“A reflection on Steve Jobs and Henrietta Lacks, two people who changed our world”

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Steve Jobs, the founder of Apple and Henrietta Lacks, the donor of HeLa cells had a lot in common:

-- Both dyed on cancer
-- Both dyed way to young
-- Henrietta Lacks died October 4th, 1951,
  Steve Jobs died on October 5th, 2011
-- Both in their own way changed our world!
HeLa cells: their essential role in research and teaching
(A ‘story’ based on the recent book by Rebecca Skloot “The Immortal Life of Henrietta Lacks”)

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For a life-scientist, a biologist, and especially for a cell-biologist, this is not a story about racism, ethics, and poverty, but a sad story about a cancer victim, research and learning, that tells the need for research to understand human health and disease!
The Source of HeLa Cells

January 1951: A young, 31 year old Afro-American woman went to Johns Hopkins Hospital, the only hospital in the area that would treat ‘colored people’, after she observed a knot in her womb and intermittent bleeding. She was diagnosed with cancer, a ‘epidermoid carcinoma of the cervix, Stage I.’

February 1951: The woman started radium treatment after a specimen had been removed from her tumor. She had agreed to the surgical procedure, but not specifically to the removal of a biopsy (which was not mentioned in the consensus form).

This biopsy was given to Dr. George Gey’s lab at John’s Hopkins which had unsuccessfully tried for more than 20 years to culture human cells in vitro to study cancer.

Surprisingly, and completely unexpected, these cancer cells, named HeLa, grew in Dr. Gey’s lab, and subsequently revolutionized biology and pharmacy.
Unfortunately, and inappropriately, in 1971 the name of the donor was released, so we know today who the patient was:

**Henrietta Lacks**

Born August 1\textsuperscript{st} 1920 as Loretta Pleasant in Roanoke, Virginia

-- grew up as a tobacco farmer  
-- married to David “Day” Lacks  
-- moved to Baltimore, MD in 1941 where her husband joined Bethlehem Steel, Sparrows Point  

-- Five children (Lawrence, Elsie, David, Deborah and Joseph)

Mrs. Lacks died on October 4\textsuperscript{th}, 1951, only 8 month after the diagnosis of her aggressive cancer.

(A note to the author:)  
“The (bad) cancer cells that killed Henrietta Lacks are alive today, not her (good) normal cells.”
Use of common cell lines in research and number of scientific publications in which they are cited:

<table>
<thead>
<tr>
<th>Name</th>
<th>Species, Cell type</th>
<th>Origin</th>
<th>Karyotype</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDCK</td>
<td>Canine, epithelioid</td>
<td>kidney, cocker spaniel</td>
<td>aneuploid</td>
<td>MEM + NEAA + 10% FBS</td>
</tr>
<tr>
<td>BHK-21</td>
<td>Hamster, fibroblastic</td>
<td>kidney</td>
<td>44–45</td>
<td>MEM + NEAA + 10% FBS</td>
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<tr>
<td>CHO-K1</td>
<td>Hamster, epithelioid</td>
<td>ovary</td>
<td>aneuploid</td>
<td>Ham's F12 + 10% FBS</td>
</tr>
<tr>
<td>A431</td>
<td>Human, epithelial</td>
<td>epidermoid carcinoma</td>
<td>aneuploid</td>
<td>DMEM + 10% FBS</td>
</tr>
<tr>
<td>BeWo</td>
<td>Human, epithelioid</td>
<td>choriocarcinoma</td>
<td>aneuploid</td>
<td>RPMI 1640 + 20% FBS</td>
</tr>
<tr>
<td>Caco-2</td>
<td>Human, epithelioid</td>
<td>colonic adenocarcinoma</td>
<td>aneuploid</td>
<td>MEM + NEAA + 10% FBS</td>
</tr>
<tr>
<td>Daudi</td>
<td>Human, lymphoid</td>
<td>Burkitt's lymphoma</td>
<td>aneuploid</td>
<td>RPMI 1640 + 10% FBS</td>
</tr>
<tr>
<td>EB-3</td>
<td>Human, lymphoid</td>
<td>Burkitt's lymphoma</td>
<td>aneuploid</td>
<td>RPMI 1640 + 10% FBS</td>
</tr>
<tr>
<td>HeLa</td>
<td>Human, epithelioid</td>
<td>cervical carcinoma</td>
<td>aneuploid</td>
<td>MEM + NEAA + 10% FBS</td>
</tr>
<tr>
<td>Hep G2</td>
<td>Human, epithelioid</td>
<td>hepatocellular carcinoma</td>
<td>aneuploid</td>
<td>MEM + NEAA + 10% FBS</td>
</tr>
<tr>
<td>HUT 78</td>
<td>Human, lymphoid</td>
<td>cutaneous T-cell lymphoma</td>
<td>n.d.</td>
<td>RPMI 1640 + 10% FBS</td>
</tr>
<tr>
<td>COS-7</td>
<td>Monkey, fibroblastic</td>
<td>kidney, SV40-transformed African green monkey</td>
<td>n.d.</td>
<td>DMEM + 10% FBS</td>
</tr>
<tr>
<td>CV-1</td>
<td>Monkey, fibroblastic</td>
<td>kidney, African green monkey</td>
<td>aneuploid</td>
<td>MEM + 10% FBS</td>
</tr>
<tr>
<td>Vero</td>
<td>Monkey, fibroblastic</td>
<td>kidney, African green monkey</td>
<td>aneuploid</td>
<td>medium 199 + 5% FBS</td>
</tr>
<tr>
<td>3T3-L1</td>
<td>Mouse, fibroblastic</td>
<td>clonal derivative of 3T3-Swiss albino</td>
<td>aneuploid</td>
<td>DMEM + 10% FBS</td>
</tr>
<tr>
<td>AR42J</td>
<td>Rat, fibroblastic</td>
<td>pancreatic tumor</td>
<td>n.d.</td>
<td>Ham's F12 + 20% FBS</td>
</tr>
</tbody>
</table>
Why use cells (and especially human cells) as a research tool?

1) Homogeneity (all researchers use the same material)
2) Cells grow faster than whole organisms
3) No ethical issues related to the use of animals in research
4) Human subjects can not be used for certain experiments
5) Depending on the research question, the whole animal is not needed.

HeLa or other human cells were used to discover/develop:

- Poliovirus vaccine (Jonas Salk, 1954)
- Papilloma virus infection can cause cancer/vaccine
- Anti-cancer drugs (vinblastine, taxol)
- Ibuprofen (the active ingredient in Motrin and Advil) is highly toxic to cats!

etc. ...
Summary

Henrietta Lacks, an African-American woman from a tobacco farming slave family, consented to surgery and treatment when diagnosed with cervical cancer – she was not informed that some of her tissue would be removed and used for research. After successful cultivation (1951), distribution, commercialization and many scientific breakthroughs using HeLa cells her identity was uncovered in 1971. During all the decades of research and discovery the Lacks family did not get any recognition or compensation.

HeLa cells sparked a legal controversy between patient's rights and ownership of medical matter

Some Ethics Questions and Concerns

HeLa: the leak of Henrietta’s name: How can patient privacy be better protected?

What kind of information should be included in the ‘informed consent’?

‘Informed consent’ – what do you do with people who lack basic education?

Who owns the tissue that is removed during surgery?

Can this tissue be used for research?

What if this research results in a profitable product?