

Chapter 7 Reproduction and sex education

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Abstract

Reproduction is a key characteristic of all living organisms yet school biology often pays little or no attention to reproduction in taxa other than humans and a small number of ‘typical’ flowering plants. In this chapter I argue that there is still much value in a traditional introduction to life cycles and reproduction in a large range of taxa. I go on to consider such issues as the reasons why sex evolved and the diversity of ways in which sex is determined. The second topic addressed in this chapter is sex education, sometimes referred to as sex and relationships education. There is more to sex education than school biology education yet biology teachers can play an important role in sex education. At the same time, many teachers find it challenging to teach sex education well. I consider what makes for an appropriate sex education course, considering such issues as comprehensive sex education versus abstinence education and how school sex education can address questions to do with sexual orientation.

Introduction

Reproduction as a topic in biology has links to many other biology topics and is a key component of any school biology course. Nevertheless, there is considerable variation in the extent to which school biology courses only address mammalian reproduction, sometimes alongside a more superficial treatment of reproduction in flowering plants, or give a broader coverage of the topic. It is argued here that school teaching about reproduction and life cycles should not focus on mammals and flowering plants to the virtual exclusion of other taxa.

The topic of sex education has clear links with that of reproduction but there are some important differences. For a start, sex education is restricted to humans. It is also important that sex education does not focus only on issues to do with reproduction. The extent to which sex education is taught in schools varies greatly, from country to country and often within countries. It is argued here that while sex education – sometimes called sex and relationships education – should not be treated as being only the preserve of biology teachers; school biology teachers nevertheless have a central role to play.

Students’ misconceptions about reproduction and sex education

There is a large and somewhat diffuse literature about students’ misconceptions about reproduction and sex education. As might be expected, misconceptions are more likely to be reported about human reproduction than about reproduction in other species (Scharmann, 1991; Nguyen & Rosengren, 2004). Schussler (2008) showed that children’s books about plants not infrequently contain inaccuracies about plant reproduction. Hershey (2005) reported that plant misconceptions, more generally, are common in textbooks, science project books, dictionaries, encyclopaedias, science education journals and educational websites. Yip (1998) found that many students showed problems in relating the time of conception in humans to the condition of the uterine lining, and that they did not appreciate the connections between menstruation, ovulation and the likelihood of a fertilised egg implanting. Misconceptions about contraception

are also widespread (e.g. Hamani *et al.*, 2007). More generally, there is a large literature about misconceptions in sex education, particularly for HIV with regards to methods of transmission (e.g. Harvey & Reiss, 1992); there is even a Wikipedia page titled ‘Misconceptions about HIV/AIDS’. A number of instruments have been developed to assess knowledge about human reproduction / sex, and so identify misconceptions, an early one being Miller and Lief (1979).

As discussed in our Introductory chapter, the term ‘misconceptions’ may fail to convey all the ways in which scientifically incorrect views are held about a topic, and this is perhaps particularly the case in regards to reproduction and sex education. Often, students, especially young students, are simply ignorant – and this is not something for which they should be blamed. As any biologist knows, the diversity of reproduction in the natural world is immense; it is hardly the fault of students if they have been taught very little of this diversity, or even of the specifics of human reproduction. Moreover, when it comes to sex education, misconceptions or ignorance are sometimes fuelled by prejudice, for example in regards to sexual identities and behaviours.

One example of widespread ignorance, not only among school students but among adults too, is to do with age-dependent female fertility rates in humans (Bunting *et al.*, 2014). It is widely presumed that female fertility rates only drop off once a woman is in her late 30s. The reality, though, is that fertility rates typically drop off from the age of about 32. This is also the case for men, albeit the rate of decline with age is far shallower. Given that more and more women seek nowadays not to have children until they are in their late 20s or early 30s and that if they do not become pregnant, they typically don’t seek medical help until they have had more than a couple of years of not conceiving, this biological fact is an important one – and one rarely addressed in school education.

Difficulties in teaching about reproduction and sex education

One advantage of teaching about reproduction and sex education is that student interest is often high. Nevertheless, there are a number of difficulties in teaching about these topics. One difficulty, especially with regards to human reproduction and associated topics within sex education, is that teachers may feel embarrassed. The solution to this is better teacher education, whether during their initial teacher training or subsequent professional development. Support from senior management within schools is important too (Buston *et al.*, 2002).

