Supplementary Figure 1

A

	1	10	20	30	40	42

Aβ1-42 (wild-type)   DAEFRHDSGY   EVHHQKLVFF   A**E**DVGSNKGA   IIGLMVGGVVIA   IA

E22K (Itanian)   DAEFRHDSGY   EVHHQKLVFF   A**K**DVGSNKGA   IIGLMVGGVVIA   IA
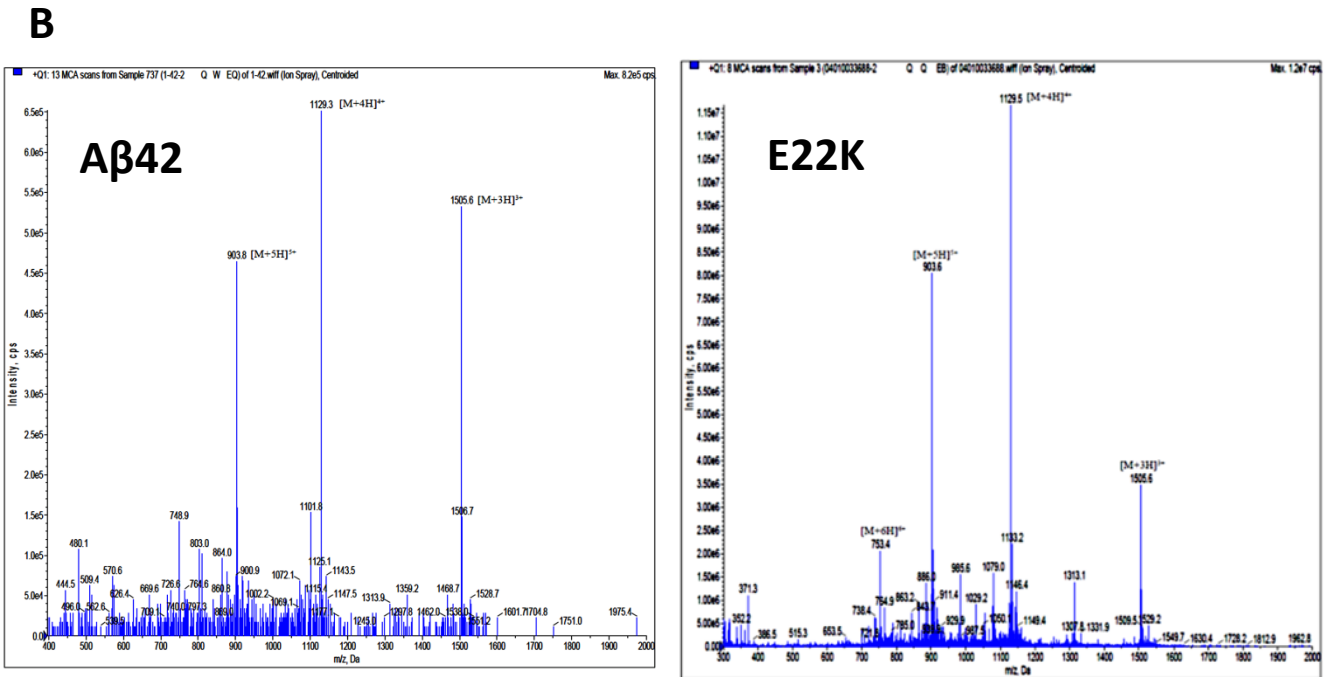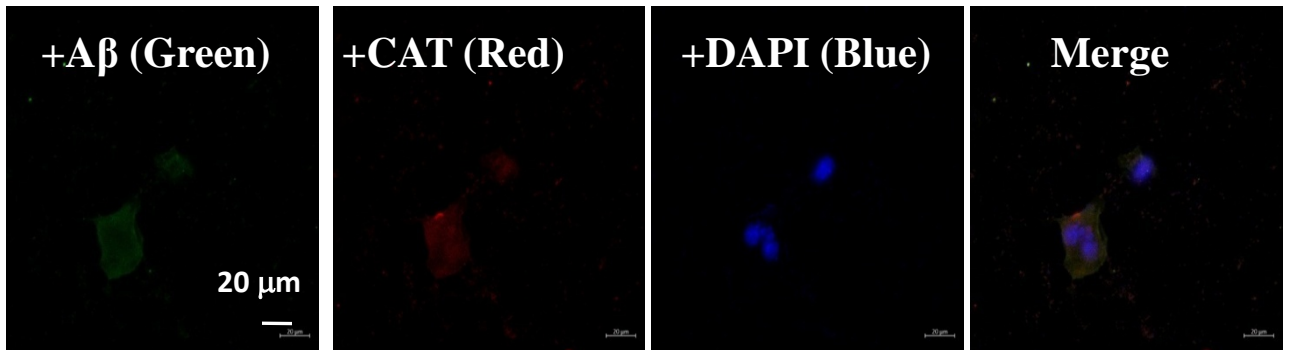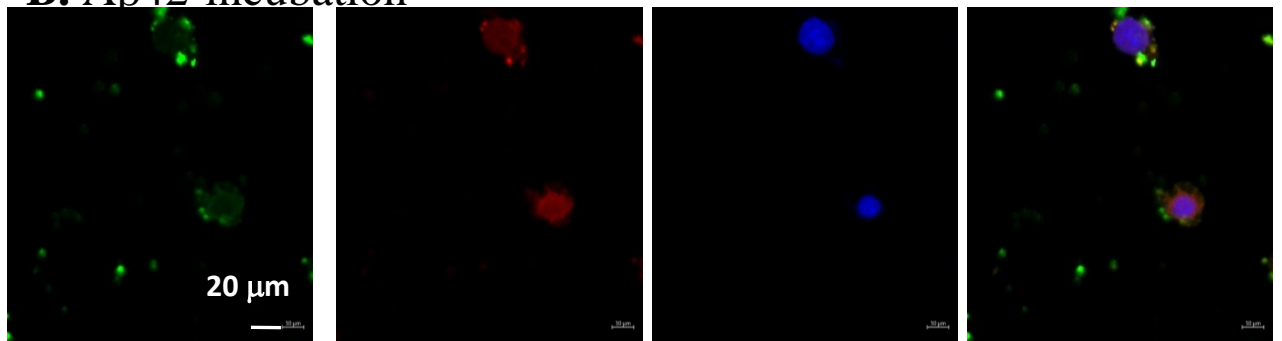
B

