

The Conceptual Contours of Sex in the Chinese Life Sciences: Zhu Xi (1899–1962), Hermaphroditism, and the Biological Discourse of *Ci* and *Xiong*, 1920–1950

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Abstract This paper “maps” a number of trajectories through which the conceptual contours of sex could be traced in the bioscientific discourse of Republican China. Focusing on the writings of the embryologist Zhu Xi (1899–1962), I analyze the epistemic functionality of such biological terms as *ci* (“biological femaleness”) and *xiong* (“biological maleness”) that acquired an unprecedented scope of cultural discursiveness in China only alongside the arrival of Western biology, which replaced classical learning and natural studies as the authoritative field of inquiry about life. I first show that when Chinese scientists used these terms to describe the sex of biological species, they relied on an epistemological framework of visual knowledge that granted some foundational operative power to a signifying order in which one could *know by seeing* the differences between *ci* and *xiong* (and, ultimately, sexual differences). These two terms’ lexicality and indexicality thus mutually reinforced one another in the production of their semiotic possibilities and epistemo-*logicality*. I then show that while they adopted *ci* and *xiong* as the bioscientific synonyms of the more culturally anthropocentric words such as *nü* (woman) and *nan* (man), Chinese biologists also incorporated sophisticated biological theories of sex from Europe and North America, including the theories of “gynandromorphism” and “intersexuality.” The implicit and explicit figurations of hermaphroditism reveal the ways in which at the heart of the entire bioscientific discourse of *ci* and *xiong* resides its key conceptual anchor: the human–non-human divide.

Keywords Biology · Castration · *Ci* · Gynandromorphism · Hermaphroditism · Intersexuality · Life · Republican China · Sex · *Xiong* · Zhu Xi (1899–1962)

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1 Introduction

The final decade of the twentieth century, beginning with the publication of Thomas Laqueur's *Making Sex* (1990) and concluding with Charlotte Furth's *A Flourishing Yin* (1999), witnessed a critical shift in the historiography of science and medicine towards a greater appreciation of how gender, medicine, and the body intersected historically.¹ These possible historical intersections were not only important in the West. As Furth's monograph attests, they also played a significant role in the history of science in non-Western parts of the world such as East Asia. In Europe and China specifically, abstract medical understandings of the body both shaped and reflected the status, role, and experience of women in society: Laqueur's study makes clear the trajectory by which conceptualizations of sex in Europe took a decisive turn during the eighteenth century, when the "one-sex" model (which viewed women and men as two versions of a single-sexed body) eventually gave way to the "two-sex" model (which treated men and women as opposite incommensurable counterparts);² on the other hand, Furth's work contrasts the androgynous "Yellow Emperor's body" with the female gestational body that clearly distinguished itself when *fuke* (Chinese gynecology) emerged in the Song dynasty (960–1280). Despite their impressive contributions, neither Laqueur nor Furth sheds sufficient light on the legacy of these epistemological transformations in the twentieth century.

For modern western societies, numerous scholars before and after Laqueur have examined the historical relationship between the science–medicine–technology nexus and the sex–gender–sexuality nexus on both the theoretical and the empirical level in remarkable detail, with varying disciplinary orientations and topical focus.³ As far as China and East Asia are concerned, however, the gap in the historiography is striking.⁴ As late as 2005, in her editorial introduction to a special issue of *Nan Nü* on "Medicine for Women in Imperial China," Angela Leung remarked on this significant void:

Recent publications on medicine for women in China show that this topic defines a field of scholarly research of great potential...So far, we have only talked about research done on imperial China, and there are, in my opinion, even greater possibilities on the modern period when China faced challenges from Western medicine and culture. While the confrontation between Chinese and Western medicine has been studied by a number of talented young scholars,

¹ Laqueur (1990); Furth (1999). See also Clarke (1998) and Oudshoorn (1994).

² For critiques of Laqueur's thesis, see Cadden (1993), Chiang (2007), Daston and Park (1996), Goldberg (2006), Harvey (2004), Park (1997), Park and Nye (1991), and Stolberg (2003). For Laqueur's response to Stolberg, see Laqueur (2003).

³ The historical literature that can be cited is too vast for me to give full acknowledgement here. For studies that directly address the topics of intersexuality, transsexuality, and bisexuality, see Angelides (2001), Dreger (1998), Fausto-Sterling (2000), Haussman (1995), Kessler (1998), Mak (2005, 2006), Matta (2005), Meyerowitz (2002), Moscucci (1990), Oudshoorn (1994), Park (2006), Redick (2004), Rudacille (2005), Sengoopta (2006), and Storr (1999). This already extensive list touches very minimally on the even larger body of scholarship on homosexuality. For a fairly comprehensive overview of this topic, see Rosario (2002). Compare Chiang (2008). The best study of the relationship between expert knowledge and AIDS from a sociological perspective to date is Epstein (1996).

⁴ The notable exceptions are Dikötter (1995, 1998), Frühstück (2003), Fu (2005), and Pflugfelder (1999).

[here she cites the works of Sean H. Lei and Bridie Andrews] there have been few serious studies related specifically to the development of modern Chinese gynecology. The changes in or the “Westernization” of the conceptualization of the female body in China, in medical, sociopolitical, and cultural terms should be a most fruitful topic of research, and hopefully we shall not wait for too long to see work done on this period.⁵

In this paper, I wish to continue the historiographic thread initiated by Laqueur, Furth, and others by taking up the kind of project Leung proposes, with the exception that biological notions of sex more broadly, rather than the female body per se, will occupy the central role of my analysis. Specifically, I will trace the conceptual contours of sex in the bioscientific discourse of Republican China (1912–1949) by focusing on the topic of hermaphroditism, which I understand as a condition that displays various possible combinations of the biological features of both sexes.⁶ I have chosen hermaphroditism as my key analytic prism because scientific definitions of the boundaries of sex are the most salient and at the highest stake for scientists to discern the sexually ambiguous status of this biological category.

It follows that no other source serves the purpose of my inquiry better than the writings of one of the most authoritative figures in reproductive biology in twentieth-century China, the embryologist Zhu Xi (1899–1962), best known at the time for his work on the parthenogenesis of frogs. Throughout the late 1930s and the 1940s, Zhu authored and revised a total of six monographs under the book series called “Modern Biology” (現代生物學叢書; published by *Wenhua Shenhuo Chubanshe* [Cultural Life Publishing House]) that introduced various subjects in Western biology to the Chinese lay public.⁷ Most pertinent to the topic of hermaphroditism is his fourth volume, *Changes in Biological Female and Maleness* (1945), a second edition of which appeared 3 years after the end of the Second Sino-Japanese War in 1948.⁸

In executing a close historical reading and epistemological contextualization of this particular text, what I intend to accomplish over the course of this paper is a “cartography” of the typological significance of the hermaphrodite figure, so to speak, that maps the intellectual origins, destinations, locations, problems, solutions, movements, organizations, and arrangements of sex as a candidate of biological

⁵ Leung (2005), 17–18. On the history of Chinese gynecology, see also Dikötter (1995, 1998), Leung (2006), and Leung and Furth (forthcoming).

⁶ Despite how this definition of hermaphroditism only stresses its biological dimension to fulfill the more immediate purpose of my study, I am aware that late nineteenth-century and early twentieth-century European sexologists also entertained the notion of “psychical hermaphroditism.” Two of the most reputable physicians advocating this idea are Richard von Krafft-Ebing and Magnus Hirschfeld. See, for example, Krafft-Ebing (1892 [1886]) and Hirschfeld (2000 [1914]).

⁷ See Zhu (1946a), (1946b [1939]), (1948a [1940]), (1948b [1941]), (1948c [1945]), and (1948d [1946]).

⁸ The main difference between the two editions is the additional materials Zhu included in the second addition of his text. Under the influence of Western studies in endocrinology and biochemistry, Zhu adopts an even more chemical model of sex in this post-war material that reflects the increasing prominence of sex endocrinological research in the preceding decades. For the additional materials in the second edition, see Zhu (1948c [1945]), 335–380. For how these ideas developed in the context of Europe and North America, see Oudshoorn (1994), Clarke (1998), and Sengoopta (2006).

thinking in twentieth-century China. What I tease out is a global web of circulating and interacting scientific ideas, ways of knowing, modes of comprehension, and styles of inquiry about the relation between life and sex.⁹ Rather than surveying a wide array of sources as historians such as Frank Dikötter have done in their work on similar topics,¹⁰ I focus on Zhu's writings in particular to bring into better visibility the *detailed* aspects of the configurations of biological knowledge about sex in China, and to situate those technicalities more generally against developments in biological research on sex in Europe and North America. While a vast body of scholarship has already elucidated the broader social, cultural, and political transformations of gender in Republican China,¹¹ this study instead probes the under-appreciated technical and intellectual dimensions of sex in the Chinese discourse of biological science for the same historical period, one Angela Leung has identified as that of "the 'Westernization' of the conceptualization of the female body."

Specifically, in interrogating how Chinese life scientists conceptualized sex, I analyze the *epistemic functionality* of such biological terms as *ci* ("biological femaleness") and *xiong* ("biological maleness") that acquired an unprecedented scope of cultural discursiveness in China only alongside the rise of Western biology after the closing decades of the nineteenth century. For instance, one finds in Charlotte Furth and Judith Zeitlin's analyses of literary, legal, and medical accounts of hermaphroditism in the late imperial period that the notions of *yin* and *yang* carried with them a much more discursive quality than *ci* and *xiong* did.¹² As such, a key objective of my study is to understand the historical process by which *ci* and *xiong* emerged in the modern era as the most widely employed pair of biological concepts for conveying sexual differences in Chinese culture—a process by which these two terms gradually replaced *yin* and *yang* as the definitive conceptual candidates for understanding sex and life in the natural world. In fact, as I will show, the possible congruency among these two pair of concepts—*ci/xiong* and *yin/yang*—precisely relied on their similarity in denoting sex as a *form* of life.

My discussion begins with some historical contextualization of the period and the topic under consideration. I then go on to argue that when Chinese scientists used *ci* and *xiong* to describe the sex of biological species, they relied on an epistemological framework of visual knowledge that granted some foundational operative power to a

⁹ My using of the notion of "cartography" in this more metaphorical sense is closer to how Gregory Pflugfelder has utilized it in his study of male same-sex sexuality from early modern to modern Japan. According to Pflugfelder, he "evoke[s] the image of mapmaking in the title [of his book], if only metaphorically, out of a belief that human understanding involves a continual mapping and remapping, not just of physical but also of social reality. Maps of the latter variety are not necessarily tangible, but they are no less instrumental than the conventional sort in orienting us to our environments." Pflugfelder (1999), 1. I thus share Pflugfelder's intention to bring into better visibility the discursive social reality of sex by looking at its conceptual arrangements in various types of discourse. Specifically, this paper focuses on the configuration of sex in the discourse of bioscience in Republican China.

¹⁰ Dikötter (1995) and (1998).

¹¹ Though beyond the scope of the current project, scholarly inquiry into these dimensions of the history of gender in modern China is undoubtedly important and indispensable. See the critical contributions by Barlow (1993); Brownell and Wasserstrom (2002); Chow (1991); Evans (2007); Gilmartin (1995); Glosser (2003); Hershatter (2007); Larson (1998); Lean (2007); Zito and Barlow (1994).

¹² See Furth (1993); Zeitlin (1993), chap. 4.

signifying order in which one could *know by seeing* the differences between *ci* and *xiong* (and, ultimately, sexual differences). These two terms' lexicality and indexicality thus mutually reinforced one another in the production of their semiotic possibilities and epistemo-*logicality*, by which I mean the logical coherence of key words used in substantiative statements of knowledge production. I will then show that while they adopted *ci* and *xiong* as the bioscientific synonyms of the more culturally anthropocentric words such as *nü* (woman) and *nan* (man), Chinese biologists also incorporated sophisticated biological theories of sex from Europe and North America, including the theories of "gynandromorphism" and "intersexuality" from the laboratories of Calvin Bridges, Thomas Morgan, and Richard Goldschmidt. The implicit and explicit figurations of hermaphroditism reveal the ways in which at the heart of the entire bioscientific discourse of *ci* and *xiong* resides its key conceptual anchor: the human–non-human divide.