A related difficulty is that in many countries, teachers receive little or no training about sex education. Biology teachers, of course, are nearly always trained to teach about reproduction, both in humans and in other taxa. However, the knowledge and skills to teach sex education well are not the same as the knowledge and skills to teach reproduction well. In particular, good sex education makes use of a range of pedagogical approaches (including role plays and debates) that are less often used in biology teaching. Then there is the fact that teaching about sex education raises issues to do with values to a greater extent than when teaching biology. In schools where religious values are important, attitudes towards sex education may be conservative, for example with regards to homosexuality and abortion. Teachers need to be skilled when teaching sex education in such situations (Halstead & Reiss, 2003). For many teachers, the easier and more pragmatic option may be stick to the biological facts, and this can disadvantage students.

Conceptualising reproduction and sex education

Few students are likely to find it difficult to understand the fundamental concept that reproduction (more precisely, attempting to reproduce either directly or vicariously – via related individuals in cases of kin selection) is a key characteristic of living organisms. Nor are students likely to object to being taught sex education; indeed, surveys repeatedly show that school sex education is desired by the large majority of students and their parents (e.g. Barr *et al.*, 2013). However, there are a number of issues that need to be considered when conceptualising reproduction and sex education.

Diversity in the natural world

An important contribution that biology can make to students' understandings of the natural world is helping them to appreciate something of the enormous diversity of organisms and their ways of living. This is as true for organisms' life cycles and reproduction as it is for their ecology or any other branch of biology. Hermaphroditic snails were once thought bizarre, jokes of nature (Findlen, 1990). There is great value in students being taught to think about the following issues:

- Why are some organisms sexual and some asexual? This question is often included in biology courses, and it is good for students to realise that sexual reproduction enables species to evolve more rapidly to changing environments, because it contributes to the increase of variation within a population. However, students are less often taught the extent to which sexual reproduction is disadvantageous, at least in the short-term, to at least one parent – after all, sexual reproduction is all about passing on only half of one's genetic material to one's offspring. The most likely solution to the evolutionary problem of the evolution of sex is that it enables organisms to deal with the problem of parasites (Hamilton, 1980).
- How is sex determined? Students need to be taught, if they don't already know, that (by and large) in humans, females are XX and males XY. However, it is good for students to realise that a great many other sex-determining mechanisms exist. In birds, some reptiles and certain other taxa, sex determination is chromosomal, as for mammals, but females have two different kinds of chromosomes (ZW – equivalent to male mammals being XX) while males are ZZ (equivalent to female mammals being XX). Another chromosome determining system, haplodiploidy, is found in ants, bees and wasps. Here females are diploid whereas males result from unfertilised eggs and so are haploid. Perhaps the best known non-chromosomal mechanism is when sex is determined by the external temperature (e.g. in some reptiles such as alligators, where eggs are laid and develop externally). Other non-chromosomal mechanisms exist. In clown fish, the large dominant adult in a group is a female with the smaller adults being males.

Morality and values

Many of the issues that are core to sex education are ones where a moral / values dimension is evident: At what age is it right to have a sexual relationship? Is the notion of consent the be all and end all for determining when sexual activity is right? Should someone always be faithful to their sexual partner? Has religion anything positive to contribute to sex education or is it

simply always a constriction on sexual behaviour (e.g. teachings about *in vitro* fertilisation and abortion, and restrictions on any expression of sexuality other than heterosexuality within marriage)? Before deciding how such questions might be answered, it is worth asking whether there is such a thing as a *distinctive* sexual ethics or not. At first the answer may seem obvious. Surely sexual behaviour has its own ethics. People, at different times and in different cultures, argue about the acceptability of polygamy and homosexuality and the age of consent, whether rape can exist within marriage and so on.

However, Igor Primoratz (1999) has argued that sex is morally neutral, so that moral guidance regarding sexual behaviour is provided by the *same* general moral rules and values that apply in other areas:

Thus adultery is not wrong as extramarital *sex*, but only when it involves breach of promise, or seriously hurts the feelings of the non-adulterous spouse, etc. Prostitution is not wrong as commercial *sex*, but if and when the prostitute is forced into this line of work by the lack of any real alternative. Pedophilia is not wrong as adult-child *sex* but because even when the child is willingly participating, its willingness is extremely suspect in view of the radical asymmetries of maturity, knowledge, understanding, and power of children and adults. Sexual harassment is not wrong because it is *sexual*, but because it is *harassment*. Rape is not wrong as *sexual* battery, but as sexual *battery*. (Primoratz, 1999, pp. 173-174)

The argument is a powerful one and has much to commend it. After all, if there is something ‘special’ about sexual ethics, from where does this specialness come? Of course, there are particular ethical questions that it only makes sense to ask in the context of sex, and in that sense there is a sexual ethics, but in the same way that there is, for example, business ethics and environmental ethics. The issue at hand is whether there is anything *distinctive* about sexual ethics, business ethics and environmental ethics beyond the localised application of more general forms of ethical reasoning – such as the use of the principles of autonomy, the greatest happiness of the greatest number, the avoidance of harm and, as suggested below, the promotion of human flourishing.