Figure S1. The synthetic wild-type Aβ and E22K mutant identified by liquid chromatography-tandem mass spectrometry (LC-MS/MS).

Supplementary Figure 2

A. PBS-incubation

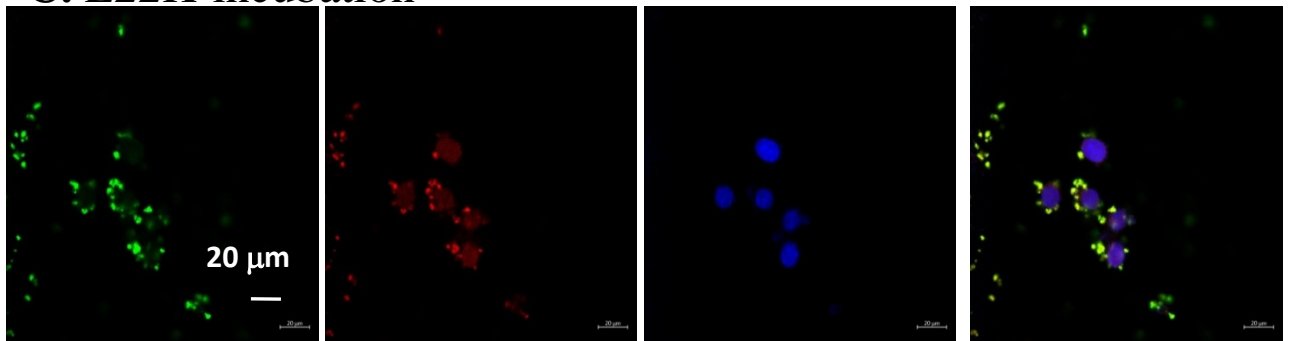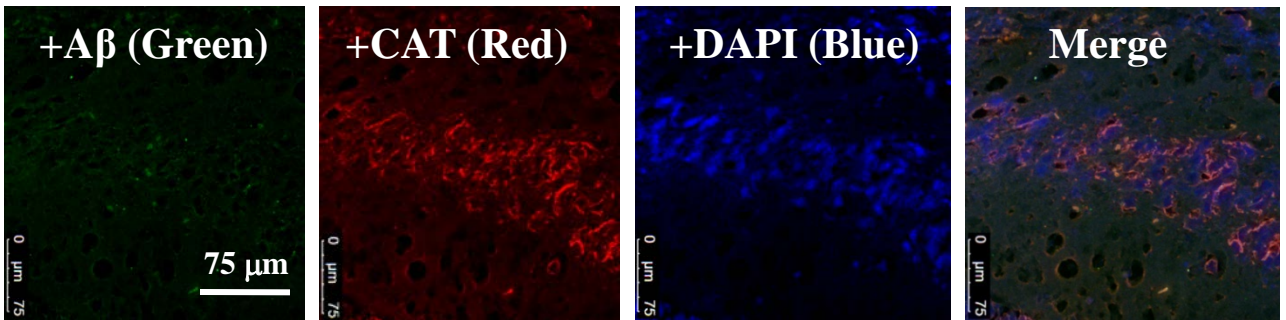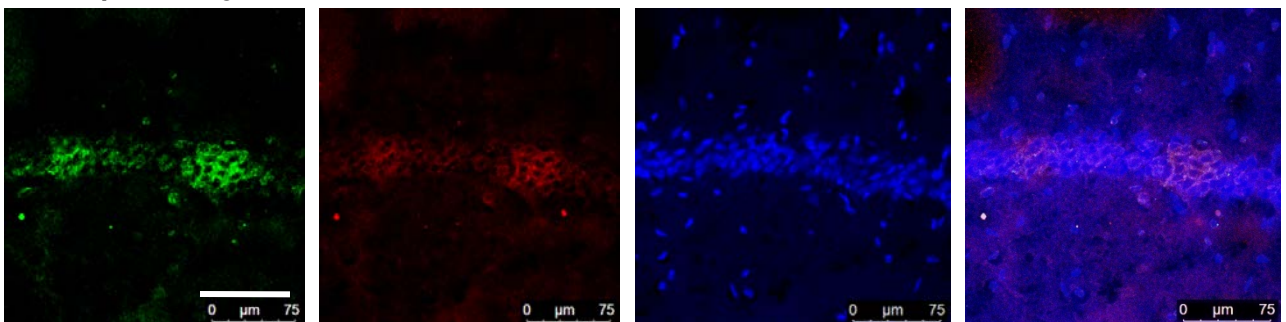**B.** Aβ42-incubation

C. E22K-incubation

Fig. S2. The localization of Aβ with catalase (CAT) in the cultured human SY5Y cells (H-SY5Y) after PBS, Aβ42, or E22K incubation 6 hours.

