Gene Therapy: Hype Cycles & Technological Maturity

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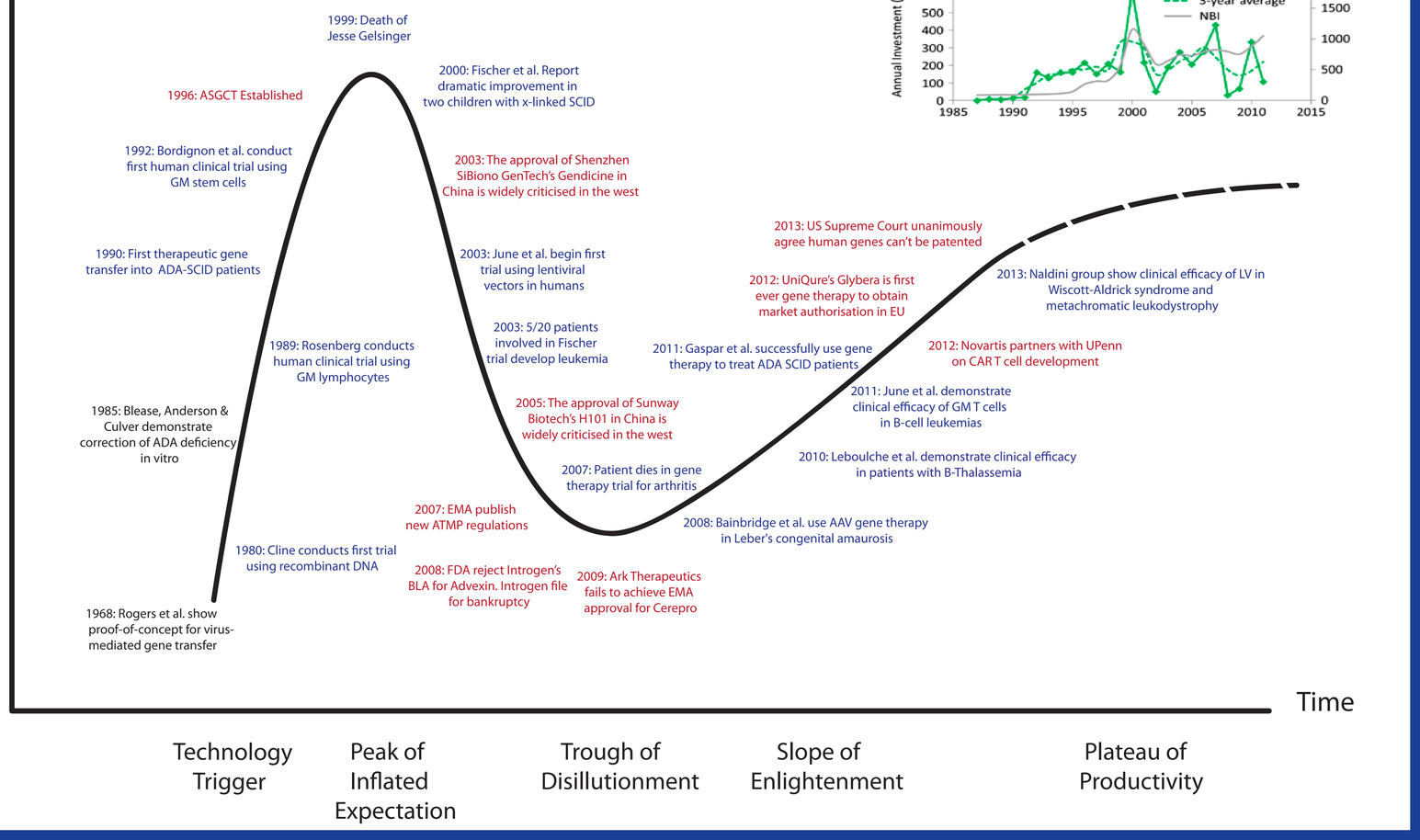
Introduction

In the 24 years since the first gene therapy (GT) was administered to a human patient (Blaese, 1995), the gene therapy industry has advanced significantly, culminating in the approval of Glybera (UniQure) in 2012. Despite this, the clinical and commercial success originally envisioned for gene therapy is yet to be realised. This poster considers the historical development of the field, and compares it with the maturation of another paradigm shifting technology, bone marrow transplantation (BMT).