It has been argued that there are certain limits to acceptable sexual behaviour, set by the harms caused to others (Halstead & Reiss, 2003). In some cases, such as rape and sexual abuse, these harms are clear-cut; in others, such as visiting sex workers or leaving one sexual partner and changing to another, there are arguments on both sides. What one surely wants is for young people, at the appropriate age, to reflect on and discuss their developing sexual values. There is much, therefore, to be said for them considering such issues. One of the great things about schooling is that teachers are given the authority to promote discussion and get students to think. Schools can therefore add to and shape what children learn from their parents. As Allen (2017) points out, what happens in the sexuality education classroom is key to how and what students learn about sexuality at school. Done well, in a safe environment, teaching can enable students to develop age-appropriate skills rather than being the object of a patronising and fear-driven narrative in which adults try to keep them for as long as possible in a presumed world of childhood innocence. In some countries, sex education is referred to as ‘sex and relationships education’ or even ‘relationships and sex education’, acknowledging that much good teaching in this area is concerned with the way we relate to and treat others.

Religion plays an important part, as noted above, in the context of morality and values in sex education. Until fairly recently, relatively little had been written in any detail about religious values and school sex education. In recent years, though, there has been an increasing acknowledgement from all sex educators, whether or not they themselves are members of any

particular religious faith, that religious points of view needs to be taken into account, if only because a significant number of children and their parents have moral values significantly informed by religious traditions (e.g. Yip & Page, 2013).

Religious believers need no arguments to be voiced in favour of taking religious values seriously, both generally and with particular reference to sexual ethics and behaviour. However, those without a religious faith can often be frustrated at what they perceive as the sexist and heterosexist views of those in religious authority. There is much truth in this. However, things can change and there are pockets of encouragement. Indeed, it is an oversimplification to see religion as always associated with sexual conservatism (Reiss, 2014). More will be gained by working with those of a religious faith than by excluding them. Of course, it important that all those participate in such working commit to listening and are open to the possibility of change.

Recommendations for teaching about reproduction and sex education

I concentrate in this section on sex education, which includes human reproduction. There is, of course, great value in students being introduced to the diversity of ways in which organisms reproduce and, as discussed above, to the ways in which sex is determined. Examples can (and should) be taken from prokaryotes, fungi, algae, gymnosperms, flowering plants and a number of animal taxa, both invertebrate and vertebrate. Such teaching can also help students better understand the centrality of mitosis and meiosis in reproduction in different taxa. Nowadays, video clips showing the great diversity of sex-determination mechanisms and modes of reproduction in the natural world can easily be sourced on YouTube or elsewhere and are invaluable when teaching.

The aims of education and the aims of sex education

It has been argued that there should be two fundamental aims of school education: to enable each learner to lead a life that is personally flourishing and to help others to do so too (Reiss & White, 2013). A central aim of education should therefore be to prepare learners for a life of autonomous, whole-hearted and successful engagement in worthwhile relationships, activities and experiences. In formal school education, this aim involves acquainting students with a wide range of possible options from which to choose both when they are in school and once they leave school. With their development towards autonomous adulthood in mind, schools should provide students with increasing opportunities to choose among the pursuits that best suit them. Young children are likely to need greater guidance from their teachers, just as they do from their parents. Part of the function of schooling, and indeed parenting, is to prepare children for the time when they will need to, and be able to, make decisions more independently.

The notion of human flourishing, for oneself and for others, seems a good basis on which to ground sex education for all students. In 1993, I wrote a paper titled ‘What are the aims of school sex education?’ (Reiss, 1993). The ones I identified as being the aims of existing sex education programmes – ‘Stopping girls getting pregnant’, ‘Reducing the incidence of sexually transmitted diseases’, ‘Decreasing ignorance’, ‘Decreasing guilt, embarrassment and anxiety’, ‘Enabling students to make their own decisions about their sexuality’, ‘Helping students develop assertiveness’, ‘Helping students question the present role of women in society’, ‘Helping students question the present role of men in society’ and ‘Providing an ethical

framework for the expression of sexuality’ – can, with some updating and repositioning, each be seen as contributing towards human flourishing.