2 Historical Context: Science and the Questions of Life and Sex in Modern China

Under the global gaze, China's rapid and unexpected defeat by Japan in the first Sino-Japanese war (1894–1895) completely repositioned the two countries' international standing. The signing of the Treaty of Shimonoseki in 1895 represented a watershed event in the cultural imagination of China's power and weakness, on both domestic and foreign fronts. According to Benjamin Elman and Ruth Rogaski, for instance, the twentieth century opened with the reversal of frames of reference between China and Japan in which one "acquired" scientific knowledge and conceptions of health and diseases from the other.¹³ As the key to maintaining social order, classical learning and natural studies in China slowly gave way to Western scientific, medical, and technological expertise, which Chinese educated individuals began to learn via Japan, as opposed to Japanese learning from Chinese scholars during the long imperial past of China. To be sure, after their interactions with the Jesuits in the "investigation of things and extension of knowledge" during the seventeenth and eighteenth centuries, Chinese literati were exposed to Western science by direct contact with Protestants in the nineteenth century.¹⁴ Yet, to bring Japan into the larger East Asian picture, in the opening decades of the twentieth century, after waves of self-strengthening efforts, Chinese officials and revolutionaries alike learned from their defeat by Japan that Western science and technology held the distinct key to effective modernization. And this soon became deeply imbricated with the larger and increasingly intensified cultural discourse of nationalism.

The survival of the Chinese nation emerged as one of the foremost preoccupations of governmental officials and educated individuals in the early twentieth century. Though immensely shaped by the imported discourse of social Darwinism, this preoccupation nonetheless raised a separate but fundamentally related question: the

¹³ Elman (2006); Rogaski (2004).

¹⁴ See Elman (2005).

question of life itself. At this point, however, the status of religion and science in Chinese society were so volatile that it is difficult for historians to discern whether either one was at the time regarded by Chinese people as the ultimate authority for providing answers to the question of life. The relations between science and religion were perhaps not consistently oppositional, but a variation of this certainly surfaced in the famous 1923 “science versus metaphysics” debate in the aftermath of the New Culture Movement.¹⁵ This, of course, did not resolve for many, then or now, the question of whether Confucianism is ultimately a type of “religion” or a system of philosophical—and to some even “scientific”—knowledge. It did, however, reflect a growing tendency among many Chinese intellectuals at the time to approach Western science with greater appreciation and commitment. It was within this broader political and cultural context that Western biology gained epistemological grounding over and indeed gradually replaced classical neo-Confucian cosmology as the preeminent way to the study and understanding of life in twentieth-century China.¹⁶

If sex was the “most secret quintessence of life” in the minds of European and North American biochemists and other scientists in the early twentieth century,¹⁷ issues of sexual characteristics and desire, gender roles and behavior, and heterosexual reproduction as well as marriage, love, passion, and how they relate to friendship and companionship similarly dominated the intellectual horizon of Chinese modernizing thinkers, including public intellectuals, university professors, scientists, physicians, self-appointed experts, etc.¹⁸ The publication of *Sex Histories* by China’s “Dr. Sex,” Zhang Jingsheng, in 1926 gave a distinct new currency among Chinese modernizing figures to devote their attention to the scientific study of sexuality. Some did so exclusively while others pursued such topics peripherally.¹⁹ Yet, both before and after Zhang published his *Sex Histories*, other concerned writers and scholars, themselves may or may not had a formal scientific background, took up sex as a serious topic of study.²⁰ Not only did they see sex as an important subject of scholarly inquiry, but they saw it as such precisely because of their conviction that the question of life was inextricably bound up with the question of sex. In their view, to understand the origins of men (and women)—the origins of the entire human race—also meant understanding the origins of sex itself, and no other epistemological vehicle provided a better way to approach these questions of life than the recent ideas and modes of thought stemming from Western biological science. A case in point is how the envisioning of the inter-relatedness of sex and life

¹⁵ On the historical significance of the debate, see, for example, Adas (2004); Chow (1960), esp. 327–337; Elman (2006), 223–226; Furth (1970), esp. chap. 5; and Kwok (1965), esp. chap. 6.

¹⁶ Dikötter (1992, 1995); Schneider (2003).

¹⁷ Sengoopta (2006). See also Clarke (1998).

¹⁸ Dikötter (1995, 1998); Sang (2003); Rocha (2007). See Chiang (2009) for the historical-epistemological significance of this emergent cultural environment in 1920s China.

¹⁹ On Zhang Jingsheng, see Chung (2002); Leary (1994a, b); Lee (2006a); Rocha (2007); Sakamoto (2004); Tsu (2005), 128–166; Wong (2006), 249–265. See also my discussion of him in Chiang (forthcoming).

²⁰ See Chiang (forthcoming).

was most pronounced in the increasingly popular framework of eugenics starting in the 1920s.²¹

According to Laurence Schneider's institutional history of biology in twentieth-century China, the history of genetics and evolutionary biology can be seen as an example of "how modern science was transferred to China, how it was established there and *diffused throughout culture* and institutions."²² Indeed, numerous Republican Chinese magazine and journal articles, periodicals, books, and pamphlets published under the banner of "biology" were not always written by individuals belonging to formal institutional establishments of biological science, such as Peking, Fudan, Qinghua, Yanjing, and Nanjing Universities. For instance, one of the most reputable popular life-science journalists at the time was Zhou Jianren (1890–1984), Lu Xun's youngest brother. Unlike his two elder brothers, Zhou continued pursuing his interest in the sciences (rather than literature for example) and earned his bachelor's degree from the Agricultural School of Tokyo Imperial University. Published mostly in popular periodicals such as the *Eastern Quarterly* (東方雜誌), his writings that defended Lamarckism during the Republican period and Lysenkoism after the rise of the Chinese Communist Party reached a wide readership and had a huge influence on those absorbed by the riddle of life.²³ This suggests that in China, the question of life was taken up discursively by a wide array of cultural actors. By extension, many who wrote about life also wrote about sex, as in the case of Zhou, and that the field of reproductive biology by no means preoccupied only those whom European and North American scientists would consider adequate "biologists" based on their more strictly defined standard of scientific competence.

In this respect, Zhu Xi (1899–1962) and other important Chinese geneticists and biologists such as Tan Jiazhen were notable exceptions. Born in Linhai, Zhejiang Province, Zhu went to France with several friends in May 1920 as participants in anarchist Li Shizeng's "work-study programme." According to his autobiographical account, they received no assistance from the Sino-French Education Association upon arriving in France, so they had to live in tents on the lawn in front of the Chinese Federation. Eventually, they were allowed to sleep on the floor of the building on a temporary basis. During the first 5 to 6 years of his life in France, Zhu's experience was quite typical of Chinese young adults who decided to join the "work-study programme" and travel overseas: frequent job changes, difficult physical labor, poor living conditions, numerous negative encounters with Westerners, and an increasingly entrenched sense of disappointment and despair. Nevertheless, Zhu ended up attending Montpellier University and studied embryology under J. E. Bataillon from 1925 to 1932. After earning his doctorate degree in biology from Montpellier, Zhu returned to China and began his academic career as a

²¹ On eugenics in Republican China, in addition to the sources cited in n. 19, see also Dikötter (1989, 1992); Lee (1996, 2006b), 186–217; Rogaski (2004), 225–253; Tsu (2005), 98–127; and Wong (2006), 197–232.

²² Schneider (2003), 1 (emphasis added).

²³ See the coverage of Zhou in Schneider (2003). The only biography of Zhou to date is in Chinese: see Yang (1991). See also Wong (2006), 155–196, and my brief discussion of him in Chiang (forthcoming).

professional biologist. From 1932 onward, he was associated with National Zhongshan University, the Beijing Academy of Sciences, and various private research organizations. Zhu became a member of the Experimental Biology Institute of the Chinese Academy of Sciences (CAS) in 1950, and was appointed as its director 3 years later.²⁴

Before joining the CAS Experimental Biology Institute, throughout the late 1930s and the 1940s, Zhu authored and revised a total of six monographs under the book series called “Modern Biology” that introduced various topics in Western biology to the Chinese lay public. In his general preface to this six-volume project, Zhu made clear his goals:

My intention in publishing this series of monographs is to offer my knowledge in biology to the lay reader in a systematic way, hoping that it will encourage a better understanding of humans themselves. The topics of our investigation include the origins of human beings, the evolution of their ancestors, and the development of human thinking, behavior, and moral consciousness. Simply put, we need to analyze ourselves, research ourselves, understand ourselves; after understanding we need to improve ourselves, allowing humans to be part of science and to march forward to somewhere more reliable.²⁵

This statement reflects the conviction Zhu shared with many other modernizing thinkers (and not only scientists) of the time that it is important to acquire a general knowledge about life through a scientific way of thinking rooted in Western biological, especially evolutionary, ideas. He therefore opened his series with a volume called *Humans from Eggs and Eggs from Humans* (蛋生人與人生蛋) that described various aspects of the developmental processes and phases of birth and life, including detailed accounts of male and female reproductive anatomy (as well as an interesting chapter on teratology).²⁶ In this first volume, Zhu distinguished humans from animals, plants, and other living species in distinctive ways that would become even more vivid throughout his subsequent writings as a crucial framework for an adequate appreciation of sex as a powerful symbol of life.

3 Sex as Form of Life: Visual Knowledge, Parasitic Castration, and the Hermaphroditic Figuration in a Signifying Order of *Ci* and *Xiong*

In ways that had not previously held sway, the human–non-human divide came to anchor the entire Chinese biological discourse of *ci* and *xiong* during the Republican period and beyond. In fact, this divide defined what was so decisively different between these two terms and others such as *nü/nan* or *yin/yang* that appeared much more frequently in the popular discourse. In an earlier essay, “The Evolution of Sex” (性的進化) written in the 1920s, Zhou Jianren defined *ci* and *xiong* by maintaining that “In the evolution of sex, after the first step of making a distinction between an

²⁴ Levine (1993), 84–85; Schneider (2003), 137; Zhu (1923).

²⁵ Zhu (1946b [1939]), ii.

²⁶ Zhu (1946b [1939]).

egg and a sperm, the second step is thereby to differentiate *ci* from *xiong* on the individual organismal [個體] level—the individual organism that produces sperm is identified as *xiong* and the organism that produces eggs is identified as *ci*.²⁷ For Zhou, the way *ci/xiong* relates to *nü/nan* can be explained as follows: “humans are animals that are either *ci* or *xiong* and not both [雌雄異體的動物]: those who generate sperms are called *nan*; those who generate eggs are called *nü*.”²⁸ Succinctly put, *nü* is the human equivalent of *ci*, and *nan* is the human equivalent of *xiong*.

Following this logic of positioning *ci/xiong* and *nü/nan* on two different semantic planes, the epistemic functionality of the former pair of biological terminologies denotes a lexical paradigm that grounds its meaningfulness as a non-human marker, while the latter pair acquires its epistemological intelligibility by being cemented with a layer of exclusive anthropocentric value. Especially apparent in examples of biological organisms with sexually ambiguous status, the ways in which Chinese life scientists attempted to interpret, explain, and essentially describe the sexual features of animals and humans show that what they took as indications of natural sex (or sex differences) were in fact the product of their own constructions—the result of their assignment of meanings to what they considered carrying indexical values of sex. The following examples explicate the very constructive dimension of sex in this process of “sexualizing” life. Ultimately, when biologists such as Zhu Xi, in ways similar to Zhou Jianren, wanted to establish a scientific lexicon of sex rooted in an authoritative framework of Western biology, their writings and modes of representation followed a “conceptual space” that determined what knowledge claims could or could not be made with such concepts as *ci* and *xiong*.²⁹ For these two terms to mean “biological femaleness” and “biological maleness” respectively, the figuration of the hermaphrodite subject played a typologically crucial role that stabilized the human–non-human boundary by always making it the tacit threshold for the *ci/xiong–nü/nan* distinction, always deferring the most immediate epistemic significance of the former pair to its mapping onto non-human species.