Methods

The literature was reviewed and a Gartner Hype Cycle constructed to illustrate technology development. The curve was populated with key milestones and shapes of the curves are relative to each other as dictated by patterns as described by van Lente *et al* (2013). The contributing factors selected are of course illutrative rather than comprehensive.

Figure 1.



Results

Based on a comparison with events in the field of bone marrow transplantation, analysis of the literature suggests that gene therapy is maturing as a technology and is currently on the 'slope of enlightenment'.

When comparing the shapes of the curves for GT and BMT it is clear that:

1. The peak of inflated expectation is higher for GT, implying greater hype around the start of the technology. This reflects not only the high profile nature of the technology but also changes in media coverage between the 1960's and the 1980's.
2. The trough of disillusionment is shallower for GT, this may be due to the broader potential application of the technology. GT was positioned as a treatment for many different diseases, including monogenic disorders, cancers, and viral and bacterial infections. In comparison, the applications of BMT were limited.
3. The slope of enlightenment is at a higher level of visibility for GT. This reflects the greater commercial potential of GT. BMT developed as a treatment without the use of companies as vehicles to market the technology, as did some early GT research, for example, in SCID patients. However, as GT matures commercial exploitation is becoming increasingly common, for example with Glybera, which is the most expensive therapy ever approved in the EU.

It is important to note that both of these technologies have persevered despite early disappointment. A factor in this recovery is that for both GT and BMT, a new network was established, creating a group of companies and researchers that had invested heavily in the success of the field, and so would continue to work on the area despite setbacks.

Interestingly, the shape of the Gartner Curve for gene therapy also mimics capital investment in the field as shown by Ledley et al. (2013) [Figure 1 inset]

Figure 1 shows the Gartner Hype cycle for the development of gene therapy from 1968 - 2013. Figure 2 shows the Gartner Hype cycle for the development of bone marrow transplantation from 1945-1990.
Events shown in red are of commercial interest, events shown in blue are of clinical interest, and events shown in black represent pre-clinical or basic science discoveries.

