Review

[Designing cell lines for viral vaccine production: where do we stand?]

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Figure 1.

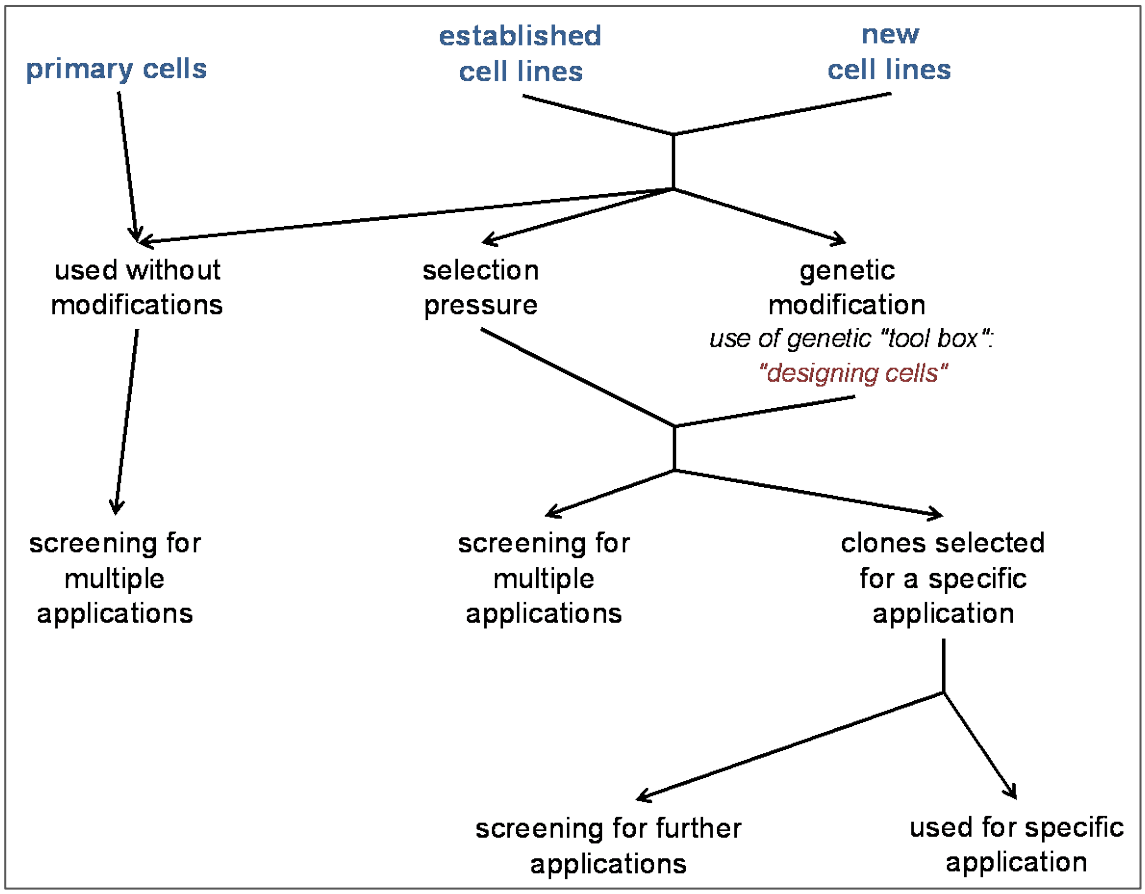

Figure 1. Strategies to develop new cell substrates for viral vaccine production

Table 1. Overview on established cells for vaccine production

cells	first described	origin	source	immortalization	used for:	comments
MRC5	1970 [5]	human	embryonic lung	diploid cells	hepatitis A	adventitious agents? finite life span
WI38	1965 [6]	human	embryonic lung	diploid cells	polio	adventitious agents? finite life span
HEK293	1977	human	embryonic kidney or neuronal cells	transformation with adenovirus functions		ethical concerns? easy into suspension
BHK21	1961	hamster	kidney	spontaneous transformation	rabies, foot-and-mouth disease	not for human vaccines, easy into suspension
Vero	1962	monkey	kidney	spontaneous transformation	polio, rabies	only low passage nr, multilayer, bead-to-bead transfer difficult, limitation of WHO cell bank
MDCK	1958	dog	kidney	spontaneous transformation	influenza	only low passage nr, available as suspension cells
CEF	-	chicken	embryonic fibroblasts	primary cells	measles, mumps, rabies, tick-borne encephalitis	finite life span

(see also Merten et al. [1])

Table 2. Overview on production options of viruses in PER.C6 cells

virus	reference
adenovirus (vectors)	[51,53,54]
influenza	[55,56]
rotavirus	[56]
herpes simples	[56]
measles	[56]
polio	[57]
west nile fever	[58,59]

Table 3. Overview on virus production options in AGE1.CR cells

virus	reference
influenza	[36,37,67,68]
MVA	[14,65,67,69]
fowlpox	[65]
ALVAC-GFP	[65]
attenuated alphaviruses[a]	[70]
duck circovirus, duck hepatitis A virus 1, goose parvovirus, goose haemorrhagic polyomavirus	[71]

[a] Cells are modified and stably contain additional structural genes of alphaviruses in the nucleus (named AGE1.CR pool C cells).