I will return to the importance of the human–nonhuman divide for the Chinese bioscientific discourse of *ci* and *xiong* in the next section. In preparing for that, I wish to concentrate for now on building up the significance of the implicit typological figuration of hermaphroditism in the possible epistemologization of sex as a *form* of life. In order to uncover the logical coherence, scope of lexical possibility, epistemic value, and syntactic valency of *ci* and *xiong* in the discourse of Chinese bioscientific knowledge, another ideal entry point in addition to Zhou’s writings would be Zhu’s monograph *Changes in Biological Female and Maleness* (1945; 1948), the fourth volume of his “Modern Biology” series. In this book, Zhu begins his investigation of the life sciences of sex with an opening chapter called “The Conceptualization of *Ci* and *Xiong*” (雌雄的概觀), where he defines the different qualities of living species—animals, plants, and humans—as the decisive features that are most representative of the difference between *ci* and *xiong*, or *nü*

²⁷ Zhou (1928 [1927]), 19–20.

²⁸ Zhou (1931), 37.

²⁹ My usage of “conceptual space” adopts Arnold Davidson’s definition of it as “a space that determines what statements can and cannot be made with the concepts.” Davidson (2001), 136.

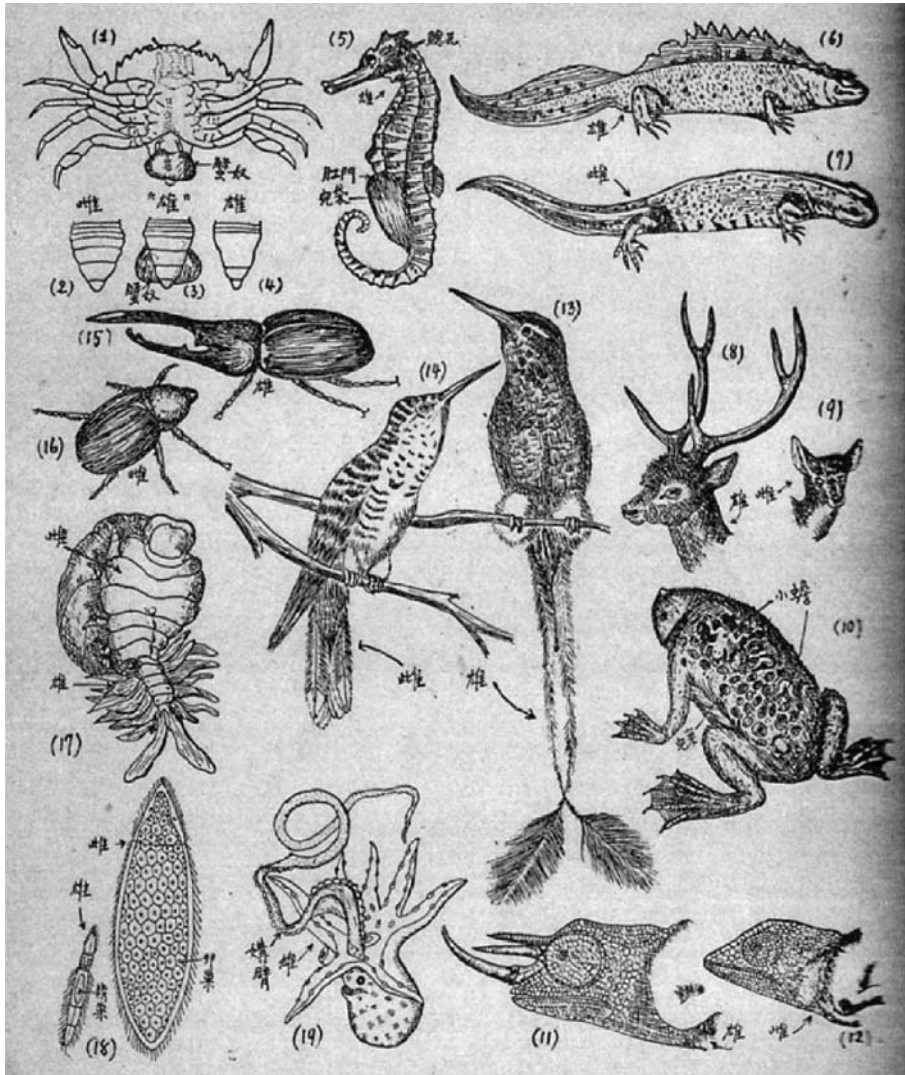


Fig. 1 The morphological differences between Ci and Xiong in animals

and *nan* when he refers to humans.³⁰ To locate these qualities on the physical level, he provides his reader the visual drawings reproduced here in Fig. 1.³¹

Zhu intended the 19 visual illustrations in Fig. 1 to assist readers of his book to *know by seeing* how *ci* and *xiong* should be differentiated. For instance, whereas pictures 6, 8, 11, 13, and 15 all are the “雄” (*xiong* or “male”) versions of a particular species, pictures 7, 9, 12, 14, and 16 indicate their “雌” (*ci* or “female”) counterpart. The very marking and explicit indications of such words as “雌” (*ci*)

³⁰ Zhu (1948c [1945]), 5–16.

³¹ Zhu (1948c [1945]), 33.

and “雄” (*xiong*) on the diagrams give these words a particular semantic epistemologicality, according to which *ci* and *xiong* acquire their linguistic logic, usage, value, valency, coherence, significance, and, essentially, possibility by being visually equated with particular physical representations of a wide range of biological organisms. The reader could learn to distinguish *ci* from *xiong* precisely by *looking* at their visibilized epistemic associations on the page. In other words, these visual illustrations are not mere passive aids for learning; rather, they actively conveyed to the reader the prescribed conceptual boundaries of *ci* and *xiong*.³²

Out of all of these visual illustrations, the first four are particularly interesting. Unlike the other pictures, they do not simply highlight those physical markers that differentiate *ci* from *xiong* for the reader, but do so through a visualized example of the possibility of sex transformation. With respect to these pictures, Zhu’s explanation is worth quoting at length:

In the natural world, the secondary sexual characteristics of certain animals are determined by their relationship to their parasites.

The French animal biologist J. Pérez observed the effect of the Stylops [melittae] parasites on bees: *xiong* would become *ci* and *ci* would become *xiong*. Although the site of parasitic activity lies outside the reproductive organs, the parasites nonetheless are able to transform [改變] the secondary sexual characteristics of their host.

Many types of crabs are prone to be parasitically infected by a lower-level crustacean—*Sacculina* [蟹奴].³³ The body of this kind of parasite is much degenerated [退化]. In a root-like fashion, it penetrates the entire body of the host without any visible appearance on the physical body. Only during the period of sexual maturation does its reproductive organ manifest itself on the outside of the crab’s abdominal area in the appearance of a light yellow bulge like a bean (see picture 3). However, before making an observation about the kind of changes this parasitic relationship could bring about, one needs to know the distinction between *ci* and *xiong* crabs under normal conditions. With respect to the abdominal region, *ci* crabs tend to have a larger abdominal region (see picture 2), while that of *xiong* crabs is smaller and narrower with three segments combined into one (see picture 4)...

Those *xiong* crabs infected by *Sacculina* have an abdominal region that is larger than usual and it becomes more clearly separated into different segments (see picture 3), much like a *ci* crab...According to Giard’s observation, those *xiong* crabs infected by *Sacculina* not only become more *ci*-like [雌化] on the

³² My arguments in this section build on the extensive body of literature on the important role visual images play in the production of scientific knowledge. See, for example, Arnheim (1969), Baigrie (1994), de Chadarevian and Hopwood (2004), Knorr-Cetina and Amann (1990), Latour (1990), Lynch and Law (1999 [1988]), Lynch and Woolgar (1988), and Ruse and Taylor (1991). The question of whether the images such as the ones presented in this paper were “new” in China is an important and legitimate question. However, it is beyond what the empirical data for my study can address.

³³ Stylops—those that infect bees—are Strepsipterous parasites, but *Sacculina* is not.

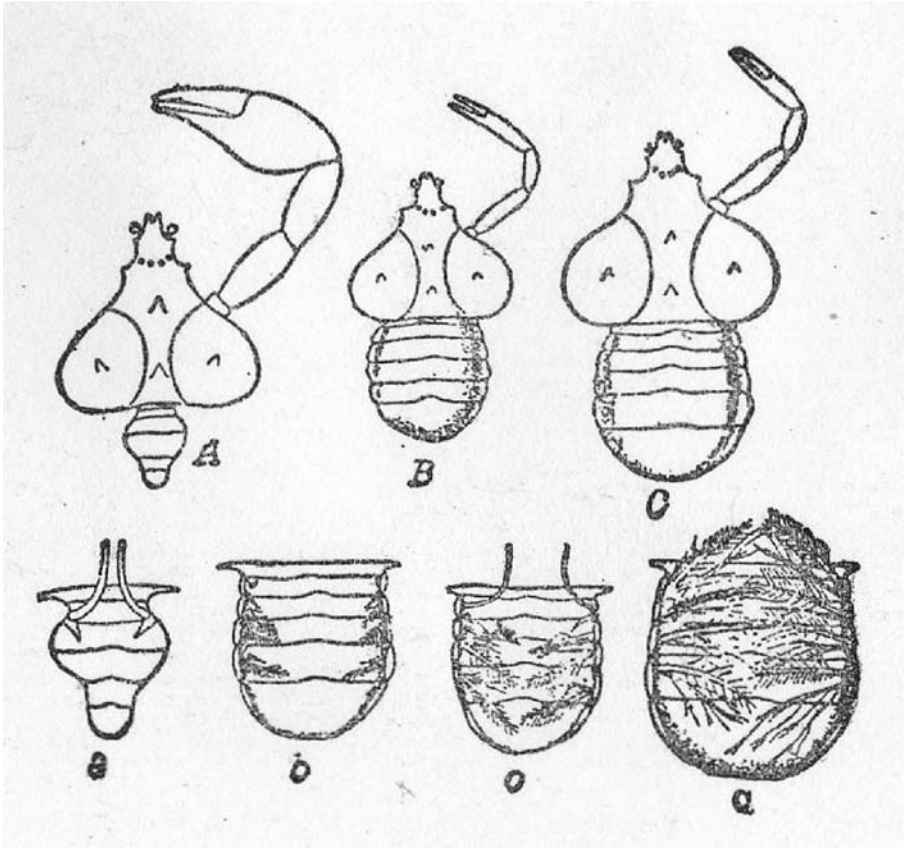


Fig. 2 The parasitically induced changes in crabs. *A* Normal *Xiong* crab. *B* Parasitized *Xiong* Crab looks similar to *C*. *C* Normal *Ci* crab. *a*, *b*, *b'*, and *c* are the close up of the corresponding abdominal regions

morphological level, but also experience significant changes on the psychological level [心理亦大改變].³⁴

In fact, in 1933, experimental biologist Fei Hongnian, who taught at the Peking Agricultural University and Canton University, relied on the exact same example to demonstrate the potential mutability of an animal's biological sex after birth. The visual illustrations that Fei used in his book to suggest that sex is not established once and for all at fertilization are reproduced in Fig. 2. Since the same example of parasitically induced sex alteration caught the attention of both biologists, its historical origins are worth probing more deeply.³⁵

Beneath Zhu and Fei's explanatory apparatus lies a history of biological thinking about the mutability of "life forms" that stretches as far back as the late 1830s, the period during which European naturalists were just recovering from the famous debate between Georges Cuvier and Etienne Geoffroy Saint-Hilaire. The thundering

³⁴ Zhu (1948c [1945]), 43–44.