Supplementary Figure 3

A. PBS-injection

+Aβ (Green) +CAT (Red) +DAPI (Blue) Merge

75 µm

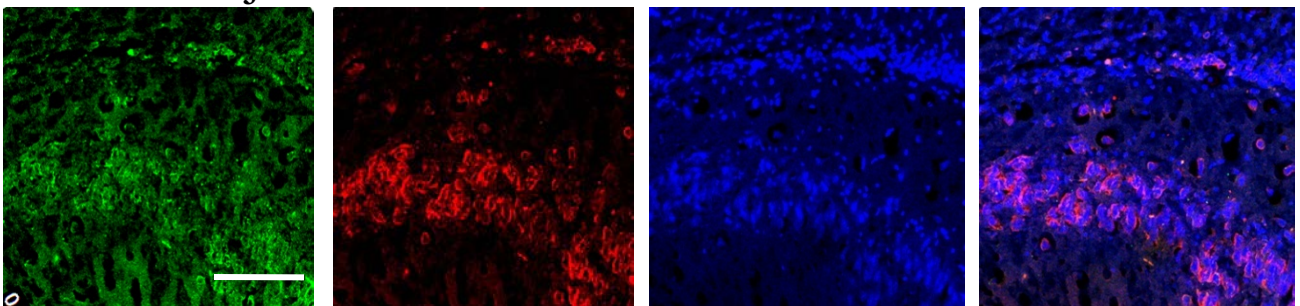**B.** Aβ42-injection

C. E22K-injection

Fig. S3. The localization of Aβ with catalase(CAT) in the hippocampus of these SD rats injected with PBS, Aβ, or E22K on day 30.
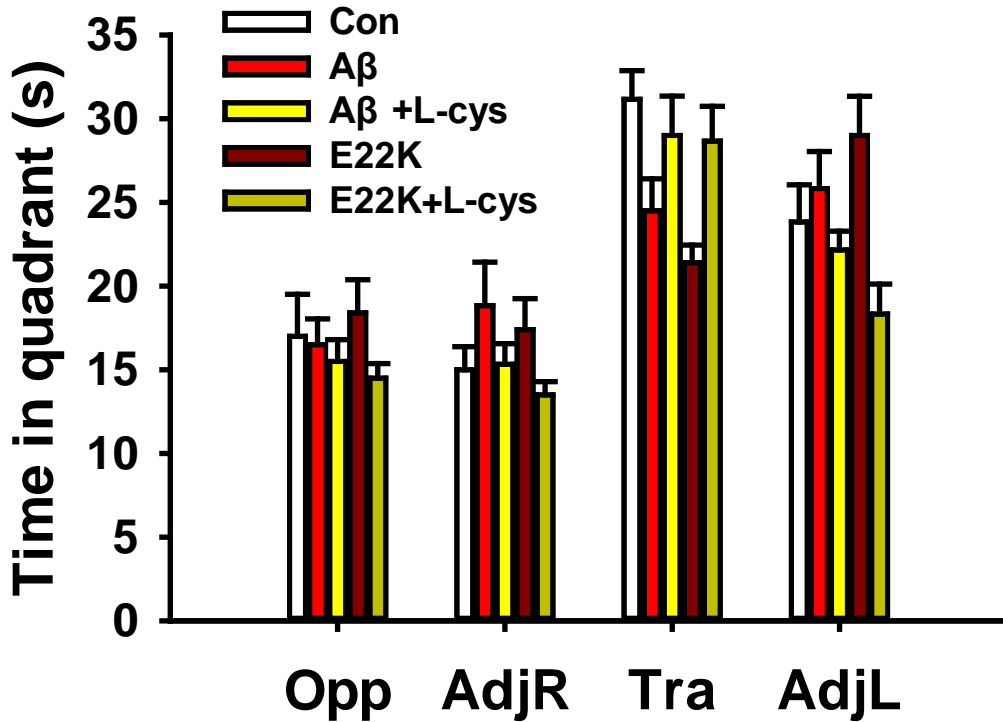
Supplementary Figure 4

