



# **BIOTECHNOLOGY**

## **TECHNICAL REPORT**

### **VOLUME 1**

*Editors:*  
**Ann Anton**  
**Vijay Kumar**  
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Biotechnology Research Institute  
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**BIOTECHNOLOGY**  
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**VOLUME 1**

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## **FORWARD FROM THE VICE CHANCELLOR**

I take this opportunity to congratulate the Biotechnology Research Institute (BRI) on the publication of their first technical report. BRI was established in 2002 as one of the centers of excellence at UMS in the field of biotechnology. The Institute has, since then, actively conducted research and innovation in molecular biology for applications in various areas of biotechnology.

Technical reports such as this will benefit UMS in archiving the university's research findings and also serve as reference materials for work carried out in niche areas of the university. In addition, such reports will allow for an avenue to inculcate the writing culture expected of university academicians.

I wish BRI continued success in their research and achieving academic excellence.

**YBHG. PROF. DATUK DR. MOHD. NOH DALIMIN**  
**Vice Chancellor**  
**Universiti Malaysia Sabah**

## **FORWARD FROM THE DIRECTOR OF BIOTECHNOLOGY RESEARCH INSTITUTE**

**This report is a compilation of extended abstracts of research carried out at the Institute since its conception in 2002. I wish to thank all the contributors of the articles in this Technical Report viz the lecturers and Associate Fellows of the Biotechnology Research Institute (BRI) and their research students.**

**It is hoped that in these early years of BRI's establishment, the Technical Report is a means of inventoring the research outputs of the Institute. The report will eventually evolve to become a peer-reviewed journal in the area of biotechnology/ molecular biology.**

**Finally, I take this opportunity to thank the Vice Chancellor and Management of UMS for having supported BRI in its endeavors to play its role in biotechnology and the commercialization of research outputs in line with the efforts of the nation to drive biotechnology as the new engine of growth for the 21<sup>st</sup> century.**

**PROF DATIN DR ANN ANTON  
Director  
Biotechnology Research Institute**