³⁵ Fei (1933), 74. It is interesting to note that these drawings bear striking similarities to the drawings included in Morgan (1914), fig. 80, on p. 157.

disagreement between Cuvier and Geoffroy echoed across various circles of scientists and other gentlemen not only within the Académies des Sciences in Paris but also in many other parts of Europe starting in the early 1820s, reached its peak around 1830, and lasted until Cuvier's death in 1832. It appeared as a "great event" to the Romantic naturalist-poet Johann Wolfgang von Goethe: in his conversation with Frédéric Soret of Geneva, Goethe characterized the public debate as a "volcano" that "has come to an eruption," a "contest" of "the highest importance for science."³⁶

As Toby Appel has shown, this decade-long controversy between Cuvier and Geoffroy is best understood as the surfacing of a fundamental division in the life sciences at the time intimately linked to its surrounding larger institutional and political forces: should the primary referential point for the biological explanations of animal structure be laws of functional or morphological regularity?³⁷ In Edward Stuart Russell's words, it was "a struggle...between the commonsense teleological view of nature [Cuvier] and the abstract transcendental [Geoffroy]."³⁸ This battle between Geoffroy's Lamarckian "philosophical anatomy" and Cuvier's teleological "comparative anatomy" concerned not only French biologists, and the German morphologist Martin Heinrich Rathke (1793–1860) enters the picture here. Rathke made sure his voice was heard in relation to the controversy when he first described the gill slits and arches that he had found in the embryos of mammals and birds. According to Timothy Lenoir, Rathke posited an embryological argument that viewed the gill system as a more highly developed form of the hyoid of higher vertebrates (a position that prioritized functional importance), thus explicitly refuting Geoffroy's claim that the gill system was somehow related to the ribs of larynx of higher vertebrates (a position that emphasized the transcendental centrality of structural regularities).³⁹

It is in the context of the aftermath of the Geoffroy–Cuvier controversy that later studies on the relationship between parasites and the mutability of "life forms" can be best understood. In *De Bopyro et Nereide* (1837), Rathke made the observation that in certain prawns (*Leander serratus*), only the females can be infected by *Bopyro* parasites.⁴⁰ Fifty years later, in 1888, Alfred Giard (1846–1908) provided an alternative explanation for Rathke's observation. A convinced follower of the doctrine of transformism, Giard was heavily influenced by Ernst Haeckel and thought Lamarckism complemented Darwinism. While Darwinism was an emergent framework for organizing and unifying ideas in the life science, as evident in the biological thinking of Giard himself, it was not consistently shared by European and North American natural scientists before the twentieth century.⁴¹ Giard suggested that male prawns parasitized by *Bopyro* parasites show characteristics of sex reversal—what he called "castration parasitaire" or parasitic castration.⁴² Therefore, according to Giard, those parasitized prawns that Rathke observed were not originally female but actually

³⁶ Cited in Appel (1987), 1.

³⁷ Appel (1987).

³⁸ Russell (1916), 78.

³⁹ See Lenoir (1989 [1982]), 95–102. On Rathke, see also Bullough (1970); Menz (2000); and Russell (1916), 134–141.

⁴⁰ Rathke (1837).

⁴¹ See Glick (1972).

⁴² See the citations on Giard in Botts (1906). I am also relying on Callan (1940).

male prawns before undergoing the process of *Bopyro* parasitism. It is this phenomenon of parasitic castration that provided the most plausible common origins for the explanations that both Zhu Xi and Fei Hongnian cited for their example of the sex alteration of parasitized crabs (see drawings 1–4 in Figs. 1 and 2). Crabs and prawns, after all, belong to the same subphylum of species—Crustacea.

To be sure, the example of the sex change of parasitized bees that Zhu mentioned near the beginning of his explanations of parasitized crabs also has its place in the historical trajectory of this story. In 1886, 2 years before Giard provided an alternative explanation for the observation made by Rathke, J. Pérez published an article in French that retains its authoritative status to the present day for defining and explaining the phenomenon of “stylopisation.”⁴³ Stylopisation simply refers to parasitism by Strepsiterous parasites (or Stylops), and, accordingly, Pérez’s study of the stylopisation of solitary bees served as one of the first widely recognized examples of parasitic castration, anticipating Giard’s contribution. Writing in the French tradition of evolutionary biology, both Pérez and Giard’s studies of parasitic castration may have embraced a more Lamarckian approach that prioritized structure to explain function. It is in this sense that Giard’s interpretation of the parasitized prawns differed from Rathke’s most clearly. While one may speculate, with good reason, the possibility that Pérez’s study may have served as a crucial inspiration for Giard’s reinterpretation of Rathke’s findings, it is certainly the case that Pérez’s work on the bees initiated the interest of other turn-of-the-century experimental biologists in exploring the possible phenomenon of “parasitic castration” in other species.

In 1914, Geoffrey Smith and A. H. Hamm at Oxford University published an article in the *Quarterly Journal of Microscopic Science* that compared the kind of parasitic castration induced by *Sacculina* parasites on crabs to the kind induced by Stylops on bees.⁴⁴ Beginning with a reference to Pérez’s study, they observed that “in certain cases the female host is induced to assume certain male characters as the result of parasitic castration by Stylops, an effect which is *never observed in the case of Sacculina*.”⁴⁵ Moreover, they found that “the effects of Stylopisation on the secondary sexual characters are comparatively slight, and amount to no more than a reduction of certain characters, such as the scopa of the female, while in the case of *Sacculina* the whole morphological structure of the male crab may be entirely converted to the female state.”⁴⁶ Therefore, if Giard’s study of the *Bopyro* parasitic castration of prawns denotes an implicit (or indirect) genealogical ancestor to Zhu Xi and Fei Hongnian’s example of the parasitically castrated crabs, Smith and Hamm’s study on the *Sacculina* parasites would certainly be the most direct, explicit one via Pérez’s earlier work on bees.⁴⁷

⁴³ Pérez (1886).

⁴⁴ However, Geoffrey Smith began to entertain the idea of “parasitic castration” as early as 1905, if not earlier. See Botts (1906), 600 and 620.

⁴⁵ Smith and Hamm (1914), 436, emphasis added.

⁴⁶ Smith and Hamm (1914), 454.

⁴⁷ As early as 1906, F. A. Botts of Cambridge University expressed the problematic assumptions implied by Giard’s phrase “castration parasitaire.” Botts wrote “the term ‘castration parasitaire,’ or at least its literal rendering in English, is somewhat misleading, and should not be applied to the phenomena which form the subject of this paper. Castration means destruction of the gonad, and though the phenomenon here described may eventually culminate in this, yet the changes principally here discussed occur before the complete destruction of the gonad, which is consequent on the parasitism, and, so far from being the cause of the other modifications, is probably merely an effect of the same order as the rest.” See Botts (1906), 599.

Interestingly, in an earlier article published in 1906, F. A. Botts of Cambridge University highlighted for his readers Giard's contribution to the study of *Sacculina* parasitism, which is fundamentally different from the conclusion that Smith and Hamm would arrive at 8 years later. According to Botts,

In his conclusion, Giard recognises a tendency of the secondary sexual characters of either sex to become modified toward the type of the other under the influence of parasitism, while at the same time those originally possessed may potentially be effaced. Thus in the Oxyrhynchid crab *Stenorhynchus phalangium*, attacked by *Sacculina fraissei*, the male almost entirely loses its copulatory styles and assumes, in greater or less degree, the abdominal ovigerous appendages proper to the female; in the female these last-mentioned characters become less accentuated, and the abdomen gradually approximates to the appendageless condition of the male, Giard regard this as a true modification toward the male type.⁴⁸

Recall that Giard had earlier offered an alternative explanation for the observations made by Rathke on the *Bopyro*-parasitized prawns. Namely, according to Giard, the "female" parasitized prawns that Rathke saw were really "males" before undergoing the process of parasitism. Here, we see another example where Giard adopts a more flexible position concerning parasitically induced sex alteration. According to Botts, Giard sees the effect of *Sacculina* parasites as possibly going in both directions: male crabs could assume female characters and vice versa. Smith and Hamm's later study would argue against this interpretation and suggest that parasitically induced sex transformation from female to male "is never observed in the case of *Sacculina*."⁴⁹ Whereas Giard believed that changes in the sexual characters of the crabs are due to the parasites' direct attack or destruction of their reproductive organs, Smith argued that they are actually the result of the parasitically induced changes in the crabs' metabolic system.

It is precisely through these persistent contradictory accounts offered by European experimental biologists on parasitically induced sex alteration that we can begin to appreciate the fundamental typological significance of the "hermaphroditic" figure in the biological discourse of sex. If we now return to Zhu's picture "3" in Fig. 1, we see that he had actually followed Smith and Hamm's interpretation: Zhu indicated this morphological appearance as a *xiong* crab transformed into a female by labeling it with 雄 (*xiong*) in quotation marks and describing it as such in his text. He mentioned no examples of female-to-male change in parasitized crabs. Yet, it might be useful to think of picture 3 in Fig. 1 as a drawing of a "hermaphroditic" crab, because it is not entirely clear whether this would be a male-to-female transformation or a female-to-male one without any label such as "雄." Through its operative value on the levels of epistemological visualization and visual epistemologization, then, the marking of this sexually ambiguous "hermaphroditic" figure with "雄" stabilizes a signifying order that renders not just *xiong* but also *ci* as

⁴⁸ Botts (1906), 600.

⁴⁹ See n. 45.

candidates of bioscientific knowledge about sex comprehensible by simply looking at the morphological appearance of living species.

The varying positions taken by European experimental biologists in interpreting the parasitic effects of *Sacculina* were also apparent among Chinese biologists. When we turn to Fei Hongnian's explanation of his drawings in Fig. 2, we find that he actually adopts Giard's interpretation that *Sacculina* parasites could induce sex manipulation in both directions, female to male and male to female.

Smith discovered *Sacculina* parasitism on *Inachus* crabs...when *Sacculina* parasites infect the abdominal regions of crabs, it appears as a bulge outside the abdominal region. Subsequently it absorbs the nutrients of the crab and begins to spread across the crab's entire body. Both *Ci* crabs and *xiong* crabs are prone to be parasitized by *Sacculina*. When *ci* crabs get infected, the change in their secondary sexual characters is less pronounced...when *xiong* crabs get infected, the degree of change is significantly greater. The abdominal region enlarges to a size much like the abdominal region of *ci* crabs [see picture B in Fig. 2]...This is referred to as "parasitic castration" [寄生去勢].⁵⁰

For Fei, *Sacculina* parasites could induce sex transformation in both *ci* and *xiong* crabs, with the latter case displaying a degree of change more pronounced than the former. Even though he explicitly cites Smith, his position appears to be much closer to Giard's: by 1914, Smith went so far to argue that "the *Sacculina* exerts an active *feminising* influence on *both sexes* of infected crabs,"⁵¹ and Botts pointed out this disagreement between Giard and Smith as early as in 1906 in light of the preliminary research results Smith provided him.⁵² Yet this is not to suggest that Smith is "more correct" than Giard and that Fei simply got it all wrong. As late as 1919, for instance, commenting on the topic of parasitic castration, Thomas Hunt Morgan "still fail[ed] to be convinced by Smith's interpretation of his facts."⁵³ My point here is that the ways in which explicit disagreements among Western biologists were not rendered apparent in Fei's account illustrate the very decisive role of living bodies with indefinite sexual appearances (as portrayed in picture "3" of Fig. 1 or picture "B" of Fig. 2) in the process by which sex became *naturalized* and *stabilized* through the language of *ci* and *xiong* in the Chinese discourse of bioscience.

Whether the intellectual origin of Chinese biologists' interpretation of sex in these examples of parasitized crabs is Giard or Smith, or Pérez or Rathke for that matter, the intellectual movement of "sexualizing" life marked a distinct trajectory from European to Chinese conceptualizations of life and sex. The intellectual prominence of sex in Chinese bioscientific thinking anchors the epistemological grounding of *ci* and *xiong* in concrete biological examples, oftentimes reinforced through visual illustrations. During the Republican period, the reformulated discourse of *ci* and *xiong* thus produced a key epistemological reorganization in Chinese thinking about questions of sex and life. Replacing traditional Confucian cosmologically centered

⁵⁰ Fei (1933), 74–75, with slight alteration.

⁵¹ Smith and Hamm (1914), 454, emphasis added.

⁵² See Botts (1906), 601.

