| Patient number | Birth date  | Treatment | Remarks                                                                 |
|----------------|-------------|-----------|------------------------------------------------------------------------|
| PM-05          | 07/02/1944  | YES       |                                                                         |
| RC-10          | 30/03/1958  | YES       |                                                                         |
| TV-13          | 30/04/1949  | YES       |                                                                         |
| CO-14          | 11/12/1939  | YES       |                                                                         |
| CM-16          | 26/09/1944  | YES       |                                                                         |
| MF-17          | 15/01/1975  | YES       |                                                                         |
| PP-03          | 07/08/1943  | NO        | No HLA-A*0201 haplotype                                               |
| CC-09          | 16/05/1961  | NO        | No HLA-A*0201 haplotype                                               |
| GF-12          | 28/09/1939  | NO        | No HLA-A*0201 haplotype                                               |
| MF-07          | 09/02/1952  | NO        | Lymphopenic patient : Lymphocytes $< 1500$ / $\mu$L                    |
| KP-19          | 14/10/1957  | NO        | Lymphopenic patient : Lymphocytes $< 1500$ / $\mu$L                    |
| LE-20          | 06/02/1952  | NO        | Lymphopenic patient : Lymphocytes $< 1500$ / $\mu$L                    |
| OA-08          | 10/04/1946  | NO        | No Melan-A expression in the tumor                                      |

Improper inclusion criteria$^3$

| Patient number | Birth date  | Treatment | Remarks                                                                 |
|----------------|-------------|-----------|------------------------------------------------------------------------|
| PP-03          | 07/08/1943  | NO        |                                                                        |
| CC-09          | 16/05/1961  | NO        |                                                                        |
| GF-12          | 28/09/1939  | NO        |                                                                        |
| MF-07          | 09/02/1952  | NO        |                                                                        |
| KP-19          | 14/10/1957  | NO        |                                                                        |
| LE-20          | 06/02/1952  | NO        |                                                                        |
| OA-08          | 10/04/1946  | NO        |                                                                        |

Defective T-cell production process$^2$

| Patient number | Birth date  | Treatment | Remarks                                                                 |
|----------------|-------------|-----------|------------------------------------------------------------------------|
| SC-01          | 25/05/1946  | NO        | No Melan-A-specific T cells after the peptide stimulation step        |
| BM-02          | 15/01/1964  | NO        | No Melan-A nor MELOE-1-specific T cells after the peptide stimulation step |
| SE-04          | 21/04/1961  | NO        | No MELOE-1-specific T cells after the peptide stimulation step        |
| CJ-06          | 18/03/1946  | NO        | Compassionate treatment                                              |
| PA-18          | 10/03/1942  | NO        | No Melan-specific T-cells after the sorting step                      |
|                |             |           | Insufficient number and reactivity of MELOE-1 specific T-cells at the end of the production process |

Other$^3$

| Patient number | Birth date  | Treatment | Remarks                                                                 |
|----------------|-------------|-----------|------------------------------------------------------------------------|
| CM-11          | 29/08/1942  | NO        | Awaiting amendment approval from the ANSM: No authorization for inclusion |
| DM-15          | 08/05/1933  | NO        | General alteration of the patient status during the production process: transition to palatial care |

$^1$Pre-included patients withdrawn from the study due to improper inclusion criteria (no production process initiated). $^2$Patients who did not receive the ACT treatment due to antigen-specific T cell repertoire deficiency, improper sorting yield or poor quality of expanded T-cells. $^3$Pre-included patients withdrawn from the study for administrative issues or patient’s health status (no production process initiated).
Table S2: Blood frequencies of tetramer-positive T-lymphocytes among CD8⁺ T cells

|       | Day 0 Melan-A | Day 1 Melan-A | Day 7 Melan-A | Day 30 Melan-A | Day 90 Melan-A | Day 0 MELOE-1 | Day 1 MELOE-1 | Day 7 MELOE-1 | Day 30 MELOE-1 | Day 90 MELOE-1 |
|-------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| P5 SM | 1.3x10⁻⁴      | 1.8x10⁻⁴      | 2.3x10⁻⁴      | 2x10⁻⁴        | 3.3x10⁻⁴      | 4.7x10⁻⁴      | 4.5x10⁻⁴      | 4.1x10⁻⁴      | 2.6x10⁻⁴      | 4.6x10⁻⁴      |
| P10 RC| 3.5x10⁻⁴      | 1.3x10⁻⁴      | 7.6x10⁻⁴      | 7.3x10⁻⁴      | 6.9x10⁻⁴      | 3.9x10⁻⁴      | 4.5x10⁻⁴      | 4.5x10⁻⁴      | 1.1x10⁻⁴      | 3.6x10⁻⁴      | 1.3x10⁻⁴      |
| P13 TV| 1.1x10⁻⁴      | 1.7x10⁻⁴      | 2.1x10⁻²      | 1.9x10⁻²      | 3.6x10⁻⁴      | 7.6x10⁻⁴      | 2.7x10⁻⁴      | 1.2x10⁻⁴      | 2x10⁻⁴        | 1.5x10⁻⁴      |
| P14 CO| 2.8x10⁻⁴      | 5.5x10⁻⁴      | 1.3x10⁻⁴      | 3.4x10⁻³      | 2.9x10⁻⁴      | 6.7x10⁻⁴      | 3.1x10⁻⁴      | 4.4x10⁻⁴      | 3x10⁻⁴        | 2.1x10⁻⁴      |
| P16 CM| 3.5x10⁻⁴      | 2.3x10⁻¹      | 6.3x10⁻⁴      | 3.1x10⁻⁴      | 4.5x10⁻⁴      | 4.5x10⁻⁴      | 3.3x10⁻⁴      | 2x10⁻⁴        | 2.8x10⁻⁴      | 1x10⁻⁴        |
| P17 MF| 3.7x10⁻⁴      | 8.9x10⁻⁵      | 5.4x10⁻⁴      | 2.1x10⁻⁴      | 6.4x10⁻⁴      | 2.1x10⁻⁴      | 4.5x10⁻⁴      | 1.3x10⁻⁴      | ND            | ND            |

Total blood (3 mL) from melanoma patients at different time-points, were incubated with 10 μg/mL of either Melan-A or MELOE-1/HLA-A*0201 APC-tetramers and with PE-conjugated anti-CD8 and FITC-conjugated anti-CD3, for 1h at 4°C in the dark, with gentle agitation every 15 minutes. After incubation, the red blood cells are lysed during 15 min at room temperature. After washing in PBS-0.1%BSA, cells were resuspended in PBS and analyzed on a FACSCanto. Frequencies of antigen-specific T-cells are calculated based on the number of tetramer positive cells, divided by the total number of CD3⁺/CD8⁺ T lymphocytes analyzed.