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Aging control by the macronucleus, analyzed by macronuclear transplantation in *Paramecium tetraurelia*

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In *Paramecium tetraurelia*, the fission rate decreases with each cell cycle after conjugation or autogamy. Finally, it reaches zero and this results in clonal death. The lifespan after autogamy is generally about 200 fissions. Generally, clonal age is recorded by the length of the telomere. However, paramecium telomeres do not shorten in accordance with clonal age. So where is the clock for clonal age? It is known that the immaturity period for autogamy is measured by the number of rounds of DNA synthesis since autogamy. If this is also true for clonal aging, the clock must be integrated with chromatin replication. To analyze the clock for clonal age, macronuclear transplantation was used. When the macronucleus was transplanted from a young cell (20 fissions after autogamy) to an aged cell (170 fissions) from which the macronucleus had been removed, the fission rate of the aged cell recovered to that of the young cell by the 4th day after autogamy. The lifespan of the transplanted clones lengthened to 325 fissions. The total lifespan of the transplanted clone equals the sum of the recipient cell age (170 fissions) and the donor's remaining lifespan (155 fissions). In the reverse experiment, when a young amacronucleate cell (20 fissions) was transplanted with the macronucleus of an aged cell (170 fissions), the young cell decreased its fission rate for about 4 cell cycles. These results suggest that the clock for fission number after autogamy must be in the macronucleus.