⁵³ Morgan (1919), 92.

philosophy, Western biology became the preeminent paradigm for rethinking maleness and femaleness. After the increasing penetration of Western natural sciences in China, to borrow Frank Dikötter's words, "physical bodies were no longer thought to be linked to the cosmological foundations of the universe: bodies were said to be produced by biological mechanisms inherent in 'nature.'"⁵⁴ And "nature," writes Dikötter, "previously imagined as a purposeful whole, a benevolent structure which could not exist independently from ethical forces," was now "conceptualized as a set of relatively impersonal forces that could be objectively investigated."⁵⁵ In other words, nature became a unifying field of knowledge with its own sets of laws and orders in which "truth" was encoded and to be explained by its observer—the scientist. Conceptualized through the Chinese bioscientific vocabulary of *ci* and *xiong*, the nature of maleness and femaleness was thus represented as a *form* of life with two different morphological possibilities. Any deviation must be interpreted through this naturalized dichotomous framework, the binary features of which gave even more power to the cultural congruency among seemingly related notions of *ci/xiong*, *nü/nan*, and *yin/yang*.

4 Sex as Function of Life: Biological Theories of Hermaphroditism and the Human–Non-human Divide in the Discoursing of *Ci* and *Xiong*

Having shown how the visualization and epistemologization of *ci* and *xiong* involved the figuration of hermaphroditism as an implicit biological category, I now turn to Zhu Xi's writings on hermaphrodites as explicit visualizable life entities. The two terms that Zhu used most frequently to describe the biological condition of hermaphroditism are *cixiong tongti* (雌雄同體) and *liangxing tongti* (兩性同體). The former literally means "*ci* and *xiong* in the same body," and the latter literally means "two sexes in the same body." By looking at Zhu's understanding of what he directly identifies as "hermaphrodites," I hope to bring into sharper focus the temporality and spatiality of sex, now not only represented as a form but also a *function* of life. It is also where Zhu begins to use such terminologies as *nan* and *nü* in his discussions of human hermaphrodites that the significance of the human–non-human divide emerges as crucial to the comprehensibility and epistemic functionality of *ci* and *xiong* in Chinese bioscience.

Rather than a historical point of departure, a more useful one for delving into the scientific discussion of hermaphroditism in Republican China is perhaps historiographical: Frank Dikötter's *Imperfect Conceptions: Medical Knowledge, Birth Defects, and Eugenics in China* (1998). His section on "'The Intermediate Sex': Embryology, Hermaphroditism, and Gender Distinctions" is the most extensive treatment of the topic in the literature to date. It should be noted that hermaphroditism during the Republican era is by no means the central focus of his book; rather, for the more immediate purpose of his monograph, Dikötter offers a sweeping account of the history of eugenics in relation to medical ideas about birth

⁵⁴ Dikötter (1995), 14.

⁵⁵ Dikötter (1998), 65.

abnormalities from the late imperial period to late-twentieth century People's Republic (ergo the subtitle of his book). My following attempts to revise what he has written therefore should not undermine the historiographical value of his highly original work published more than a decade ago.

With respect to Zhu's writings on the topic of hermaphroditism in *Changes in Biological Female and Maleness*, Dikötter claims that

Popular neo-Lamarckian theories, which represented women as a lower stage on the evolutionary ladder, were endorsed by more elaborate investigations into the nature of hermaphroditism. Zhu Xi (1900–62), a professor at Sun Yatsen University in Canton and an authority in the field of reproductive biology, carefully analysed the sexual organs of a number of hermaphrodites which he classified as the 'intermediate sex' of the human species: in a reconfiguration of older notions of gender hierarchy, the female hermaphrodite was seen as the 'lower level of the intermediate sex', the male counterpart was renamed the 'higher level of the intermediate sex'. Since women were a grade below men on the evolutionary ladder, female hermaphrodites were said to be more common, as evolutionary forces always strove forwards.⁵⁶

On the following page he reproduces a diagram from Zhu's book (included here as Fig. 3) and labels it as "The development of hermaphroditism."^{57,58}

However, there are many problems with Dikötter's account simply on the level of factual description. First, a minor corrective, Zhu was born in 1899 and not 1900.⁵⁹ More problematic is Dikötter's suggestion that Zhu had "carefully analysed the sexual organs of a number of hermaphrodites which he classified as the 'intermediate sex' of the human species." Based on my reading of Zhu's book in several iterations, I believe Zhu had no first-hand experience in scientifically studying or "analyzing" human hermaphrodites. Thus Zhu's writings on this subject relied solely on other scholars' account of human hermaphrodites.⁶⁰ As I will show below, if nothing else, Zhu's explanation of hermaphroditism actually demonstrates an impressive grasp of sophisticated theories of sex posited by Western geneticists of the time, most notably Thomas Morgan, Richard Goldschmidt, and Calvin Bridges in the United States.⁶¹ Last, Zhu did not present the diagram reproduced in Fig. 3 as something that shows "the development of hermaphroditism." Rather, the images are merely visual illustrations of the "appearances of sex-transformations in human reproductive organs" (人類生殖器官變性的型態).⁶² At most, we could interpret them as illustrations of the heterogeneous appearance of the reproductive organs of

⁵⁶ Dikötter (1998), 77.

⁵⁷ Dikötter (1998), 78.

⁵⁸ Zhu (1948c [1945]), 196.

⁵⁹ Both Laurence Schneider and Marilyn Levine would attest to this statement. See n. 24.

⁶⁰ See, for example, Zhu (1948c [1945]), 205–213 and 309–312.

⁶¹ This thus also undermines Dikötter's earlier claim that "The impressive repertoires of anomalies, perversions and deformed sexualities constructed by psychiatrists and sex researchers in Europe envisaged the social subject as a site of individualized desires, and expressed the possibility that pleasure could be an end in itself. Such a possibility was not envisaged by modernizing élites in China." Dikötter (1995), 143.

⁶² Zhu (1948c [1945]), 195.

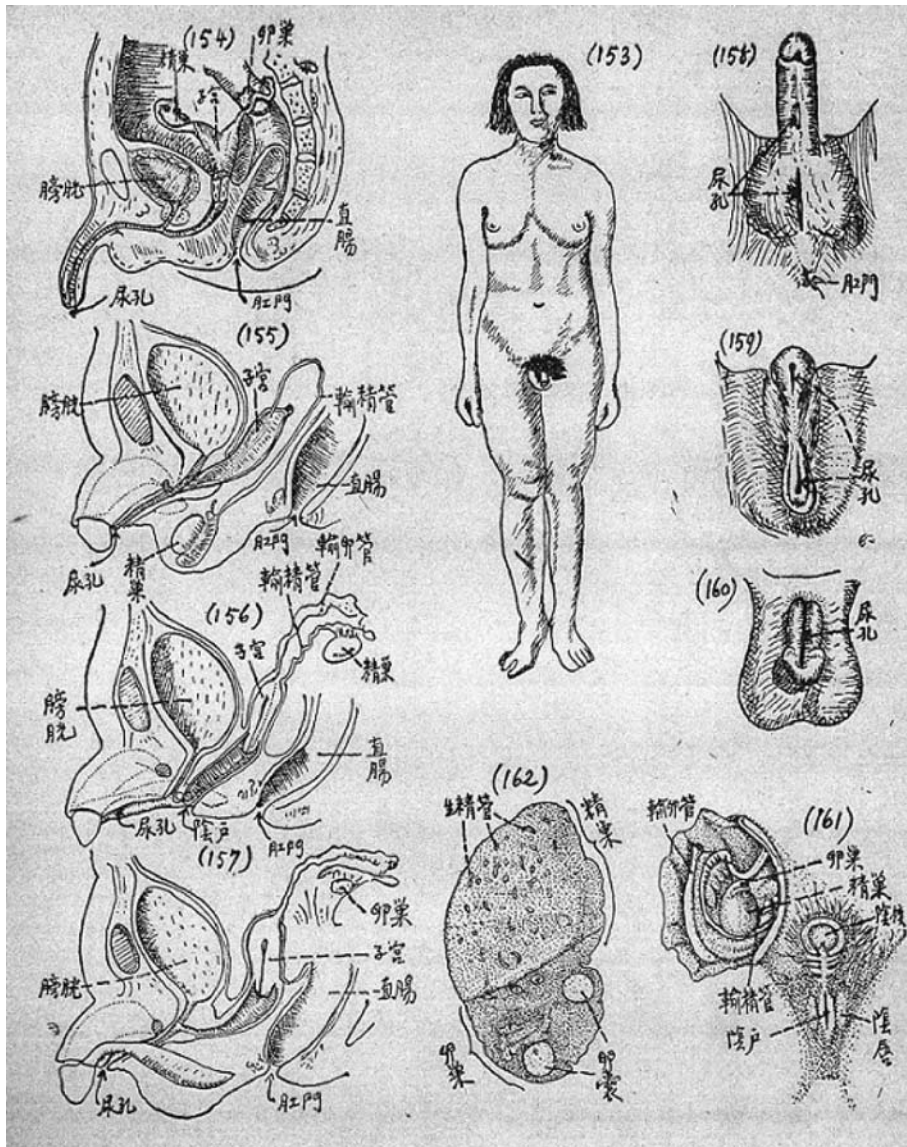


Fig. 3 The appearances of sex transformations in human reproductive organs

human hermaphrodites. Based on these diagrams, Zhu made no claims about the *development* of hermaphrodites; only the possible forms different hermaphroditic reproductive organs could take.

A more serious problem with Dikötter's account rests on the level of historical analysis. The main argument he makes with respect to gender ideology in the Republican period is best captured in his own words:

Biologising discourses of the body in republican China reflected a tension between the idea of gender hierarchy, in which female bodies were the passive

counterparts of active male bodies, and a vision of modernity in which men and women were undifferentiated members of an organic collectivity. As in the late imperial period, hermaphroditism remained a symbol of the ambivalent nature of human sexuality and demonstrated the fundamental kinship of men and women.⁶³

This argument extends from Dikötter's interpretation that Zhu's "neo-Lamarckian" perspective understands female hermaphrodites "as the 'lower level of the intermediate sex,'" while "the male counterpart was renamed the 'higher level of the intermediate sex'." Since women were a grade below men on the evolutionary ladder, female hermaphrodites were said to be more common, as evolutionary forces always strove forwards."⁶⁴ In contrast, I argue that Zhu's conceptualization of hermaphroditism was much more sophisticated than what is represented by Dikötter's account, and was by no means restricted to human hermaphrodites. Looking at Zhu's monograph *Changes in Biological Female and Maleness* in its entirety allows us to appreciate Zhu's comprehension of the theoretical relationship between human and non-human hermaphroditism. From there, we also begin to see why Zhu equated *specific* female hermaphrodites (not all female hermaphrodites) with the notion of a "lower *degree* of intersexuality"—*not* an overly simplified idea of a "lower level of the intermediate sex," as Dikötter would have it.

For Zhu, one of the most fundamental theoretical distinctions that needed to be made in order to understand biological hermaphroditism is between the *theory of intersexuality* and the *theory of gynandromorphism*. Two diagrams included in his 11th chapter on "An Analysis of the Two Sexes in Invertebrate Animals" (reproduced here as Figs. 4 and 5) are most representative of his effort to make this distinction.^{65,66}

In introducing the theory of intersexuality, Zhu writes:

From 1921 to 1922, after [Calvin] Bridges, one of the foremost American Morganists, examined the reproductive results of fruit flies, apart from pure *ci* and pure *xiong* types, he observed a third kind of organism that appears to have a type of body that is neither entirely *ci* nor entirely *xiong*. At first he was very surprised, but after careful research, he realized that they are monsters with a *ci-xiong* dual-sexed body [雌雄兩性混生的怪物], a condition that could be called hermaphroditism [雌雄同體]. However, this author specifically names them "Intersexes" [中間性個體], in order to distinguish them from the regular hermaphrodites. Although these monsters [怪物] have the features of both sexes, they can never reproduce.⁶⁷

The point Zhu goes on to make with respect to the theory of intersexuality is that through a deep chromosomal analysis of intersexed fruit flies, Bridges realized that the mere presence or absence of a Y chromosome alone could no longer be the sole

⁶³ Dikötter (1998), 81.

⁶⁴ See n. 56.

⁶⁵ Zhu (1948c [1945]), 221.

⁶⁶ Zhu (1948c [1945]), 222.

⁶⁷ Zhu (1948c [1945]), 224.

