DETECT KARYOTYPIC ABNORMALITIES IN HUMAN ES & iPS CELLS

Using the hPSC Genetic Analysis Kit

Human pluripotent stem cells (hPSCs), including embryonic and induced pluripotent stem cells, acquire recurrent genetic abnormalities during prolonged culture (1-3). These karyotypic abnormalities can alter the behavior of stem cells, jeopardizing the validity of a disease model, drug screen, or cell therapy. The hPSC Genetic Analysis Kit contains all required components to detect over 70% of the most common karyotypic abnormalities reported in hPSC cultures. This qPCR-based kit detects the copy number of the minimal critical regions of commonly mutated genetic loci with high specificity and sensitivity through the use of double-quenched probes. It is designed to address an unmet need in the field and empowers researchers to confirm stem cell culture quality and have confidence in their data.

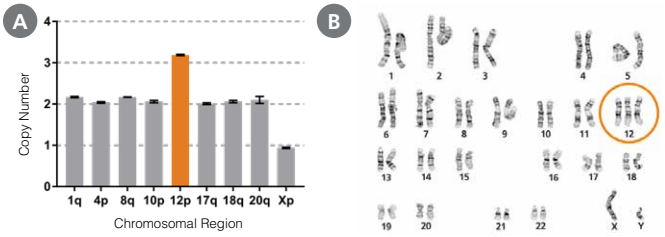

Figure 1. The hPSC Genetic Analysis Kit Identifies Chromosome 12 Trisomy

Chromosome 12 trisomy in WLS-1C human iPS cell line is (A) detected using the hPSC Genetic Analysis Kit (orange bar: $p < 0.05$) and (B) confirmed by G-banding.

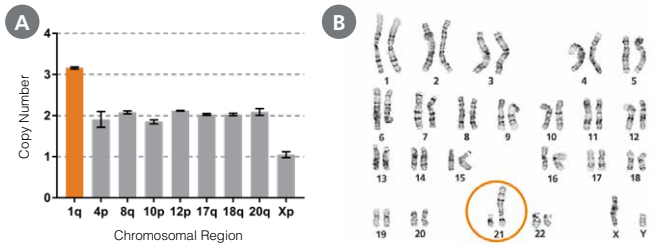

Figure 2. The hPSC Genetic Analysis Kit Identifies Chromosome 1 Duplication via Unbalanced Translocation

Unbalanced rearrangement of chromosome 1 in the WLS-1C human iPS cell line in which an extra copy of the long (q) arm of chromosome 1 translocated to the short arm (p) of chromosome 21 was (A) detected using the hPSC Genetic Analysis Kit (orange bar: $p < 0.05$) and (B) confirmed by G-banding.

Why Use the hPSC Genetic Analysis Kit?

TARGETED. Designed to detect the majority of karyotypic abnormalities observed in hPSC cultures.

RAPID. From cells in culture to results within one day.

COST-EFFECTIVE. Low cost per sample enables more frequent screening of multiple samples.

CONVENIENT. Online hPSC Genetic Analysis Tool for streamlined data analysis and interpretation.

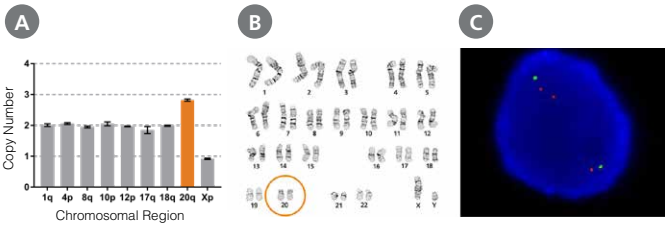

Figure 3. The hPSC Genetic Analysis Kit Identifies Chromosome 20q11.21 Duplication

Chromosome 20q duplication in WLS-4D1 human iPS cell line is (A) detected using the hPSC Genetic Analysis Kit (orange bar: $p < 0.05$), (B) undetected by G-banding, and (C) confirmed by fluorescent in situ hybridization using probes for 20p11 (green) and 20q11.21 (red).

Detection of a Sub-Karyotypic Recurrent Abnormality with the hPSC Genetic Analysis Kit

Amplification of chromosome 20q11.21 is a sub-karyotypic abnormality, and thus is often undetected by traditional karyotyping methods (G-banding). Chromosome 20q11.21 gain results in increased copy number of several genes, including BCL-XL, which confers a strong selective growth advantage to hPSCs (4, 5).

