MSC-Klotho

Klotho is a pleiotropic regulator of aging with neuroprotective activity, produced predominantly in the kidney and brain. Klotho deficiency is associated with neurodegeneration — including Alzheimer's disease[1], Parkinson's disease[2,3] and multiple sclerosis[4] — as well as with aging[5,6], chronic kidney disease[7,8] and acute cardiac events[9,10,11]. Restoring Klotho to therapeutic concentrations is challenging because of its short serum half-life. MSCs engineered to constitutively produce and secrete Klotho (MSC-Klotho) overcome this limitation, enabling sustained, targeted delivery[12,13].

- In preclinical studies, mice deficient in Klotho have a shortened lifespan[5], whereas mice overexpressing Klotho have a prolonged lifespan[6].
- Serum Klotho falls in the early stages of chronic kidney disease (CKD) and correlates with disease stage across CKD stages 1–5[7,8], making it one of the earliest markers of declining renal function. Timely elevation of Klotho levels by allogeneic MSC-Klotho could slow progression toward dialysis-dependent kidney failure[14,15].
- After myocardial infarction, the heart responds to injury and stress signals by pathological growth and remodeling that often progresses to heart failure and sudden death. Soluble Klotho protects the heart against these processes in preclinical models[9,10,11]. This suggests that treating acute cardiac events with allogeneic MSC-Klotho may arrest the pathological process and prevent permanent cardiac damage.
- Patients with Alzheimer's disease[1] and Parkinson's disease[2,3] exhibit significantly reduced Klotho levels in serum and cerebrospinal fluid. Restoring Klotho has demonstrated neuroprotective and neuroregenerative effects in preclinical models[16,17,18,19]. Because the blood-brain barrier limits delivery of systemically administered protein to the central nervous system, and because Klotho is produced within the brain itself, CNS-directed delivery via MSC-Klotho is a rational therapeutic strategy for neurodegenerative disease and longevity applications.
- In models of multiple sclerosis, MSCs engineered to secrete Klotho reduced neuroinflammation and blood-brain barrier disruption more effectively than unmodified MSCs[12,13], and Klotho promotes oligodendrocyte maturation and myelination[20]. Klotho concentrations are reduced in the cerebrospinal fluid of patients with relapsing-remitting multiple sclerosis[4].
- In an SOD1-G93A model of amyotrophic lateral sclerosis, increasing Klotho improved neurological deficits and prolonged survival[21].
- Klotho enhances cognition in aged mice and in aged nonhuman primates[22,23,24].

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The Kyttaro Approach: MSC-Klotho Across Neurodegeneration and Organ Injury

MSC-Klotho is being developed with a primary focus on amyotrophic lateral sclerosis (ALS), an orphan indication in which Klotho has shown neuroprotective activity in preclinical models[21], with a defined path to an IND-ready package. Additional neurological indications — Alzheimer's disease, Parkinson's disease and traumatic brain injury — and high-burden conditions including chronic kidney disease (CKD)[7,8] represent follow-on opportunities in which Klotho deficiency plays a pathophysiological role and unmet medical need remains high.

Data from the CDC and the National Kidney Foundation show that around 37 million Americans suffer from impaired kidney function[25]. For over 130,000 people each year, this leads to end-stage renal disease (ESRD) requiring dialysis.

Alzheimer's disease: a growing burden in the United States

More than 7.4 million Americans of all ages have Alzheimer's disease. One in three seniors dies with Alzheimer's or another form of dementia, and it kills more people than breast cancer and prostate cancer combined. In 2026, Alzheimer's and other dementias are projected to cost the nation $409 billion[26].

The neurological indications — Alzheimer's disease and Parkinson's disease — as well as CKD, show a relatively slow chronic course in which early therapeutic intervention with MSC-Klotho could meaningfully slow or prevent disease progression. Traumatic brain injury, by contrast, is an acute event in which early intervention would instead target secondary injury. The US patent for MSC-Klotho was granted in 2026 (US 12,559,724)[27], with additional grants in Europe and key international markets.

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