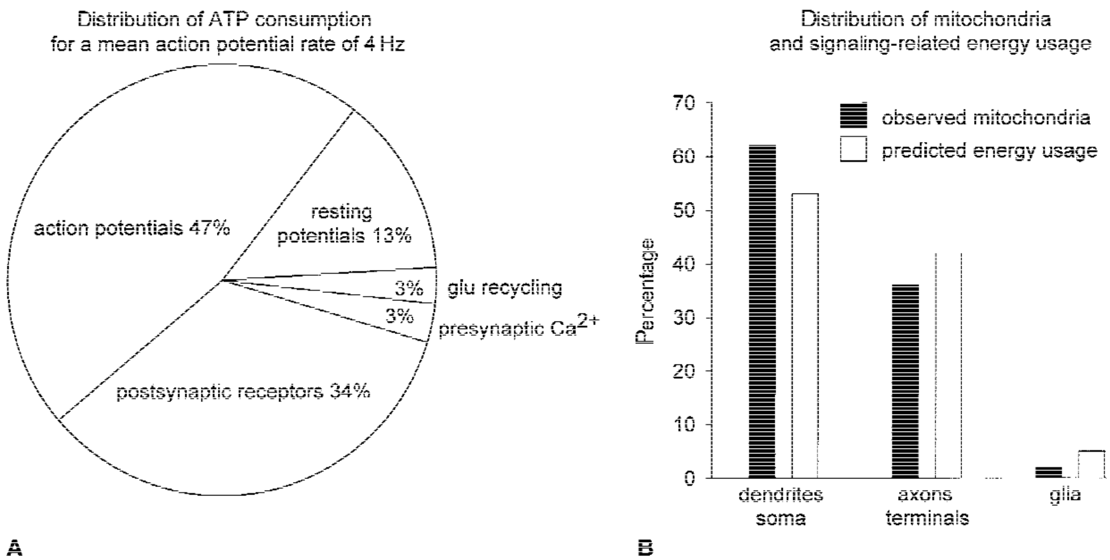

FIG. 3. (A) Distribution of signaling-related ATP usage among different cellular mechanisms when the mean firing rate of neurons is 4 Hz. The percentages of the expenditure maintaining resting potentials, propagating action potentials through a neuron, and driving presynaptic Ca^{2+} entry, glutamate recycling, and postsynaptic ion fluxes, are shown (100% = 3.29×10^9 ATP/neuron/s). **(B)** Comparison of our predicted distribution of signaling-related energy consumption with the distribution of mitochondria observed by Wong-Riley (1989). For the dendrites + soma column, Wong-Riley's data are the percentage of mitochondria in dendrites, whereas our prediction is the percentage of energy expended on postsynaptic currents, dendritic and somatic action potentials, and the neuronal resting potential. For the axons + terminals column, Wong-Riley's data are the percentage of mitochondria in axons and presynaptic terminals, and our prediction is for the percentage of energy expended on axonal action potentials, presynaptic Ca^{2+} entry, accumulating glutamate into vesicles, and recycling vesicles. The close spacing of terminals along axons (5 μm, implying a diffusion time of only 25 milliseconds (Braitenberg and Schüz, 1998)) will make terminal and axonal mitochondria functionally indistinguishable. For the glia column, Wong-Riley's data are the percentage of mitochondria in glia, whereas our prediction is for the energy expended on the glial resting potential, glutamate uptake, and its conversion to glutamine. This comparison ignores the 25% of energy expenditure not related to signaling (see Discussion), and the possibility that some processes (for example, in glia) may be driven mainly by glycolysis.