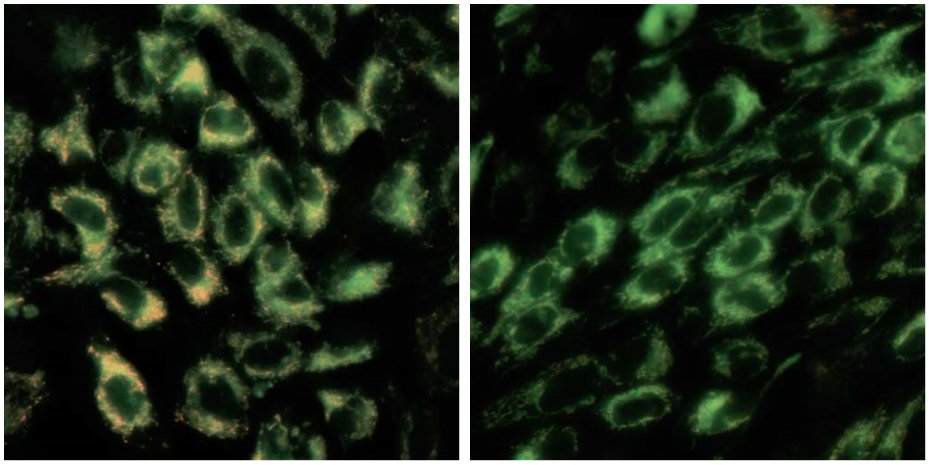
Cell line profile

MDCK (ECACC catalogue number 85011435)

Cell line history

The parental MDCK cell line (ECACC **85011435**) was derived in 1958 from the kidney of a normal adult Cocker Spaniel by SH Madin and NB Darby Jnr. The cell line was established alongside cell lines from other mammalian species.

Images



ECACC 85011435 MDCK cells stained with the mitochondrial dye (JC-1). The image on the left shows red mitochondrial fluorescence and the image on the right shows loss of red fluorescence and increased cytoplasmic diffusion of green monomeric fluorescence due to the loss of mitochondrial membrane potential following exposure of the cells to carbonyl cyanide m-chlorophenyl hydrazone (CCCP) a chemical inhibitor of oxidative phosphorylation. Loss of mitochondrial membrane potential is a hallmark of apoptosis. (Molecular Devices ImageXpress® Nano Automated Imaging System (20X magnification) with CellReporterXpress Image Acquisition and Analysis Software - courtesy Simon Lydford, Molecular Devices).

Key characteristics

The MDCK cell lines are widely used as epithelial models as they have clear apico-basolateral polarity and form well defined tight junctions. They have the advantage of rapid cell growth and are well suited to use in advanced (e.g. confocal) microscopic techniques. Subsequently many studies into epithelial cell trafficking, cell polarity and tight junctions have relied heavily on the use of MCDK cells and its sub-clones[1]. If allowed to reach confluence on conventional tissue culture plastics MDCK monolayers exhibit “doming”; where the cells become polarised and actively transport solutes through the epithelial monolayer to the plastic below.

A commonly used method for evaluating the competence of *in vitro* epithelial barriers grown on Transwell® systems is to measure the trans epithelial electrical resistance (TEER) across the cell monolayer as first demonstrated by Cereijido et al in 1978[2]. JM Arthur in 2000 showed that the MDCK parental cell line is heterogeneous and made up of populations of cells with different resistive and transport properties. This heterogeneity helps explain different characteristics of the cell line's numerous subclones[3].

MDCK I (ECACC 00062106) has been shown to have high (TEER) values indicating the cell line expresses "tight" junctions, however MDCK II (ECACC 0006210) cells were obtained from higher passage cultures and display lower TEER values, indicating that the junctions are more "leaky". These differences stem from differences in the expression of junctional complexes in the cells[4] .

Applications

MDCK cells were initially used in virology, they are permissive and support the growth of influenza virus[5] making them suitable for virology research, diagnostics, and vaccine production[6] The MDCK SIAT1 sub-clone (ECACC 05071502) expresses high levels of sialic acid making it especially useful in infection studies[7].

More recently MDCK cells have been used extensively to help model, image and explore the properties of mammalian epithelia *in vitro*[1].

Culture tips

MDCK cells express tight junctions at confluence it is therefore essential to keep growing stocks subconfluent or they become very difficult to trypsinise. It is very important to give MDCK cell monolayers two or more washes with calcium and magnesium free PBS before trypsinisation, keeping the PBS on the cells for several minutes before aspiration. The cells may take longer than expected to detach.

Related cell lines	ECACC catalogue number	Description
DoCI1 (S+L-)	90102523	Canine kidney, Moloney Sarcoma Virus infected
MDCK	84121903	Canine Cocker Spaniel kidney
MDCK-Protein Free	02050101	Canine Cocker Spaniel kidney
MDCK-SIAT1	05071502	Canine Cocker Spaniel Kidney Sialic Acid Over Expression
MDCK I	00062106	Canine Cocker Spaniel kidney
MDCK II	00062107	Canine Cocker Spaniel Kidney

Key references

1. Dukes, J., Whitley, P. & Chalmers, A. The MDCK variety pack: choosing the right strain. *BMC Cell Biol.* **12,** 43 (2011).

2. Cereijido, M., Robbins, E. S., Dolan, W. J., Rotunno, C. A. & Sabatini, D. D. Polarized monolayers formed by epithelial cells on a permeable and translucent support. *J. Cell Biol.* **77,** 853–880 (1978).

3. Arthur, J. M. The MDCK cell line is made up of populations of cells with diverse resistive and transport properties. *Tissue Cell* **32,** 446–450 (2000).

4. Furuse, M., Furuse, K., Sasaki, H. & Tsukita, S. Conversion of Zonulae Occludentes from Tight to Leaky Strand Type by Introducing Claudin-2 into Madin-Darby Canine Kidney I Cells. *J. Cell Biol.* **153,** 263–272 (2001).

5. Green, I. J. Serial propagation of influenza B (Lee) virus in a transmissible line of canine kidney cells. *Science* **138,** 42–43 (1962).

6. Brands, R., Visser, J., Medema, J., Palache, A. M. & van Scharrenburg, G. J. Influvac: a safe Madin Darby Canine Kidney (MDCK) cell culture-based influenza vaccine. *Dev. Biol. Stand.* **98,** 93–100; discussion 111 (1999).

7. Matrosovich, M., Matrosovich, T., Carr, J., Roberts, N. A. & Klenk, H.-D. Overexpression of the α2,6-Sialyltransferase in MDCK Cells Increases Influenza Virus Sensitivity to Neuraminidase Inhibitors. *J. Virol.* **77,** 8418–8425 (2003).