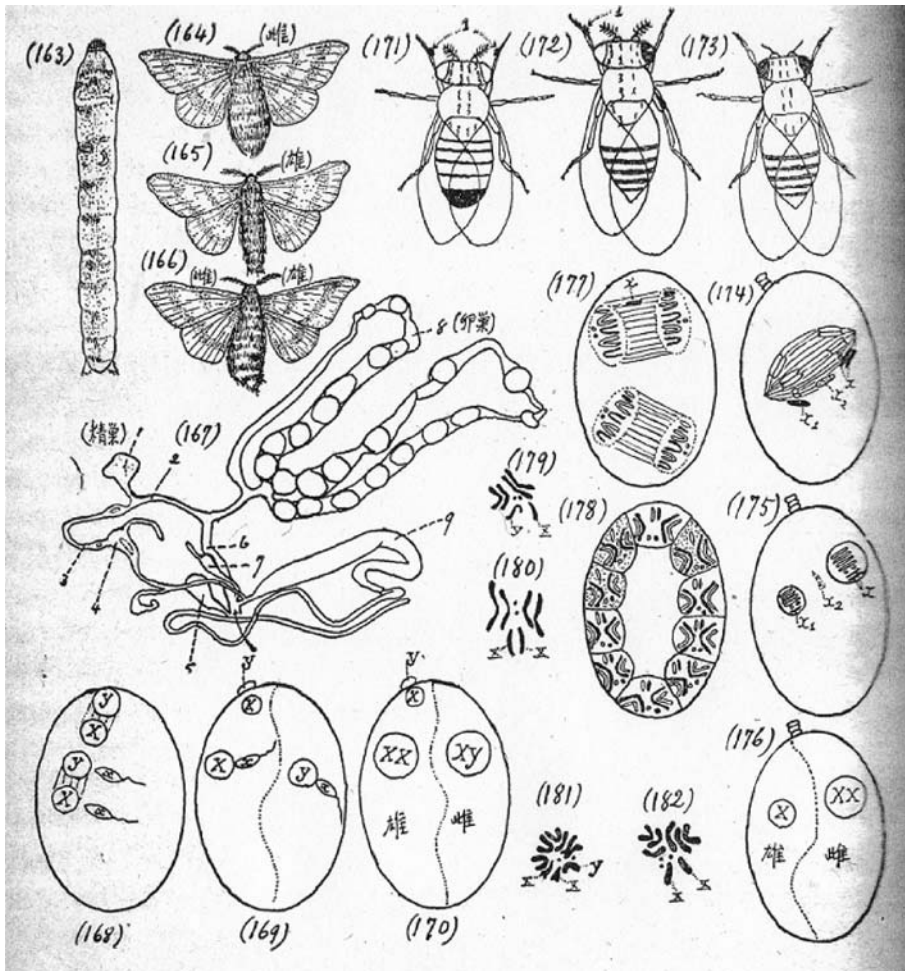


Fig. 4 The gynandromorphism of silkworms and fruit flies

determinant factor of sex. Zhu refers to the diagrams labeled “181” and “182” in Fig. 4 as showing that “the chromosomal numbers inside these monsters’ cellular nuclei are entirely different from normal *ci* or *xiong* individuals! They have instead three pairs of autosomal chromosomes and one pair of X chromosomes.”⁶⁸ As such, Zhu notes that Bridges began to incorporate autosomal chromosomes into his formula of sex determination. As Bridges began to calculate the ratio of the number of X chromosomes to the number of autosomes in fruit flies, he further developed the concepts of “Superfemales” (過雌體) and “Supermales” (過雄體) to denote those organisms that contain a ratio of X chromosomes to autosomes *higher* or *lower* than the ratio for normally sexed organisms, respectively.⁶⁹

⁶⁸ Zhu (1948c [1945]), 224. An autosome is any chromosome that is not a sex chromosome.

⁶⁹ Zhu (1948c [1945]), 225–226.

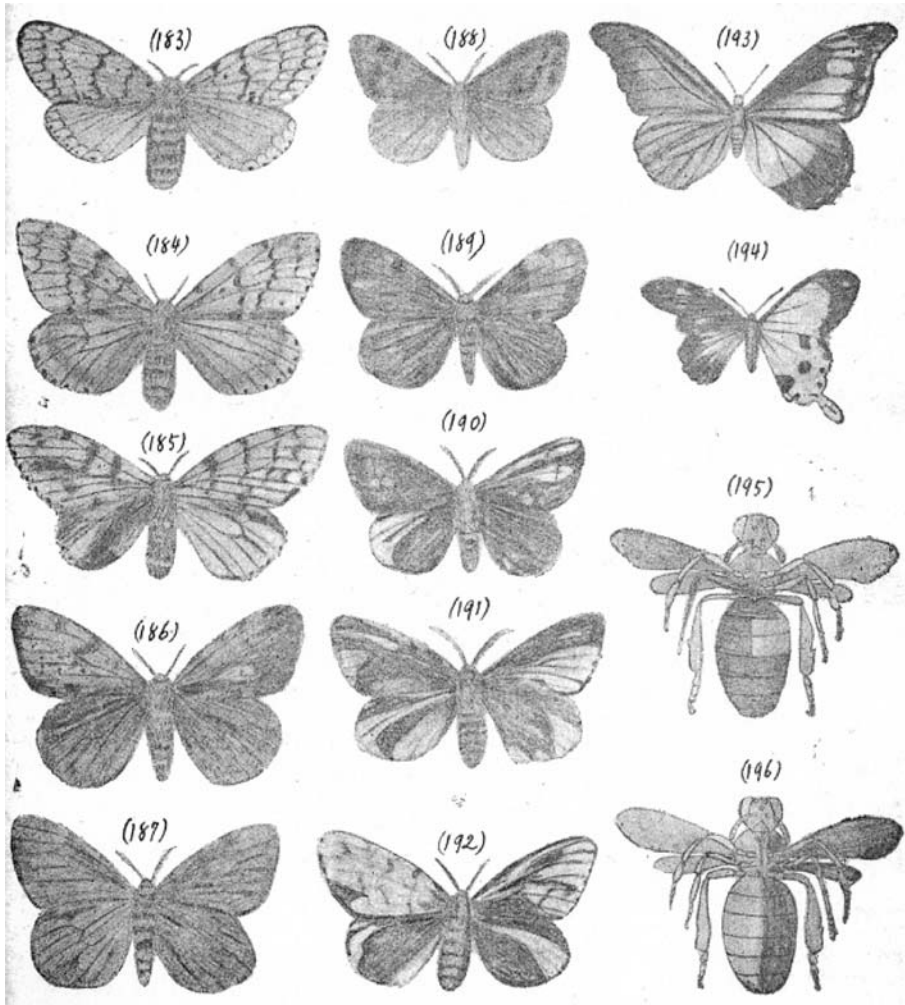


Fig. 5 The intersexuality of tussock moths and butterflies and the gynandromorphism of bees

To introduce the theory of gynandromorphism, Zhu begins with Morgan and his students:

Among the fruit flies they investigated, [Thomas] Morgan and his students unexpectedly discovered cases in which the features of *ci* and *xiong* collapsed in a single body [雌雄性形合璧的個體]; one side of this body not only displays *xiong* secondary characters but also contains testes, while the other side of the body not only displays *ci* secondary characters but also contains ovaries.⁷⁰

To portray this “mosaic” understanding of hermaphroditism, Zhu directs the reader to the diagram labeled “172” in Fig. 4. According to Zhu, picture “171” refers to

⁷⁰ Zhu (1948c [1945]), 226.

the normal body of *xiong* fruit flies with white eyes, picture “173” refers to the normal body of *ci* fruit flies with red eyes, and “172” shows the body of a “gynandromorph” fruit fly with both *xiong* white eyes on the left and *ci* red eyes on the right.

So the question raised is this: are “gynandromorphs” simply “intersexes”? In order to demonstrate that they are fundamentally different, Zhu cites the works of Richard Goldschmidt and argues that one distinct feature of “intersexes” is that they can be further separated into “*xiong*/male intersexes” and “*ci*/female intersexes,” whereas gynandromorphs could not. In Fig. 5, for example, diagram “183” is supposed to represent a normal *ci*/female tussock moth, with “a large abdomen, light-colored wings, and short antennae.” Accordingly, diagrams “184” through “187” are representations of “*ci*/female intersexed” moths. Similarly, diagram “188” is a normal *xiong*/male moth, with “a small abdomen, dark-colored wings, and long antennae,” while “189” through “192” represent “*xiong*/male intersexed” moths.⁷¹

It is within this comparative context that the notion of a “lower degree of intersexuality” (低度的中間性) that Dikötter cites (as “the lower level of the intermediate sex”) first appears in the entire monograph. Zhu explains that a “lower degree of intersexuality” simply refers to a very limited “change in sex” (變性) due to a later (in the temporal sense) opportunity for inducing this developmental change in the sexual appearance of an individual organism.⁷² Therefore, the extent to which this notion of a “lower degree of intersexuality” differs from a “higher degree of intersexuality” (高度的中間性) only depends on the *timing* of the possibility for modifying the sexual characters of an organism along its developmental pathway.⁷³ According to Zhu, diagram “184” in Fig. 5 would represent a *ci* moth with a “lower degree of intersexuality,” while “187” would be a moth with a “higher degree of intersexuality,” and both “185” and “186” are simply ones that lie somewhere in between (“a medium degree of intersexuality”). This quantitative notion of intersexuality is not restricted in its applicability to *ci* intersexes; *xiong* intersexed organisms could also display varying degrees of intersexuality. It follows that diagram “189” would represent a *xiong* moth with a “lower degree of intersexuality,” while “192” would be one with a “higher degree of intersexuality,” and both “190” and “191” resemble those that display a “medium degree of intersexuality.”

To bring home the fundamental difference between “gynandromorphs” and “intersexes,” Zhu explains that

The origins of gynandromorphic bodies derive from the moment of conception. Due to the irregular chromosomal interactions at the time...some cells are *ci* types that contain a *ci*-like chromosomal make-up in the nucleus, thus displaying *ci* features. Other cells are *xiong* types that contain a *xiong*-like chromosomal make-up in the nucleus, thus displaying *xiong* features...

As for the origins of intersexuality, all of the cells of an intersexed individual are either *ci* or *xiong*...Intersexed bodies are the result of sex-change at some

⁷¹ Zhu (1948c [1945]), 223.

⁷² Zhu (1948c [1945]), 243.

⁷³ Zhu (1948c [1945]), 243–244.

point along the developmental pathway [中途變性]; it is purely a function of the time of sex-change, which could be early or late, that the degree of transformation (high or low) corresponds to...What is important here is that intersexuality is a symptom of change with respect to a developmental pathway; this can be identified as *a change in temporality* [時間上的變化]. On the other hand, gynandromorphism is something inherent to the individual organism; this can be identified as *a change in spatiality* [空間上的變化].⁷⁴

Through the example of the sexually ambiguous category of hermaphroditism, sex is now conceived not only as a form of life but also as a complex *function* of life—a function of its time and space.

Therefore, if we now turn to the paragraph in Zhu's book from which Dikötter cites his translated notion of a “lower level of the intermediate sex” for female hermaphrodites and a “higher level of the intermediate sex” for male hermaphrodites, we can better understand what Zhu exactly means—“degrees of intersexuality”, not “levels of the intermediate sex.” Zhu writes:

To sum up, humans are like other animals: the origins of sex-determination reside within the hereditary materials. Midway sex-changes in humans take place in ways similar to how they occur in animals—there is nothing unique about this. Moreover, similar to the sex-transformation cases in animals, *nü-bian-nan* (“female-to-male changes”) in humans tend to occur more frequently than *nan-bian-nü* (“male-to-female changes”). From this observation, we can conclude that the basis of *nüxing* (“female essentials” or “femaleness”) is more mutable, similar to the cases in amphibians and other types of animals. In the past, what people meant by female human pseudo-hermaphrodites [女性的假兩性同體者] can be more accurately understood as individuals with a lower degree of intersexuality; what people meant by true human hermaphrodite [地道的男女同體者] can be more accurately understood as individuals with a medium degree of intersexuality (having testis, ovaries, and the corresponding spermatic duct and oviduct simultaneously in the reproductive organ); what people meant by male human pseudo-hermaphrodites [男性的假兩性同體者] can therefore be more accurately understood as individuals with a higher degree of intersexuality that completely transformed from a female to a male.⁷⁵

Based on this paragraph, we can now conclude that the most significant feature of Zhu's understanding of human hermaphroditism is that they should be best understood as intersexuals rather than gynandromorphs. More specifically, I think it would not be going too far to argue that for Zhu, all human hermaphrodites are *female* intersexes. This would explain why Zhu referred to the human hermaphrodite illustrated in Fig. 3 (diagram “153”) as an “intersexed lady” (中間性女子).⁷⁶ His usage of such phrases as “a lower degree of intersexuality,” “a medium degree of intersexuality,” and “a higher degree of intersexuality” to describe such conditions as

⁷⁴ Zhu (1948c [1945]), 250–251.

