

## Somatic Cell Nuclear Transfer (Cloning) Efficiency

The overall efficiency of cloning is typically between 0 and 3 % (number of live offspring as a percentage of the number of nuclear transfer embryos), irrespective of the species, the donor cell type or technique. However, this is the cumulative result of losses at each stage of the cloning process. The following tables provide a summary of the data for each published report on somatic cell (fetal to adult cells) nuclear transfer to date. Where the appropriate data was made available, the table provides cloning efficiency for each major stage of the process:

**% Embryos formed from NT Oocytes:** % of morula and/or blastocysts formed from the number of NT (nuclear transfer) oocytes created. The number of NT oocytes is the number of oocytes that were enucleated and injected or fused with donor nuclei. In some reports, only the number of oocytes cultured, or surviving activation or injection is given and the figures are denoted by \* with a corresponding footnote.

**No. Implantation Sites:** This column refers to mice only, and shows how many fetuses implanted into the uterus but were subsequently reabsorbed.

**No. Pregnant (no. of recipients):** This column is provided for each livestock species. The time of pregnancy confirmation is species dependent. (no. of recipients) refers to the total number of recipients to which embryos were transferred.


**No. Pregnancies Lost:** Refers to the number of recipients that had lost their fetuses at various stages throughout gestation.

**Live Offspring (% embryos transferred):** Refers to the number of live offspring born and is also given as a % of the total number of embryos transferred (normally morula or blastocysts, however some studies transfer 2,4, and 8 cell).


**No. Survived:** Refers to the number of live offspring that survived.


**CE: Cloning Efficiency** is the number of live offspring expressed as a % of the total number of NT oocytes (this is generally the number of oocytes injected or fused but depending on the data this may refer to, for example, the number of oocytes surviving injection or the number cultured. Furthermore it should be noted that in many studies, not all of the embryos that developed are transferred to recipient females).






**Ref:** The subscript refers to the reference bibliography provided at the bottom of this article.

	Donor Cell Age	Donor Cell	% Embryos formed from NT Oocytes	No. Implantation Sites	Live Offspring (% embryos transferred)	No. Survived	CE Ref
	Adult	Cumulus			31 (2.2%)	22	1.3% 1
					86 (2.3%)	80	1.1 % 2
			42.1%		7 (23.3%)	4	5.8% 3
					3 (0.7%)	0	? 4
			46.0%		6 (2.0%)	?	0.9% 5
					7 (2.7%)	?	2.3% 5
			52.8%		9 (5.3%)	?	2.8% 5
				Fibroblasts			3 (1.1%)
			21.8% *	134	5 (1.7%)	5	0.3% 7
	Newborn	Sertoli	23.6%**	235	16 (3.6%)	11	0.9% 8
	Fetal	Fibroblasts	16.4%	73	5 (1.1%)	2	0.2% 9
		Gonad	55.1%		6 (2.7%)	5	1.5% 2
Neural cells		29.7%		12 (10.3%)	11	3.1% 10	

No. of NT oocytes except \* no. of surviving oocytes, \*\* no. oocytes cultured

	Donor Cell Age	Donor Cell	% Embryos formed from NT Oocytes	No. Pregnant (no. recipients)	No. Pregnancies Lost	Live Offspring (% embryos transferred)	No survived	CE Ref
	Adult	Cumulus	39.4%	3 (3)	0	5 (83.3%)	2	5% <sub>11</sub>
			6 (34)	3	3 (7.3%)	3	0.9% <sub>12</sub>	
Oviduct		39.3%	2 (2)	0	3 (75%)	2	2% <sub>11</sub>	
			4 (14)	2	2 (11.8%)	2	0.8% <sub>12</sub>	
Uterine			3 (7)	2	2 (14.2%)	0	2% <sub>12</sub>	
Granulosa		69.4%			10 (10%)	10	1.8% <sub>13</sub>	
					2 (2.7%)	1	0.5% <sub>14</sub>	
		16.0%	31 (91)	23	9	8	0.7% <sub>15</sub>	
Mammary Gland		16.1%	2 (2)	1	1 (25%)	1	0.4% <sub>16</sub>	
		16.8%	4 (31)	2	2 (4.4%)	2	0.7% <sub>17</sub>	
Muscle		14.2%	8 (20)	4	4 (15.3%)	1	0.8% <sub>18</sub>	
Fibroblasts		53.3%	5 (12)	4	1 (6.25%)	0	1.1% <sub>16</sub>	
			1 (5)	0	1 (16.7%)	0	0.6% <sub>19</sub>	
		11.9%	15 (36)	9	6 (7.4%)	4	0.5% <sub>20</sub>	
		16.5%	6 (11)	5	1 (3.8%)	1	0.3% <sub>21</sub>	
			24 (48)	12	12 (20.3%)	4	2.8% <sub>12</sub>	
		31.1%	6 (37)	4	2 (4.6%)	1	0.8% <sub>17</sub>	
		?	45 (133)	36	9	6	? <sub>22</sub>	