Discussion

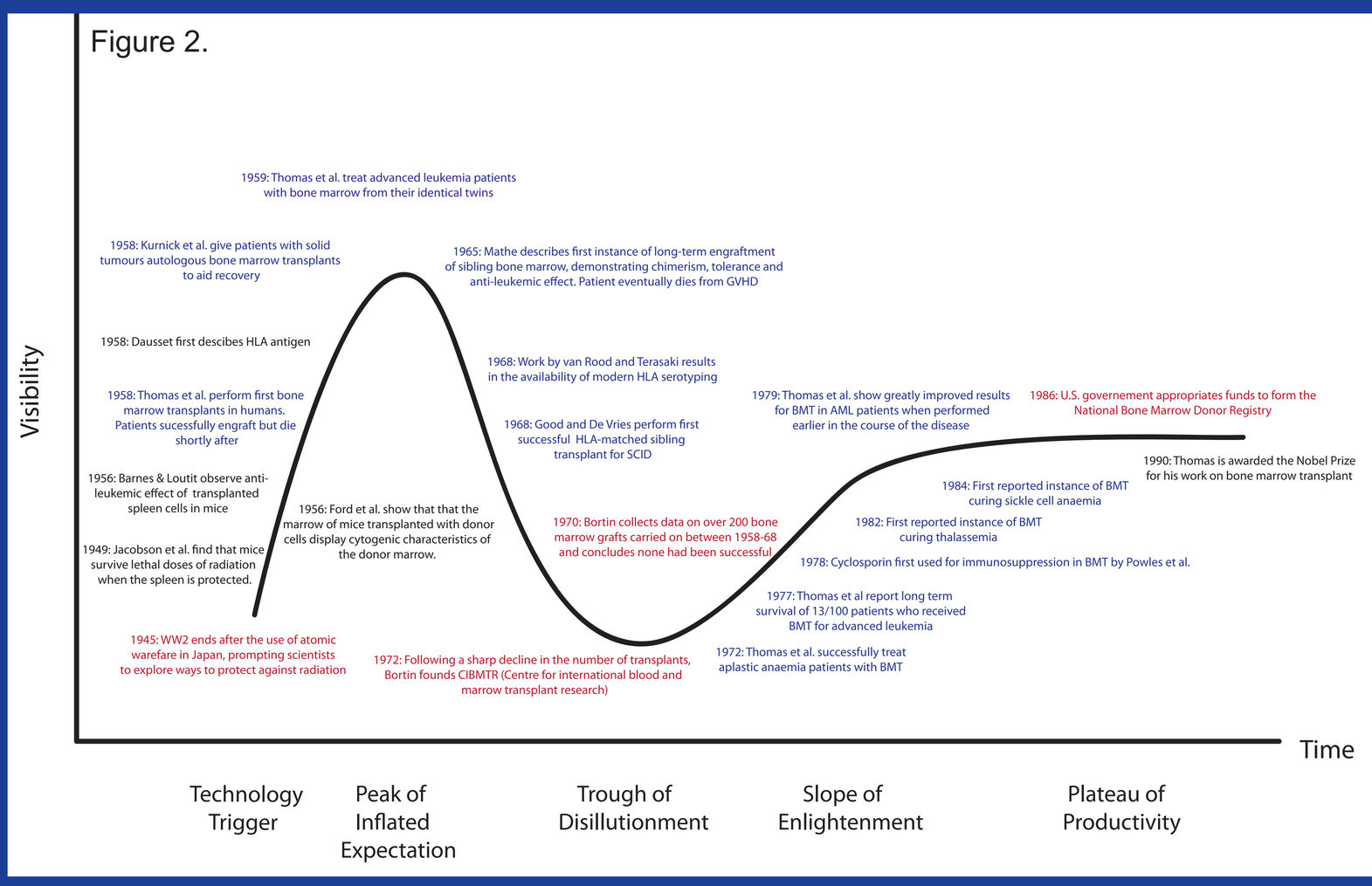
This exercise is useful in evaluating the current state of the field for progress and maturation.

The development of bone marrow transplantation faced many similar challenges to those faced by gene therapy today. A large turning point in the progression of BMT out of the trough of disillusionment was the creation of associations to encourage collaboration among academics, including the European society for Blood and Marrow Transplantation, Centre for International Blood and Marrow Transplant Research, and World Marrow Donor Association. These groups have provided a single voice for the field, conducted yearly surveys to promote the treatment, and provided the basis for new standards, registries and conferences.

In gene therapy many different groups that provide this function already exist, including ASGCT, BSGCT, and ESGCT among others. These groups play a crucial role in the development of the field. However, a key difference between GT and BMT is the commercial applicability of the therapies. Gene therapies tend to be marketed as products rather than services and the cost of development and manufacture is significant. As such, gene therapies are able to command a high price tag, as demonstrated by Glybera which has an estimated cost of $1.6M per patient.

If GT is to fulfil its promise of helping patients, in addition to generating sustainable profits, a different model is required, one in which academics collaborate not only with each other, but with industry, government, regulators, and patient groups. This will be the future focus of this research project.

Figure 2.



Conclusions

- Gene therapy has progressed since 1990, transitioning from academic bench to patient bedside.
- Understanding of basic science has improved, but other issues hinder its useful application.
- Translational barriers are difficult to overcome through lab-based research alone.
- A key limiting factor is uncertainty concerning the maturity of the technology on the part of non-academic stakeholders, including industry, regulators, and clinicians.
- Further work will assess how these groups could be engaged through different types of collaboration to streamline the translational pathway for gene therapy.

How you can help

Future work in this research area depends on the involvement of gene therapy researchers. If you have interacted with industry/academia in any way and would be willing to give a short interview by phone or in person please leave your email address on the attached sign-up sheet. Thank you.

References

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