

Why There Are Males

Men are humanity's essential
genetic design and test lab

“Almost everything I ever did, even as a scientist, was in the hope of meeting a pretty girl.”

James D. Watson, Nobel Laureate, author *The Double Helix*.

The sexes solve the problem sex itself failed to solve

The essential difference between a man and a woman? It's tied up with the mystery of sex.

Correction: the mystery of why there is such a thing as sex, in rough outline we know, and have known for some time. The real mystery is why we have the *sexes*. To understand the real root of sex difference, this has to be grasped; so what follows is an exposition – in as plain a language as possible – of the relevant science. The necessity for clarity and straightforwardness is bound to come across as a tad dry and didactic, but please do persevere, as you should find this focus worth it for the profound insight it leads to.

Just why are there males and females? After all, we could all be bisexual (hermaphrodites) – individuals each with both sets of sex organs, male and female. (On account of the primary association of the word ‘bisexual’ with sexual orientation, from now on I will use the term ‘bi-sexed’). As long as we had sex with each other rather than with ourselves, then this would be perfectly valid sex according to what, supposedly, sex is for. This is the random swapping of all the genes between any and every two individuals when their mating makes offspring, so that all the genes in the gene pool get well mixed; thereby stopping us genetically getting set in our ways. It helps avoid a collective trip down some evolutionary blind alley, leading to eventual extinction. The point is that to achieve this, you don't need everyone to have only either the one or the other type of sex organs; male or female. Penises and vaginas don't need to be segregated between individuals.

We are not all bi-sexed for a very good reason, but before I can give you the reason – for it to make sense to you – I first have to explain a little more the essence of why there is such a thing as sex.

For a long time in the history of biological evolution there was no sex at all. All individuals of all species were *asexual* reproducers, making simple duplicate copies of themselves, Xerox fashion. This was fine for simple creatures with simple genomes, because when they produced copies of themselves not much could go wrong. Even if it did, parthenogenesis (as asexual reproduction is called) is cheap, and the extended families of now unviable individuals could simply go to the wall. Quite a number of these dead-end lineages could bite the dust and the local population would just get on with it. But as new species evolved that had ever more complex genetic make-ups, this had to change, because their complexity meant that replication could turn out wrong in a vastly expanded range of ways. And the more sophisticated the genome, the more expensive they are to produce, and therefore the fewer of them there are. Consequently, allowing whole lineages to die was just too costly. So it was that sex arrived on the scene – and sure enough, at first these sexual species were hermaphrodites. Sex mixes up and dilutes genes damaged in replication (mutations), with the result that before they could do much damage to the reproducing group as a whole, they were lost from the gene pool. Or so it was supposed.

We now know that it was more complicated than that. The process of sex actually *exacerbates* the build-up of replication errors (Paland & Lynch, 2006). This is not least because whole lineages don't die off as in asexual reproduction, but also because the repeated mixing up of genes in sex dilutes any 'dodgy' genes, and then in their pairing up on chromosomes as alleles – two copies of the same gene that are not necessarily the same – defective genes can be hidden through being the 'recessive' (unexpressed) half of the gene pairing. The Xerox copy analogy of progressive degradation is more appropriate to describe sexual than asexual reproduction. Sex in itself still results in the genome in time accumulating malfunction to the point that it becomes unfeasible.

Paradoxically then, sex – the very process that evolved to deal with the problem of the building up of replication error – in itself actually contributes to this unwanted accumulation. How has Mother Nature solved this problem? By exploiting a consequence of the evolution of sex. Let me first explain this consequence and then how it was exploited.

Sex necessarily involves the fusion of two as yet undifferentiated cells (cells that have the potential to divide to make any cell type); one from each prospective parent, reserved for the purpose of sex. When sex first arrived on the evolutionary scene, these were identical; the gametes (as sex cells are called) were isogamous. There was no male and female because you could not tell them apart to so label them. Inevitably, though, ever so

slight differences would emerge. One would be fractionally larger than the other: they became anisogamous. And once there was anisogamy, differences polarised, because there were advantages and disadvantages of being either the small or the large gamete that so-called 'selfish DNA' within the one or the other exploited to preserve the 'interests' of one gamete or the other after they fused in what is then called the zygote. The larger gamete took more energy to produce and so there were fewer of them, whereas the smaller gametes were relatively easy to make and consequently were made in larger numbers. The larger and consequently less-numerous gamete type represented a logjam in reproduction: the 'limiting factor' in the process. This necessarily places most selection pressure on the smaller gamete (Kodric-Brown & Brown, 1987; Parker et al., 1972). This logjam was thought to be the root of all the various sex differences we see across nature, and not least in men and women. So far as that goes, so it is. But a little more probing of this gets you to a much fuller explanation.

The smaller and more numerous gametes competed with each other to fuse with the rarer larger gametes. With the biological imperative always to reproduce as much as possible (within whatever constraints there were locally), the smaller, more numerous gametes became relatively disposable, and the larger gametes relatively more prized. As they polarised more and more, then this became an ever bigger problem.

It's not just that as the larger gamete gets still larger there are consequently fewer of them, but that sex is an inherently expensive way for individuals to replace themselves and for the population of genes in the gene pool to try to expand itself. One small and one large gamete together make just the one offspring, whereas asexually they would make two: one each. Then there is the problem of the build-up of replication error that sex itself exacerbates.

These long-known problems of the extra cost of sexual (over asexual) reproduction and the accumulation of replication error, were then together solved by the process of evolution taking advantage of anisogamy in a simple way.

The 'quarantining' of both 'good' and 'bad' genes in the male

The solution is really quite an obvious exploitation of the difference between the gametes – which we can usefully distinguish by giving them labels: the smaller and the larger gametes are, respectively, male and female, of course.

If lots of deleterious replication errors build up across the population, then why not simply keep it away from the gamete type that is already holding up reproduction as it is? We don't want females to be loaded down with genetic errors, that even if they don't kill the females, either slow or stop them reproducing altogether. They are, as I said, the logjam in