	Donor Cell Age	Donor Cell	% Embryos formed from NT Oocytes	No. Pregnant (no. recipients)	No. Pregnancies Lost	Live Offspring (% embryos transferred)	No survived	CE Ref
	New-born	Fibroblasts		5 (13)	3	2 (12.5%)	2	1.1% <sub>12</sub>
		Liver		4 (8)	2	2 (20%)	1	1.3% <sub>12</sub>
		Testis		1 (1)	1	0	/	0% <sub>12</sub>
	Fetal	Fibroblasts	4.6%	17 (32)	11	6 (7.6%)	6	0.3% <sub>23</sub>
			22.7%	8 (12)	7	2 (8.7%)	1	0.4% <sub>24</sub>
			11.7%	5 (12)	5	0	/	0% <sub>21</sub>
				2 (6)	1	1 (14.3%)	1	3.8% <sub>12</sub>
			27.5%	52 (115)	33	25 (11.3%)	11	0.9% <sub>25</sub>
				11 (40)	5	6	5	? <sub>22</sub>
				110 (247)	80	30 (6.0%)	24	? <sub>26</sub>
		Germ Cells	22.7%	8 (17)	7	1 (3.1%)	0	0.2% <sub>27</sub>
	Liver		1 (3)	1	0	/	0% <sub>12</sub>	
	Fetal Adult	Somatic		535 (2170)	432	106	82	? <sub>28</sub>

	Donor Cell Age	Donor Cell	% Embryos formed from NT Oocytes	No. Pregnant (no. recipients)	No. Pregnancies Lost	Live Offspring (% embryos transferred)	No. survived	CE Ref	
	Adult	Fibroblasts		2 (5)	1	2 (0.9%)	2	0.9% <sup>29</sup>	
		Granulosa		2 (10)	1	5 (0.8%)	5	0.1% <sup>30</sup>	
	New - born	Fibroblasts	9.5%	1 (5)	0	4 (0.9%)	2	? <sup>31</sup>	
	Fetal	Fibroblasts					1 (0.9%)	1	0.2% <sup>32</sup>
					3 (9)	2	1	1	0.1% <sup>33</sup>
					5 (10)	3	2 (0.3%)	1	0.2% <sup>34</sup>
		Somatic					4 (0.7%)	4	0.5% <sup>35</sup>
	Adult	Mammary Gland	10.5%	1 (13)	0	1 (3.4%)	1	0.4% <sup>36</sup>	
		Granulosa		2 (4)	1	1	1	4.3% <sup>37</sup>	
				11.9%	31		6 (6.7%)	1	0.6% <sup>38</sup>
	Fetal	Fibroblasts		27.3%	5 (16)	2	3 (7.5%)	2	1.7% <sup>36</sup>
				13.6%	11 (24)	2	7 (10.4%)	5	1.4% <sup>39</sup>
					39 (78)	31	4 (3.3%)	0	? <sup>40</sup>
				19.2%	17 (42)	3	14 (17.5%)	3	3.4% <sup>41</sup>
	Adult	Granulosa		4 (9)		7 (7.3%)	6	? <sup>42</sup>	
				4 (8)	0	7 (7.7%)	6	7.2% <sup>43</sup>	
		Cumulus		2 (29)	0	3 (1.3%)	1	0.7% <sup>44</sup>	
	Fetal	Fibroblasts			1 (6)	0	2 (3.7%)	1	2.1% <sup>45</sup>
					5 (13)	0	6 (6.2%)	3	1.6% <sup>45</sup>
					5 (23)	0	5 (2.2%)	5	0.8% <sup>46</sup>
				32.1%	6 (15)	3	5 (13.2%)	5	3.1% <sup>47</sup>
		Somatic					3 (2.7%)	3	1.1% <sup>48</sup>
	Adult	Cumulus or Fibroblast		2 (8)	1	1 (1.1%)	1	? <sup>49</sup>	
	Adult	Cumulus		10 (64)	6	6 (0.6%)	4	0.3% <sup>50</sup>	

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