External Influences, Sexuality, and Chirality

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It is shown that the sexual proliferation of a chiral population leads much faster than exponentially to monochirality.

Key words: Sexuality; Chirality; Proliferation.

In this note we compare two ways in which biological species can die away, one by an injurious external influence, e. g. a change in the climate, and the other by sexuality combined with chirality, where only partners with the same chirality can mate fruitfully. The latter population is supposed to contain as many males as females, and the sum of its right- and lefthanded members is supposed to be constant in time.

We put the time t to zero when the decline of the declining sexual population is fastest. In order to get a meaningful comparison, at this time the two biological species are supposed to be equal in numbers and also equal in the velocity of the change of these numbers.

If x is the mole fraction of a disappearing species, one has, writing $-$ instead of +/$-$ and t instead of z, from equation (14) of [1] for $q = 1$

$$x_{\text{Pairs}} = \frac{1}{2}\left[1 - (1 + 2e^{-t})^{-1/2}\right]. \qquad (1)$$

For $t = 0$ one obtains from (1)

$$x_{\text{Pairs}} = 0.2113 \text{ and } \mathrm{d}x_{\text{Pairs}}/\mathrm{d}t = -0.09622.$$

The mole fraction of two singles has the form

$$x_{\text{Two Singles}} = 0.2113\exp(-at). \qquad (2)$$

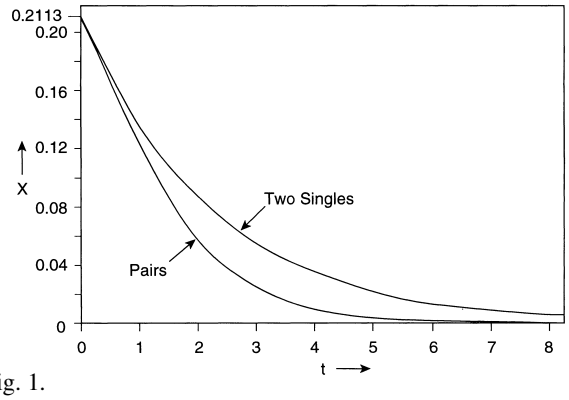

Fig. 1.

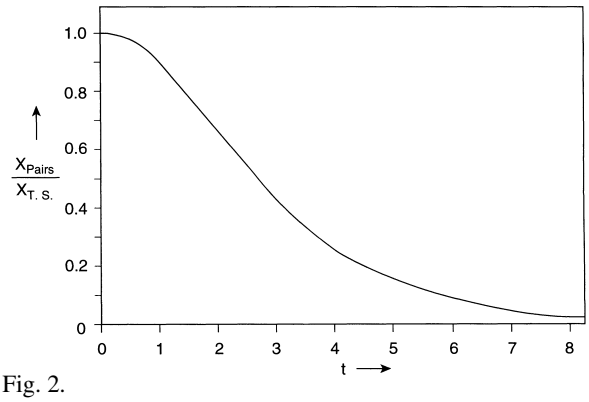

Fig. 2.

Since we have required that at $t = 0$ there is

$$\mathrm{d}x_{\text{Two Singles}}/\mathrm{d}t = \mathrm{d}x_{\text{Pairs}}/\mathrm{d}t,$$

one has

$$a = 0.09622/0.2113 = 0.4554.$$

Figure 1 shows x_{Pairs} and $x_{\text{Two Singles}}$ as functions of t, and Fig. 2 shows the ratio $x_{\text{Pairs}}/x_{\text{Two Singles}}$ as function of t. By choosing adequate units of time, any two systems can be compared in this way.

With increasing t the ratio $x_{\text{Two Singles}}/x_{\text{Pairs}}$ goes to infinity, which shows how much faster rare chiral pairs disappear than rare singles.

[1] Alfred Klemm, Z. Naturforsch. **40a**, 1231 (1985).
[2] Alfred Klemm, Z. Naturforsch. **55a**, 978 (2000).

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