Fig. S4. Time in different quadrants of the five groups of mice in the Morris water maze on day 7. The adjacent left (AdjL), training (Tra), adjacent right (AdjR), and opposite (Opp) quadrants.
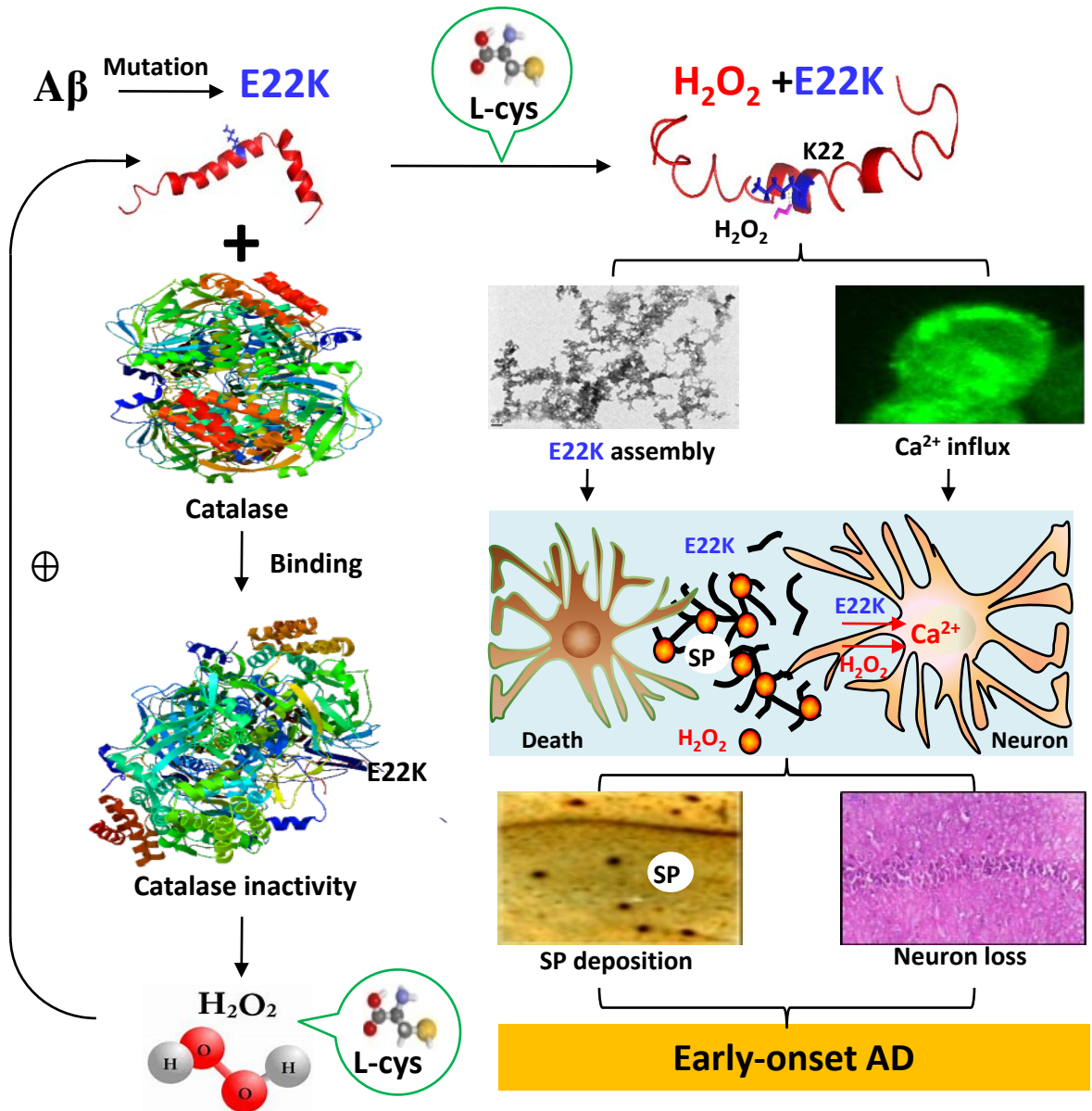
Supplementary Figure 5

Fig. S5. The model of early-onset Italian familiar Alzheimer's disease. Briefly, E22K induces higher levels of H_2O_2 generation by rapidly inhibiting catalase activity than Aβ. Excessive H_2O_2 elicits severe E22K assemblies and neuron loss, and then results in the early-onset AD. However, L-cysteine (L-cys) rescues memory functions. AD: Alzheimer's disease, SP: senile plaques.