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Hypotheses
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Stem Cells May Differentiate to Microorganisms

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ABSTRACT

This study advances a previous hypotheses, "Human body may produce bacteria "and proposes that some infections are generated by human stem cells which differentiate to bacteria and fungus.

Evidence consistent with the hypotheses that" Stem cells may differentiate to microorganisms" include studies suggesting that *Christensenellaceae* are heritable, human genetics shape gut microbiome, host genetics control the composition of gut microbiota and Tinea Versicolor skin infections caused by Malassezia species. Furthermore it has been demonstrated that, amniotic fluid, breast tissue and milk, placenta, umbilical cord blood, meconium harbor bacteria that are not contaminants.

Because human stem cells have the properties to differentiate to microorganisms, they seem to be the most likely candidates to differentiate to microorganisms.

Evidence suggests humans and other complex multi cellular organisms are giant sources of new microorganisms.

Further experimental validation of this observation is necessary yet its potential benefits to study novel avenues to combat opportunistic infections may make it worthy of further scientific scrutiny in the near future.

Keywords

Christensenellaceae
Malassezia
Stem cells
Bacteria
Germ theory
Endogenous infections

HIGHLIGHTS

- Human stem cells have the properties to differentiate to microorganisms.
- The human gut bacteria *Christensenellaceae* and Malassezia skin infections are heritable, suggesting a genetic link between human cells and microorganisms.
- Amniotic fluid, breast tissue and milk, placenta, umbilical cord blood, meconium harbor bacteria that are not contaminants.
- A human fetal microbiome that are not contaminants from the maternal-fetal transfer or the environment, multi potency of stem cells and heritable microorganisms suggest human stem cells may differentiate to microorganisms.
- Humans and other complex multi cellular organisms are giant sources of new microorganisms.

INTRODUCTION

Since the middle of 19th-century when Louis Pasteur experimentaly validated the germ theory it has been presumed that infections derive from foreign bacteria invading humans and animals [1]. Surprisingly, recent discoveries suggest that some opportunistic infections may derive from pathways independent of contamination [2-5].

This study inspired by a previously advanced hypothesis, "Human body may produce bacteria "[6] proposes that some infections are generated by human stem cells which differentiate to bacteria and fungus.

Hypotheses

Evidence consistent with the hypotheses that" stem cells differentiate to microorganisms "will be presented under three headings:

1. Heritable Microorganisms.
2. Fetus harbors bacteria that are not contaminants.
3. Human stem cells have the properties to differentiate to microorganisms.

HERITABLE MICROORGANISMS

It has been shown that the human gut bacteria Christensenellaceae are heritable [7], human genetics shape gut microbiome [8], host genetics control the composition of gut microbiota [9]. Heritable bacteria that belong to normal flora suggests a genetic link between humans and bacteria and is consistent with the observation that human cells produce bacteria .Also, this phenomenon is independent of genetic influences associated with immunity and consistent with " human cells produce bacteria".

FETUS HARBORS BACTERIA

It has been demonstrated that amniotic fluid [10], placenta [11], umbilical cord blood [12], breast tissue [13], breastmilk [14], meconium [15] and lungs [16] harbor microorganisms and they are not contaminants from mother or the environment. .Of significance, the composition of bacterial communities in different locations seems to be unique for each location ruling out a common origin and suggesting local production [17]. The oral cavity and meconium of newborn infants born as early as 24 weeks of gestation contained a microbiota that was predicted to originate from in utero sources, including the placenta [18].

Bacteria in human body parts previously considered sterile indicates some bacteria are produced by human cells.

MULTIPOTENCY OF HUMAN STEM CELLS

Stem cells have unique properties of: Multi potency, self -renewal, and ability to differentiate to epithelial and cancer cells [19,20] consistent with the hypothesis that stem cells may differentiate to microorganisms.

DISCUSSION

Stem cells may differentiate to microorganisms "is a biologically feasible hypotheses stem cells have all the properties to differentiate to microorganisms.-supported by multiple and diverse observations.

It had been presumed that the gut microbiome is acquired at birth but the fetus is not sterile. The maternal-fetal transfer hypotheses has been invalidated by evidence of distinct bacterial compositions of diverse locations.

In summary, the the presence of a human fetal microbiome that are not contaminants, multi -potency of stem cells and heritable microorganisms suggest human stem cells may differentiate to microorganisms. Of significance, the bidirectional relationship between humans and some microorganisms humans are natural habitat for certain micro-organisms and certain micro-organisms belong to normal flora-further supports "Stem cells may differentiate to microorganisms" Further experimental validation of this observation is necessary yet its potential benefits to study novel avenues to combat opportunistic infections may make it worthy of further scientific scrutiny in the near future (Table 1).

Table 1: Do Stem Cells Differentiate to microorganisms?
Direct Evidence:
• Human genetics shape gut bacteria.
• Christensenellaceae gut bacteria are heritable.
• Christensenellaceae gut bacteria belong to normal human flora and humans are their natural habitat.
• Oral bacteria are heritable.
• Malassezia Furfur infections are heritable.
Indirect evidence:
• Stem cells differentiate to epithelial and cancer cells.
• Stem cells have the essential properties to produce bacterial and fungal cells: stem cells have a nucleus in contrast to bacteria that have a fragmented nucleus or a nucleoid.
• The fetus is not sterile and humans are born with bacteria without any evidence that fetal bacteria are from the mother or the environment. Materno-fetal transfer has been suggested but never demonstrated. Breast tissue, breast milk, placenta, umbilical cord blood, amniotic fluid, meconium and lungs harbor bacteria.
• The oral cavity and meconium of newborn infants born as early as 24 weeks of gestation contained a microbiota that was predicted to originate from in utero sources, including the placenta.

WHAT ARE THE IMPLICATIONS OF THIS HYPOTHESES?

As proposed previously, there seem to be multiple pathways of infections independent of contamination [3]. Also, it would be wise to reexamine our current peptic ulcer paradigm for there has never been any evidence to differentiate association from causation in the role of H.pylori species that belong to normal flora. Finally we may have to recognize that humans and other complex multi cellular organisms are giant sources of new microorganisms.

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