Since 1993, much has happened in school sex education, however. Encouragingly, these developments have very largely been in the direction of the promotion of human flourishing. There is a greater emphasis on approaches to tackling gender and sexual violence (cf. Maxwell, 2017) as there is now more of an acknowledgement in an increasing number of countries about the prevalence of this, particularly for women and for LGBT (lesbian, gay, bisexual and transgender) youth. As is often pointed out, schools too often are heteronormative. Successful approaches to improving matters include ones based on a notion of inclusion, helping to build safer and more supportive school environments. Ingham (2017) argues that it remains the case that school sex education is expected to be effective in a way that is rarely demanded of other subjects. One problem with this is that too narrow a range of possible outcomes are evaluated; it is easier to count pregnancies than to determine whether young women’s capacity for enhanced sexual pleasure has increased.

Good sex education is comprehensive in the sense that it helps students acquire the knowledge, skills and values to make appropriate and healthy choices in their sexual lives. Successful comprehensive sex education should therefore help to reduce rates of sexually transmitted infections and the incidence of unwanted pregnancies; it should also build self-esteem and reduce the likelihood of exploitation. Abstinence-only sex education has a narrower focus, concentrating on reducing the likelihood that young people will engage in sexual intercourse before they are married. A number of studies, especially ones undertaken in the USA, have concluded that whereas comprehensive sex education can meet some of its aims, abstinence-only sex education is generally either ineffective or actually counterproductive (Kirby, 2008; Stanger-Hall & Hall, 2011).

The role of biology in sex education

Many sex educators view science rather negatively when considering how sex education might best be taught (Reiss, 2017). The ‘plumbing and diseases’ approach is rightly criticised. As Albury (2017) points out, such a presentation of the science of sex education has a number of shortcomings. One of these is that students have to seek information on the specifics of sexual practices and relationship skills from other sources; some of these sources are of high quality but others are not.

However, biology can play a more positive role in sex education. What sex educators are (quite rightly) rejecting is not biology but the rather poor biology that often passes for science when teaching about sex and sexualities. Consider how sex is all too often presented in school biology classrooms. School biology typically examines issues of sex through the lens of reproduction (Reiss, 2007). This automatically tends to assume heterosexuality. Biology is all too often presumed to be a neutral subject, so that many biology teachers in schools continue to teach gender and sex as unquestioned facts. In particular, differences between females and males are often presented as clear-cut and inevitable, and the study of school biology textbooks has shown that they are often sexist and typically ignore lesbian and gay issues (Reiss, 1998). For example, biology textbooks in England for 14-16 year-olds often omit all mention of the clitoris and, when they do refer to it, frequently talk of it in a belittling way as the female’s equivalent of a penis. Males are rendered visible, females less so; and the female exists by virtue of comparison with the male. When the possibility of being gay/lesbian is addressed (the

furthest that school biology textbooks ever get from heteronormativity), the impression is generally given that this is a sort-of second-best option which the reader may well grow out of.

Closer examination of sex in human biology provides plenty of space for critical reflection and allows for a richer understanding of what it is to be a sexual person. Emily Martin has argued that while menstruation is often viewed in scientific textbooks as a failure (you should have got pregnant), sperm maturation is viewed as a wonderful achievement in which countless millions of sperm are manufactured each day (Martin, 1991). Furthermore, sperm are viewed as active and streamlined whereas the egg is seen as large and passive, just drifting along or sitting there waiting for sperm to arrive.

It was back in 1948 that Ruth Herschberger argued that the female reproductive components (it is difficult in the scientific discourse around sex to avoid referring to reproduction!) are viewed as somehow being less autonomous than those of the male. The way the egg is portrayed in biology textbooks has been likened to that of the fairy tale *The Sleeping Beauty*, in which a dormant, virginal bride awaits a male's magic kiss. However, biologists have long seen both egg and sperm as active partners. Just as sperm seek out the egg, so the vagina discriminates between sperm, and the egg seeks out sperm to catch. Nevertheless, as Martin pointed out, even when acknowledged, such biological equality is still generally described in a language that gives precedence to the sperm. When the egg is presented in an active role, the image is one of a dangerous aggressor "rather like a spider laying in wait in her web" (Martin, 1991, p. 498).

Social historical research on sex hormones has also shown how the way that such hormones are presented in textbooks and scientific papers gives messages that go well beyond what the data indicate. Despite the fact that it has been known since the 1920s that each sex contains the 'other's' hormone – so men produce oestrogen and women testosterone – school textbooks typically ignore both this fact and the close chemical similarity between oestrogen and testosterone (Roberts, 2002). Indeed, a different reading of the data to that usually presented in school textbooks – but one more in line with the scientific evidence about the working of sex hormones – is that femaleness and maleness lie on a continuum. Such a model of the consequences of the actions of the sex hormones became common among endocrinologists in the 1940s.

