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JOURNAL ARTICLE

Sperm motility enhancement by nitric oxide produced by the oocytes of fathead minnows, Pimephelas promelas

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The effects of nitric oxide (NO) on sperm motility were examined in the fathead minnow, Pimephelas promelas, using computer-assisted sperm analysis (CASA). The observed effects underscore the dual nature of NO as both a low-concentration regulatory agent and, at higher doses, a cytotoxic agent. At 1 x 10(-6) M concentration, NO donor sodium nitroprusside (SNP) enhanced sperm motility percentages and increased CASA velocity parameters curvilinear velocity, straight-line velocity, and average path velocity, whereas 1 x 10(-2) M concentration inhibited percent motility and decreased velocities. Fathead minnow ova-produced NO was subsequently trapped as a paramagnetic ferrous iron complex and detected by electron spin resonance spectroscopy. The distinctive triplet spectrum, with a(N) = 12.5G and g(iso) = 2.04, was recorded during a critical 5-minute period following laying. Nitric oxide synthase (NOS) was histochemically localized at the micropyle of mature unfertilized fathead eggs, and an inhibitor of NOS blocked histochemical staining. CASA analysis of sperm motility in the presence of ovaproduced NO over an 8-minute time course reveals an optimum motility enhancement at 4 minutes that is similar to the effect of 1 x 10(-6) M SNP. This transient NO production by freshly laid ova and the localization of NOS near the site of sperm entry, together with the motility-enhancing effect of 1 x 10(-6) M SNP on sperm, indicates an active role for low-concentration NO in fertilization.

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