⁷⁵ Zhu (1948c [1945]), 312.

⁷⁶ Zhu (1948c [1945]), 197.

“female human pseudo-hermaphrodites,” “true human hermaphrodites,” and “male human pseudo-hermaphrodites” makes it evident that he sees all forms of human hermaphroditism as heterogeneous manifestations of human *female* intersexuality. He thus ends the paragraph with a clause specifying his definition of “male human pseudo-hermaphrodites” as individuals “that completely transformed from a *female* to a male” (emphasis mine).

According to Dikötter’s interpretation of this paragraph, Zhu embraced traditional gender ideology in his scientific explanation of hermaphroditism by believing that “Since women [a]re a grade below men on the evolutionary ladder, female hermaphrodites [are] more common, as evolutionary forces always strove forwards.”⁷⁷ This completely misses Zhu’s central thesis in *Women over Men* (1941; 1948), the third volume of his “Modern Biology” series that came before *Changes in Biological Female and Maleness* and a source that Dikötter himself actually cites.⁷⁸ In that book, Zhu’s goal is precisely to invite his readers to reconsider the appropriateness of traditional gender ideology in light of the new biological evidence he provides for suggesting that female species occupy more important evolutionary roles than males—hence the title of his book, *Women over Men*. In my view, then, Dikötter’s misreading of Zhu arises in significant part from failing to grasp the distinction between gynandromorphism and intersexuality that was so fundamental to Zhu’s own biological thinking about sex.

The most significant oversight of Dikötter’s analysis, and one of my central arguments, is that the biological discourse of *ci* and *xiong* in twentieth-century China fundamentally relies on the preservation of such terms as *nü* and *nan* for humans. In fact, in order for *ci* and *xiong* to gain epistemological significance in a style of inquiry about life rooted in Western biology, their logical coherence, scope of lexical possibility, epistemic value, and syntactic valency all necessitate a conceptual divide between human and the non-human that would always defer the comprehensibility of *ci* and *xiong* to being implicated—visually or epistemologically—by their most immediate applications to non-human species. This would explain why, throughout his book, Zhu Xi translates “gynandromorphism” into *cixiong xing* (“雌雄型,” which literally means “female–male shape”) and “intersexuality” into *zhongjian xing* (“中間性,” which literally means “intermediate sex”⁷⁹). That is, in accordance with his logic that human hermaphrodites could only be explained by the theory of intersexuality, Zhu reserves the usage of *ci* and *xiong* for translating gynandromorphism as a possible conceptual tool for understanding nonhuman hermaphroditism. There is no doubt that Zhu feels equally comfortable with using the theory of intersexuality to make sense of animal hermaphroditism, as reflected in his discussion of the sexually ambiguous moths in Fig. 5. However, Zhu did not treat the theory of gynandromorphism, or *cixiong xing* to use his own terminology, as

⁷⁷ See n. 56.

⁷⁸ Zhu (1948b [1941]).

⁷⁹ Although this is the literal translation of *zhongjian xing* 中間性, which may appear to support Dikötter’s translation, I have demonstrated that it would be more accurate to translate it for the English reader as “intersexuality,” for it is the theory of “intersexuality” that Zhu really intends to invoke with this phrase in his explanation of human hermaphroditism.

adequate for the production of knowledge about human hermaphroditism. If the notions of *nü* and *nan* find their cultural values in anthropo-exclusivity, the “biologicalness” of *ci* and *xiong*, as scientific terms meaning “femaleness” and “maleness,” carries with it the conceptual baggage of making these two terms comprehensible only by always assigning to them some kind of “non-human” or “less-than-human” epistemic functionality.

5 Conclusion

This paper has “mapped” a number of trajectories through which one can trace the richly layered and surprisingly malleable contours of sex in Chinese bioscientific thought during the first half of the twentieth century. One such trajectory on the most concrete level of global compassing is the travel of ideas and theories about sex from Europe and North America to East Asia. When Chinese bioscientists appropriated theories of parasitic castration, intersexuality, and gynandromorphism to explain the mutability of life forms, the organizational structure in which they articulated their conceptual understanding of sex was grounded in intellectual engagements with Western biological thought.

On a deeper level of epistemological technology, two other trajectories by which the bioscientific conceptualization of sex distinguished itself in Republican China are the semantic groundings of *ci* and *xiong* in (1) visual knowledge and (2) the human–non-human divide. As this paper has demonstrated, in the work of some major Chinese life scientists, the lexical possibility of *ci* and *xiong* cohered around their indexical visibility, which appeared as epistemic associations with a range of biological organisms in visual illustrations such as those in Fig. 1. Meanwhile, the non-human conceptual quality of these two terms precisely provided the necessary conditions for constituting the basis for a biological style of argumentation that systematically extends “sex” to all life forms across the human–non-human divide. When juxtaposed with such culturally anthropocentric words as *nü* and *nan*, *ci* and *xiong* carry a consistent character of being more “bioscientific” as a consequence of their always already “non-human” or “less-than-human” connotation about their most immediate applicability.

On a broader level of epistemological operation, two other pathways that uniquely marked the conceptual contours of sex in the Republican Chinese discourse of the life sciences are the representations of sex as *form* and *function* of life. The possible arrangements for a *formal* representation of sex include those more static morphological qualities that biologists associate with *ci* and *xiong* as indicators for distinguishing femaleness from maleness. A *functional* representation of sex introduces an intrinsic dimension of change to the ways in which sex could be conceived, while still retaining a binary operational framework. This is why, throughout the examples studied in this paper, Zhu consistently resolves the sexually ambiguous status of the hermaphroditic typological figuration by invoking these dichotomous categories of sex, either as a formal (e.g., in the case of parasitized crabs) or functional (e.g., in the case of gynandromorphism or intersexuality) representation of life.

On the discursive level, all of these trajectories converged in an order of knowledge in which sex is depicted as a powerful symbol of life. Through the discourse of bioscience, then, Republican Chinese modernizing figures brought about a “sexualization” of life, so to speak, that transformed the Chinese conceptualization of *xing* (性) into a system of thought that rendered sex and life as two distinctly separate, though mutually reinforcing, horizons of scientific thinking for the first time in history.

References

- Adas, M. (2004). Contested hegemony. *Journal of World History*, 15(1), 31–63.
- Angelides, S. (2001). *A history of bisexuality*. Chicago: University of Chicago Press.
- Appel, T. (1987). *The Cuvier–Geoffroy debate: French biology in the decades before Darwin*. New York: Oxford University Press.
- Armheim, R. (1969). *Visual thinking*. Berkeley: University of California Press.
- Baigrie, B. S. (Ed.). (1996). *Picturing knowledge: Historical and philosophical problems concerning the use of art in science*. Toronto: University of Toronto Press.
- Barlow, T. E. (Ed.). (1993). *Gender politics in China: writing and feminism*. Durham: Duke University Press.
- Botts, F. A. (1906). The modifications of sexual characters of the hermit crab caused by the parasite *Peltogaster*. *Quarterly Journal of Microscopic Science*, s2–50(200), 599–621.
- Brownell, S., & Wasserstrom, J. N. (Eds.). (2002). *Chinese femininities/Chinese masculinities: a reader*. Berkeley: University of California Press.
- Bullough, V. L. (1970). Martin Heinrich Rathke. In C. C. Gillispie (Ed.), *Dictionary of scientific biographies* (pp. 307–308). New York: Charles Scribner's Son.
- Cadden, J. (1993). *Meanings of sex difference in the Middle Ages: medicine, science, and culture*. Cambridge: Cambridge University Press.
- Callan, H. G. (1940). The effects of castration by parasites and X-rays on the secondary sex characters of prawns (*Leander* spp.). *Journal of Experimental Biology*, 17, 168–179.
- Chiang, H. H. (2007). Epistemic gender, sex beyond the flesh: science, medicine, and the two-sex model in modern America. *eSharp*, 9, 1–34. http://www.gla.ac.uk/media/media_41212_en.pdf
- Chiang, H. H. (2008). Effecting science, affecting medicine: homosexuality, the Kinsey reports, and the contested boundaries of psychopathology in the United States, 1948–1965. *Journal of the History of the Behavioral Sciences*, 44(4), 300–318.
- Chiang, H. H. (2009). Rethinking “style” for historians and philosophers of science: converging lessons from sexuality, translation, and East Asian studies. *Studies in History and Philosophy of Biological and Biomedical Sciences*, in press.
- Chiang, H. H. (Forthcoming). Epistemic modernity and the emergence of homosexuality in China.
- Chow, T. (1960). *The May Fourth Movement: intellectual revolution in Modern China*. Stanford: Stanford University Press.
- Chow, R. (1991). *Woman and Chinese modernity: the politics of reading between West and East*. Minneapolis: University of Minnesota Press.
- Chung, Y. J. (2002). *Struggle for national survival: eugenics in Sino-Japanese context, 1896–1945*. New York: Routledge.
- Clarke, A. E. (1998). *Disciplining reproduction: modernity, American life sciences, and “The Problems of Sex”*. Berkeley: University of California Press.
- Daston, L., & Park, K. (1996). The hermaphrodite and the orders of nature: sexual ambiguity in early modern France. In L. Fradenburg, & C. Freccero (Eds.), *Premodern sexualities* (pp. 117–136). New York: Routledge.
- Davidson, A. I. (2001). *The emergence of sexuality: historical epistemology and the formation of concepts*. Cambridge: Harvard University Press.
- De Chadarevian, S., & Hopwood, N. (Eds.). (2004). *Models: the third dimension of science*. Stanford: Stanford University Press.
- Dikötter, F. (1989). Eugenics in Republican China. *Republican China*, 15(1), 1–17.

