CLAIMS

1. Neural tissue unit for use in cell therapy in implantation into the nervous system of a human or non–human mammal, wherein said neural tissue unit contains differentiated post–mitotic neuronal cells with a phenotype of interest corresponding to the phenotype of deficient cells to be replaced, and glial cells, said cells being organized in a 3-dimensional network in an extracellular matrix, said unit being obtained from a cellular microcompartment comprising a hydrogel capsule surrounding a single neural tissue unit, said differentiated post-mitotic neuronal cells having been obtained from mammalian cells differentiated into post-mitotic neuronal cells, and said hydrogel capsule being at least partially removed before use of said neural tissue unit.

2. Neural tissue unit for use according to claim 1, wherein said neural tissue unit is free of hydrogel.

3. Neural tissue unit for use according to claim 1 or 2, wherein the neural cells form a cluster of neural cells, preferably having a smallest dimension between 50 µm and 500 µm plus or minus 10%, preferentially between 150 µm and 400 µm plus or minus 10%, even more preferentially between 200 µm and 300 µm plus or minus 10%.

4. Neural tissue unit for use according to one of the preceding claims, said neural cell unit comprising neural cells and glial cells.

5. Neural tissue unit for use according to one of the preceding claims, wherein said unit comprises between 10 and 100% of post–mitotic neuronal cells of phenotype(s) of interest, preferentially between 50 and 100%, more preferentially more than 90%.

6. Neural tissue unit for use according to one of the preceding claims, wherein said unit contains from 100 to 100,000 neural cells.

7. Neural tissue unit for use according to one of the preceding claims, for the treatment of a neurodegenerative disease, such as Parkinson’s disease, Huntington’s disease, amyotrophic lateral sclerosis (ALS), Alzheimer’s disease or neuronal ceroid–lipofuscinoses such as Batten disease.

8. Neural tissue unit for use according to claim 7, wherein said neural tissue unit contains advantageously dopaminergic neurons, for the treatment of Parkinson’s disease.

9. Neural tissue unit for use according to claim 7, wherein said neural tissue unit contains GABAergic neurons, for the treatment of Huntington's disease.

10. Neural tissue unit for use according to one of claims 1 to 9, wherein said neural tissue unit contains genetically modified neural cells.

11. Neural tissue unit for use according to claim 10, to assist, improve or repair a cognition and/or action function.

12. Method for preparing a neural tissue unit according to one of claims 1 to 11 intended to be implanted into the nervous system of a subject, said method comprising the steps consisting in:

(1) producing cellular microcompartments comprising, within a hydrogel capsule, extracellular matrix and human or non–human mammalian cells selected from pluripotent stem cells, neural progenitor cells or differentiated cells, advantageously immune–compatible with the mammal intended to receive the neural tissue unit;

(2) inducing cell differentiation within the cellular microcompartment, so as to obtain post–mitotic neuronal cells having at least one phenotype of interest;

(3) at least partially removing the hydrogel capsule in order to recover the neuronal cells as a neural tissue unit.

13. Method for preparing neural tissue units according to claim 12, comprising the additional step consisting in:

(4) loading a surgical implantation device with at least one neural tissue unit, preferentially at least 10 to 1000 neural tissue units, more preferentially between 10 and 100 units.

14. Method for preparing a neural tissue unit according to claim 12 or 13, comprising the additional step consisting in:

– freezing the neural cells as a tissue unit, before or after at least partial removal of the hydrogel capsule.

15. Method for preparing a neural tissue unit according to one of claims 12 to 14, wherein the cells used in step (1) have been previously collected from a human or non–human mammal in which the neural tissue unit is to be implanted.

16. Method for preparing a neural tissue unit according to one of claims 12 to 15, comprising the intermediate step consisting in:

– confirming the phenotype of the neural cells contained in the hydrogel capsule, after step (2) of cell differentiation.

17. Process for preparing a neural tissue unit according to one of claims 12 to 16, wherein the cells are differentiated into dopaminergic cells or into GABAergic cells.

18. Neural tissue unit implantation kit comprising at least one cellular microcompartment comprising at least one hydrogel capsule enveloping a neural tissue unit according to one of claims 1 or 3 to 11, and means for at least partial removal of the hydrogel capsule.

19. Neural tissue unit implantation kit according to claim 18, further comprising a surgical implantation device capable of implanting a neural tissue unit into the nervous system of a mammal.

20. Neural tissue unit implantation kit comprising at least one neural tissue unit according to one of claims 1 to 11, preferentially between 1 and 10,000, more preferentially between 10 and 1,000 neural tissue units in a surgical implantation device adapted to implant the neural tissue unit(s) into the nervous system of a mammal.