While this model can lead to an essentialist understanding of sexuality and sexual orientation – and it was developed at the same time as a rise in the number of studies of the presumed femininity of gay men, it can also be seen as allowing a far more fluid understanding of sex, accommodating, for example, some forms of intersexuality (cf. Callahan, 2009). The principle of intersexuality dates largely from Magnus Hirschfeld's pioneering work in the first three decades of the twentieth century on sexual difference. By rejecting the discrete categories of male and female, arguing instead that each of us sits on a continuum, Hirschfeld laid the foundation for a radical deconstruction of the sexual binary (Bauer, 2003).

One of the things good teaching can help students to appreciate is the way in which boys/men and girls/women are pressured, respectively, to perform maleness and femaleness, discourses that are structured largely in opposition to each other (cf. Martino & Pallotta-Chiarolli, 2005). My experience of teaching a non-binary version of human sex to students is that many of them find it fascinating; it can help them to see the world, and themselves, in a new light. Indeed, enabling students to see classifications that relate to gender, sex and sexualities less

categorically has the potential to lead students to question, even disrupt, other rigid typologies, facilitating the beginnings of an intersectional analysis (cf. Giffney, 2009).

Much of the literature about the ‘causes’ of sexuality concentrates on gayness, though Lynda Birke, a biologist as well as a feminist and a lesbian, provided a valuable review about lesbianism and over the years has “spent much time and energy refuting the allegations that any social categories (of gender, race or sexuality) are fixed by biology” (Birke, 1997, p. 58). However, as Birke pointed out, there are, of course, a number of reasons for hesitating in entirely rejecting biological notions of sexual orientation/preference. For one thing, some have used such notions politically to argue for gay rights (though this approach is hotly contested – see Schüklenk & Brookey, 1998); more prosaically, it may well yet turn out that there is / are biological bases to at least some people’s sexual orientation/preference.

All of which emphasises the importance of biology being taught better in schools for the purposes of sex education than it often is. Much biology teaching is focused around the use of textbooks yet “Teachers can read subtextually and resistantly and can help their students to do likewise. Too rarely are students encouraged to critique their science textbooks; too often are textbooks used as if they contained only unquestionable truths” (Reiss, 1998, p. 148). This is a simple message but one that provides a teacher – and her/his students – with a powerful tool, for it avoids buying into the general assumption of teacher or textbook writer as the expert repository of facts, instead sitting more comfortably with critical and emancipatory understandings of education. This can be more satisfying for teacher and students alike and fits well with an information society which proves students with opportunities to obtain much of the knowledge they want/need to know at the right pace for themselves.

Will Letts (2001) has explored how school science structures and is structured by norms of heterosexual masculinity. Letts’ work is particularly valuable as he focused on classroom examples of primary school science – when some might assume that at this age science is fairly neutral (but see the work of the *No Outsiders* Project: DePalma & Atkinson, 2009). He argued that science, including school science, functions as a grand narrative that seduces students and teachers; he concludes:

As a plan of action, I advocate that school science becomes an active and generative site for critical science literacy. The words ‘science literacy’ in this phrase are intended quite differently than popular utterances of them have come to mean. ‘Science literacy’ does not simply mean an intake and consumption of science texts and ‘facts’, either purposefully or through acts of seduction. I am using critical science literacy to denote something akin to critical media literacy. (Letts, 2001, p. 270)

A school biology classroom for critical biological literacy, at any age, would be one in which the traditional virtues of academic biology – its open-mindedness and refusal to accept tradition on trust – were more widely (reflexively) applied. It would allow young people to think about themselves and their sexualities more meaningfully. It would help those uncomfortable with traditional descriptions of masculinity and femininity to realise that they are not alone in their rejection of such simple dichotomies. All this can be achieved without harming those students who are comfortable with such conventional descriptions. Sadly, such classrooms are still rare. In the long run such teaching, idealistic though this may sound to some, would contribute to making the world a better place both overall and for the many individuals who otherwise feel or find that they do not fit (cf. Britzman, 1995).

Conclusions

Reproduction is rightly considered a core component of school biology. While there is far more to sex education than reproductive biology, biology teachers can play an important role in ensuring that school sex education is effective and contributes to student flourishing. However, good sex education makes different demands on a teacher from those that biology teachers are used to. Accordingly, biology teachers have a right to expect support from senior staff and high quality training if they are to teach sex education to their students.

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