- Dikötter, F. (1992). *The discourse of race in Modern China*. Stanford: Stanford University Press.
- Dikötter, F. (1995). *Sex, culture, and modernity in China: medical science and the construction of sexual identities in the early Republican period*. Honolulu: University of Hawaii Press.
- Dikötter, F. (1998). *Imperfect conceptions: medical knowledge, birth defects, and eugenics in China*. New York: Columbia University Press.
- Dreger, A. D. (1998). *Hermaphrodites and the medical invention of sex*. Cambridge: Harvard University Press.
- Elman, B. A. (2005). *On their own terms: science in China, 1550–1900*. Cambridge: Harvard University Press.
- Elman, B. A. (2006). *A cultural history of modern science in China*. Cambridge: Harvard University Press.
- Epstein, S. (1996). *Impure science: AIDS, activism, and the politics of knowledge*. Berkeley: University of California Press.
- Evans, H. (2007). *The subject of gender: daughters and mothers in urban China*. Lanham: Rowman and Littlefield.
- Fausto-Sterling, A. (2000). *Sexing the body: gender politics and the construction of sexuality*. New York: Basic.
- Fei Hongnian. 費鴻年 (1933). *Renlei xingyuan ren 人類性源論* (The determination of sex in man). Shanghai: Shangwu yinshu guan 商務印書館 (The Commercial Press).
- Frühstück, S. (2003). *Colonizing sex: sexology and social control in modern Japan*. Berkeley: University of California Press.
- Fu Daiwie. 傅大為 (2005). *Yaxi'ya de xin shenti: Xingbie, yiliao, yu jindai Taiwan 亞細亞的新身體: 性別, 醫療, 與近代台灣* (The new Asian body: Gender, medicine, and modern Taiwan). Taipei: Qünxue 群學.
- Furth, C. (1970). *Ting Wen-chiang: science and China's new culture*. Cambridge: Harvard University Press.
- Furth, C. (1993). Androgynous males and deficient females: biology and gender boundaries in sixteenth- and seventeenth-century China. In H. Abelove, M. A. Barale, & D. M. Halperin (Eds.), *The lesbian and gay studies reader* (pp. 479–497). New York: Routledge.
- Furth, C. (1999). *A flourishing yin: gender in China's medical history, 960–1665*. Berkeley: University of California Press.
- Gilmartin, C. K. (1995). *Engendering the Chinese revolution: radical women, communist politics, and mass movements in the 1920s*. Berkeley: University of California Press.
- Glick, T. F. (Ed.). (1972). *The comparative reception of Darwinism*. Austin: University of Texas Press.
- Glosser, S. L. (2003). *Chinese visions of family and state, 1915–1953*. Berkeley: University of California Press.
- Goldberg, B. (2006). Early modern reproductive anatomy and the one-sex model: A case study of the work of Regnier de Graaf. Conference paper presented at the *Joint Atlantic Seminar for the History of Biology*, 24–25 March 2006, Johns Hopkins University, Baltimore, Maryland, USA.
- Harvey, K. (2004). *Reading sex in the eighteenth century: bodies and gender in English erotic culture*. Cambridge: Cambridge University Press.
- Haussman, B. (1995). *Changing sex: transsexualism, technology, and the idea of gender*. Durham: Duke University Press.
- Hershatter, G. (2007). *Women in China's long twentieth century*. Berkeley: University of California Press.
- Hirschfeld, M. (2000 [1914]). *The homosexuality of men and women*, trans. Michael A. Lombardi-Nash. New York: Prometheus.
- Kessler, S. J. (1998). *Lessons from the intersexed*. New Brunswick: Rutgers University Press.
- Knorr-Cetina, K., & Almann, K. (1990). Images dissection in natural scientific inquiry. *Science, Technology, & Human Values*, 15(3), 259–283.
- Krafft-Ebing, R. v. (1892 [1886]). *Psychopathia sexualis, with especial reference to contrary sexual instinct: a medico-legal study*, 7th ed., trans. Charles Gilbert Chaddock. Philadelphia: F. A. Davis.
- Kwok, D. W. Y. (1965). *Scientism in Chinese thought: 1900–1950*. New Haven: Yale University Press.
- Laqueur, T. (1990). *Making sex: body and gender from the Greeks to Freud*. Cambridge: Harvard University Press.
- Laqueur, T. (2003). Sex in the flesh. *Isis*, 94, 300–306.
- Larson, W. (1998). *Women and writing in modern China*. Stanford: Stanford University Press.
- Latour, B. (1990). Drawing things together. In M. Lynch, & S. Woolgar (Eds.), *Representation in scientific practice* (pp. 19–67). Cambridge: MIT Press.

- Lean, E. (2007). *Public passions: the trial of Shi Jianqiao and the rise of public sympathy in China*. Berkeley: University of California Press.
- Leary, C. (1994a). Intellectual orthodoxy, the economy of knowledge, and the debate over Zhang Jingsheng's sex histories. *Republican China*, 18(2), 99–137.
- Leary, C. (1994b). Sexual modernism in China: Zhang Jingsheng and 1920s urban culture. Ph.D. dissertation, Cornell University.
- Lee, G. H. J. (1996). Pan Guangdan and the concept of minzu. Master's thesis, Cambridge University.
- Lee, H. (2006a). Governmentality and the aesthetic state: a Chinese fantasia. *Positions: East Asia Cultures Critique*, 14(1), 99–129.
- Lee, H. (2006b). *Revolution of the heart: a genealogy of love in China, 1900–1950*. Stanford: Stanford University Press.
- Lenoir, T. (1989 [1982]). *The strategy of life: Teleology and mechanics in nineteenth century German biology*. Chicago: University of Chicago Press.
- Leung, A. (2005). Recent trends in the study of medicine for women in imperial China. *Nan Nü: Men, Women, and Gender in China*, 7(2), 2–18.
- Leung, A. (Ed.). (2006). *Medicine for women in imperial China*. Leiden: Brill.
- Leung, A., & Furth, C. (Eds.). (Forthcoming). *Health and hygiene in modern Chinese East Asia*. Durham, NC: Duke University Press.
- Levine, M. A. (1993). *The found generation: Chinese communists in Europe during the twenties*. Seattle: University of Washington Press.
- Lynch, M., & Law, J. (1999 [1988]). Pictures, texts, and objects: the literary language game of bird-watching. In M. Biagioli (Ed.), *The science studies reader* (pp. 317–341). New York: Routledge.
- Lynch, M., & Woolgar, S. (1988). Introduction: sociological orientations to representational practice in science. *Human Studies*, 11(2–3), 259–283.
- Mak, G. (2005). "So we must go behind even what the microscope can reveal": the hermaphrodite's "self" in medical discourse at the start of the twentieth century. *GLQ: A Journal of Gay and Lesbian Studies*, 11(1), 65–94.
- Mak, G. (2006). Doubting sex from within: a praxiographic approach to a late nineteenth-century case of hermaphroditism. *Gender and History*, 18(2), 332–356.
- Matta, C. (2005). Ambiguous bodies and deviant sexualities: hermaphrodites, homosexuality, and surgery in the United States, 1850–1904. *Perspectives in Biology and Medicine*, 48(1), 74–83.
- Menz, H. (2000). *Martin Heinrich Rathke (1793–1860): Ein embryologe des 19 Jahrhunderts*. Marburg: Basiliken-Press.
- Meyerowitz, J. (2002). *How sex changed: a history of transsexuality in the United States*. Cambridge: Harvard University Press.
- Morgan, T. H. (1914). *Heredity and sex* (2nd ed.). New York: Columbia University Press.
- Morgan, T. H. (1919). *The genetic and the operative evidence relating to secondary sexual characters*. Washington: Carnegie Institute of Washington.
- Mosucci, O. (1990). *The science of women: gynaecology and gender in England, 1800–1929*. Cambridge: Cambridge University Press.
- Oudshoorn, N. (1994). *Beyond the natural body: an archeology of sex hormones*. London: Routledge.
- Park, K. (1997). The rediscovery of the clitoris. In D. Hillman, & C. Mazzi (Eds.), *The body in parts: fantasies of corporeality in early modern Europe* (pp. 171–194). London: Routledge.
- Park, K. (2006). *Secrets of women: gender, generation, and the origins of human dissection*. New York: Zone.
- Park, K., & Nye, R. A. (1991). Destiny is anatomy. *New Republic*, 204, 53–57.
- Pérez, J. (1886). Des effets du parasitisme des Stylops sur les Apiaires du genre *Andrena*. *Actes de la Société Linnéenne de Bordeaux*, 4, 21–60.
- Pflugfelder, G. M. (1999). *Cartographies of desire: male–male sexuality in Japanese discourse, 1600–1950*. Berkeley: University of California Press.
- Redick, A. (2004). American history XY: the medical treatment of intersex, 1916–1955. Ph.D. dissertation, New York University.
- Rathke, M. H. (1837). *De bopyro et nereide*. Rigae et Dorpati.
- Rocha, L. (2007). Zhang Jingsheng's *Sex Histories*: Chinese desires uncovered, waters unleashed. Conference paper presented at *Sexual Histories: Bodies and Desires Uncovered*, 23–25 July 2007, Centre for Medical History, University of Exeter, Exeter, Devon, United Kingdom.
- Rogaski, R. (2004). *Hygienic modernity: meanings of health and disease in treaty-port China*. Berkeley: University of California Press.

- Rosario, V. (2002). *Homosexuality and science: a guide to the debates*. Santa Barbara: ABC-Clio.
- Rudacille, D. (2005). *The riddle of gender: science, activism, and transgender rights*. New York: Pantheon.
- Ruse, M., & Taylor P. J. (Eds.). (1991). Pictorial representation in biology. Special issue of *Biology and Philosophy*, 6(2), 125–294.
- Russell, E. S. (1916). *Form and function: a contribution to the history of animal morphology*. London: Murray.
- Sakamoto, H. (2004). The cult of “love and eugenics” in May Fourth movement discourse. *Positions: East Asia Cultures Critique*, 12(2), 329–376.
- Sang, T. D. (2003). *The emerging lesbian: Female same-sex desire in modern China*. Chicago: University of Chicago Press.
- Schneider, L. A. (2003). *Biology and revolution in twentieth-century China*. Lanham: Rowman & Littlefield.
- Sengoopta, C. (2006). *The most secret quintessence of life: sex, glands, and hormones, 1850–1950*. Chicago: University of Chicago Press.
- Smith, G., & Hamm, A. H. (1914). Studies in the experimental analysis of sex: Part 11—on styloids and stylopisation. *Quarterly Journal of Microscopic Science*, s2-60(230), 435–459.
- Stolberg, M. (2003). The anatomy of sexual difference in the sixteenth and early seventeenth centuries. *Isis*, 94, 274–299.
- Storr, M. (Ed.). (1999). *Bisexuality: a critical reader*. London and New York: Routledge.
- Tsu, J. (2005). *Failure, nationalism, and literature: the making of modern Chinese identity, 1895–1937*. Stanford: Stanford University Press.
- Wong Xuefeng. 王雪峰 (2006). *Jiaoyü zhuanxing zhi jing: shiji shangban shi zhongguo de xingjiaoyü sixiang yü shijian* 教育轉行之鏡：世紀上半時中國的性教育思想與實踐 (Mirror of the education paradigm shift: theories and practices of sex education in China in early 20th century). Beijing: Social Sciences Academic Press.
- Yang Dexian. 楊德銑 (1991). *Zhou Jianren pingzhuan* 周建人評傳 (Biography of Zhou Jianren). Chongqing: Chongqing chubanshe 重慶出版社.
- Zeitlin, J. (1993). *Historian of the strange: Pu Songling and the Chinese classical tale*. Stanford: Stanford University Press.
- Zhou Jianren. 周健人 (1928 [1927]). *Xing yu rensheng* 性與人生 (Sex and life), rev. ed. Shanghai: Kaiming shudian 開明書店.
- Zhou Jianren. 周健人 (1931). *Xing jiaoyu* 性教育 (Sex education). Shanghai: Shangwu yinshu guan 商務印書館 (The Commercial Press).
- Zhu Xi. 朱洗 (1923). Sishiyi yue de qingong jianxue shenghuo 四十一個月的勤功兼學生活 (My forty-one months of life in the Work-Study Movement). In *Minguo ribao* 民國日報, March–May.
- Zhu Xi. 朱洗 (1946a). *Aiqing de lai yuan* 愛情的來源 (The origins of love), rev. ed. Shanghai: Wenhua shenghuo chubanshe 文化生活出版社.
- Zhu Xi. 朱洗 (1946b [1939]). *Dan sheng ren yu ren sheng dan* 蛋生人與人生蛋 (Human from eggs and egg from humans), rev. ed. Shanghai: Wenhua shenghuo chubanshe 文化生活出版社.
- Zhu Xi. 朱洗 (1948a [1940]). *Women de zuxian* 我們的祖先 (Our ancestors), rev. ed. Shanghai: Wenhua shenghuo chubanshe 文化生活出版社.
- Zhu Xi. 朱洗 (1948b [1941]). *Zhongü qingnan* 重女輕男 (Women over men), rev. ed. Shanghai: Wenhua shenghuo chubanshe 文化生活出版社.
- Zhu Xi. 朱洗 (1948c [1945]). *Cixiong zhi bian* 雌雄之變 (Changes in biological female and maleness), rev. ed. Shanghai: Wenhua shenghuo chubanshe 文化生活出版社.
- Zhu Xi. 朱洗 (1948d [1946]). *Zhishi de lai yuan* 智識的來源 (The origins of intellectual knowledge), rev. ed. Shanghai: Wenhua shenghuo chubanshe 文化生活出版社.
- Zito, A., & Barlow, T. E. (Eds.). (1994). *Body, subject, and power in China*. Chicago: University of Chicago Press.