to fully  
479 substantiate what we conceptualise as the shaping processes of the ‘gender-biology nexus’  
480 (focusing on health and illness) at the present due to lack of research. In order for this to  
481 progress, we suggest that far more interdisciplinary research between social scientists,  
482 including gender theorists, and biological and health scientists is needed.

483

#### 484 **End Materials**

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493 **Paper context:** Analyses of the relationship between social and biological factors in the  
494 production of women’s health inequality have focused predominantly on how social factors  
495 become embodied to the relative neglect of the reciprocal role played by the biological body  
496 in shaping its social world. Drawing on feminist and gender theory we develop a novel

497 theoretical approach which attends not only to the ‘gender-shaping of biology’ but also to  
498 the ‘biologic-shaping of gender’ as interweaving processes.

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