

Fig. S1. Three-dimensional distribution of GP-STN terminals

A, Sagittal, horizontal and coronal views (left, middle and right, respectively) of a GP-STN terminal field that arose from a single labeled GP neuron. Each black dot represents each of 129 labeled terminals. Note that in contrast to the example in Fig. 3 that the GP-STN field is divided into two large clusters that are located at the rostral and caudal extremes of the field. Red dots represent an equivalent number of terminals that have been arranged at random (simulated) within the volume occupied by the GP-STN terminal field, the boundaries of which are indicated (for each section) by gray lines. *B1*, Comparison of frequency histograms of all interterminal distances for the GP-STN (black) and simulated (red) terminal field confirms that the GP-STN field was arranged in two large clusters and also possessed a greater proportion of interterminal distances at the extremes of the distribution. *B2*, Subtraction of the simulated field from the GP-STN field confirmed these trends. *C*, The distance between nearest neighboring terminals was smaller for the GP-STN terminal field (black) than the simulated field (red).

Fig. S2. Individual labeled GP axons often form multiple synaptic contacts with individual STN neurons

A-C, Correlated light (*A*) and electron microscopic (*B-C*) analysis of clusters of GP-STN terminals that arose from an individual labeled GP neuron. *A1-2*, through-focus light micrographs of a cluster of labeled GP-STN terminals (1-8; blue, black) in the STN. The soma of a parvalbumin-immunoreactive STN neuron (s; brown) and a large capillary (c) serve as additional points of

registration between the light and electron micrographic images. *B1*, A low magnification electron micrograph of the region in *A*. *B2*, An intermediate magnification electron micrograph of terminals 6-8 at the level of *A2*. *C*, High magnification electron micrographs of terminals 4-8 that formed symmetrical axodendritic synaptic contacts (arrows). Terminals 4, 6 and 7 formed contacts with the same dendrite, whereas terminals 5 and 8 formed contacts with different dendrites. Terminals 1-3 formed symmetrical synaptic contacts with the soma (s) of the parvalbumin-immunoreactive STN neuron in *A* (not illustrated). Scale bar in *A2* also applies to *A1*; Scale bar in *C1* also applies to *C2-5*.

Fig. S3. GP-STN terminals arising from individual GP neurons traverse a large extent of the STN

Positions of the somata (*A1*, *A2*; large black dots) and terminals (*B1*, *B2*; small black dots) of the labeled GP neurons illustrated in Figs. 3 (*A1*, *B1*) and S1 (*A2*, *B2*) plotted with respect to the boundaries of the GP (*A*, gray lines) and STN (*B*, gray lines), respectively. Sagittal, horizontal and coronal projections of the GP (*A*, left to right, respectively) and the STN (*B*, top to bottom, respectively) are illustrated.