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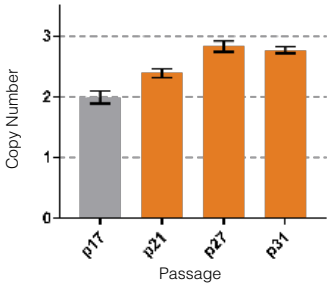

Figure 4. Genetic Abnormalities Can Be Monitored Over Time Using the hPSC Genetic Analysis Kit

Genetically normal STiPS-F019 human iPS cells were cultured for 31 passages, and genomic stability was assessed every 4 - 6 passages beginning at passage 17 (p17). At p17, the analysis demonstrated a normal diploid copy number of chromosome 20q11.21. By p21, the culture exhibited a significant amplification of 20q11.2 (orange bars: $p < 0.05$), which was also observed at p27 and p31.

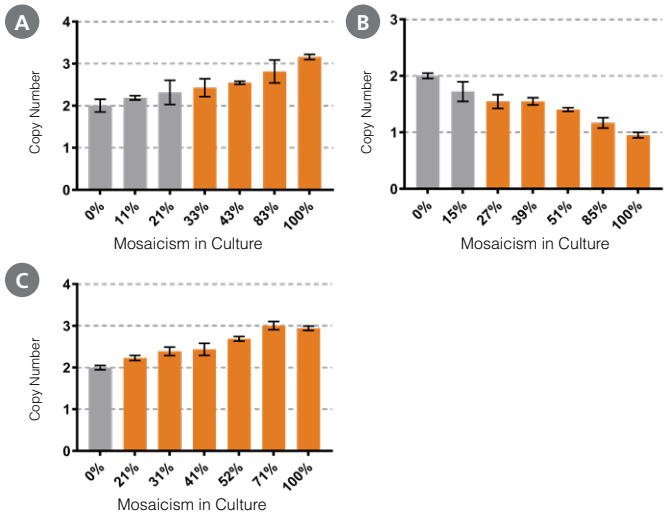

Figure 5. The hPSC Genetic Analysis Kit Identifies Abnormalities in Cultures with Approximately 30% Mosaicism

Genetically normal WLS-1C (A - B) or WLS-4D1 (C) human iPS cells were mixed in the indicated ratios with iPS cells containing (A) chromosome 12 trisomy, (B) a chromosome 10p deletion, or (C) a chromosome 20q duplication. Cultures with approximately 30% genetically abnormal cells exhibit a significantly different copy number than control (0% Mosaicism in Culture; orange bars: $p < 0.05$).

Are Your Pluripotent Stem Cells What You Think They Are?

Recurrent abnormalities may provide a selective advantage to hPSCs in culture through enhanced cell proliferation and survival, or reduced spontaneous differentiation. Cells harboring genetic abnormalities can therefore rapidly overtake genetically stable cells in culture (Figure 4) and significantly impact research conclusions (6), highlighting the need for frequent monitoring of hPSC genomic stability.

PRODUCT	SIZE	CATALOG #
hPSC Genetic Analysis Kit	1 Kit	07550

References

1. Andrews PW et al. (2017) Assessing the safety of human pluripotent stem cells and their derivatives for clinical applications. Stem Cell Reports 9(1): 1-4.
2. Baker D et al. (2016) Detecting genetic mosaicism in cultures of human pluripotent stem cells. Stem Cell Reports 7(5): 998-1012.
3. International Stem Cell Initiative et al. (2011) Screening ethnically diverse human embryonic stem cells identifies a chromosome 20 minimal amplicon conferring growth advantage. Nat Biotechnol 29(12): 1132-44.
4. Avery S et al. (2013) BCL-XL mediates the strong selective advantage of a 20q11.21 amplification commonly found in human embryonic stem cell cultures. Stem Cell Rep 1(5): 379-86.
5. Nguyen HT et al. (2014) Gain of 20q11.21 in human embryonic stem cells improves cell survival by increased expression of Bcl-xL. Mol Human Reprod 20: 169-177.
6. Andrews PW (2006) The selfish stem cell. Nat Biotechnol 24: 325-26.

The hPSC Genetic Analysis Kit is designed for use in the Maintenance stage of the hPSC Research workflow.

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