Review of current and future research funded by Leukaemia and Lymphoma NI

(2020-2024)

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1 Background

Leukaemia & Lymphoma NI (LLNI) funds research into the causes and cures of leukaemia, lymphoma, and myeloma in Northern Ireland. The LLNI research strategy is based on the study of cancers that develop from blood stem cells. The charity aims to improve our understanding of the causes and the factors controlling their development and progress by laboratory studies. It has have adopted a "bench to bedside and back" approach to improve the clinical management of patients by supporting collaboration between our research group and other expert groups.

The purpose of this document is to update and review the research support by the Leukaemia & Lymphoma NI and to propose options for future awards. The impact can be measured in terms of maintaining research capacity and outputs, but on the impact of media and awareness for the charity to increase income.

This document will look back on the funding awarded during the previous four years and examine options and opportunities for future research proposals for the period 2020-2025. The financial aspects are available from the LLNI office and are not required for this review

The administration and management needs of the charity are not considered in depth in this document as that is a Trustee Board decision but are commented on in recognition of their invaluable support for the research team.

All the research awards in the previous five years have been made to Queen's University Belfast. However, these awards were made within the context that the Charity had decided that it wanted to support research associated with, but not wholly, in the Blood Cancer Research Group in the Patrick G Johnston Centre for Cancer Research (PGJCCR) [1] at Queen's University Belfast.

Early in the previous five-year period, the management of the PGJCCR was perceived as not being as supportive of the Blood Cancer Research Group (BCRG) as the charity might have hoped. This has changed due to the change of Director, Professor Chris Scott (Acting) has been very supportive of the research group and has actively recognised the importance of the Leukaemia Lymphoma NI in the funding profile of the PGJCCR. This has been an important factor and influence in the decision to award, via Queen's Foundation, two substantial grants.

This change in attitude has reduced, but not completely removed, any potential issues around the location of the LLNI office within the PGJCCR; but this situation should continue to be monitored particularly with the formation of the limited company.

[1] The Centre for Cancer Research and Cell Biology (CCRCB) was renamed as the Patrick G Johnstone Centre for Cancer Research (PGJCCR) in February 2020

1.1 Research Themes

Blood cancer has the 5th highest incidence of all cancers and surprisingly has the 3rd highest number of deaths. The number of cases of blood cancer is around 1200 per year, but this is probably an under-estimate as the cancer registry does not collect data on several sub-types including MDS. There are three main sub-groups: leukaemia; lymphoma and myeloma, with around 130 different sub-types within the blood cancer umbrella.

The BCRG in Belfast has had a long record of research into some of these sub-types include acute myeloid leukaemia (AML), myelodysplastic syndromes (MDS), chronic myeloid leukaemia (CML), myeloproliferative neoplasms (MPN) and myeloma. The laboratory research focus remains on these, except for CML, however, we also have an active research programme on chronic lymphoid leukaemia (CLL) run in collaboration with colleagues in the Trust. The BCRG is represented by Professor Ken Mills, with interests in AML and MDS, and Dr Lisa Crawford, who has a focus on myeloma. The CLL work is coordinated by Dr Mark Catherwood, a clinical scientist in the BHSCT, whilst we also have academic partners in the PGJCCR and the Centre for Experiment al Medicine (CEM), the Centre for Public Health (CPH) and the School of Pharmacy working with the BCRG on specific projects as highlighted in the text below. The wider group also benefits from clinical interaction with Professor Mary Frances McMullin (AML, MDS and MPN), Dr Jeremy Hamilton (AML) and Dr Sarah Lawless and Professor Curly Morris (myeloma).

The laboratory research themes can be summarised as being (a) the understanding of molecular abnormalities on blood cancer development and (b) novel and repurposed therapies and therapeutic combinations for the myeloid malignancies and myeloma. These themes utilise molecular genetics, genomic and transcriptomic studies, drug screens and medicinal chemistry.

1.2 Admin support

LLNI funds three admin staff and this report must acknowledge the contribution by working with the fundraisers, committee, and the researchers in the PGJCCR and across the School.

- Joanne Badger, who is the charity coordinator, and manages and supports the two admin assistants
- Claire Gilmore supports the administration and financial aspects of the charity
- Collette McMorrow who supports the fundraising and social media aspects.

The additional appointment of the third member of the staff has meant that the office space is very tight even before any issues moving forward considering covid-19 restrictions.

2 Research Report (2016-2020)

During the period 2016-2021, the research funding strategy was focused towards three main aims:

- To maintain and grow the high-quality research within the Blood Cancer Research Group at the PGJCCR
- To develop the grow a critical mass of early stage researchers through funding, solely or in partnership, PhD studentships or pilot / seed corn research grants
- To look towards succession planning for the longer-term sustainability of blood cancer research in Belfast and Northern Ireland.

2.1 Core laboratory support

As part of Aim 1, the charity has continued to award the BCRG several recurring laboratory or development funds.

2.1..1 Core laboratory and tissue culture support

The core laboratory support and the tissue culture rolling funding awards ensure that the consumables element of the research projects is not eroded. In addition, as it supports all of the BCRG activities, then the LLNI have some degree of funding for all projects within the group irrespective of funding but this is particularly important for the Department of Employment (DfE) studentships which have limited research consumables funding.

2.1..2 Research Technician

It should be noted that the role of the Research Technician includes assessment of stem cell harvests from which a limited income is generated from the Belfast Health and Social Care Trust (BHSCT) and the processing of the haematological samples from the Northern Ireland Biobank which includes ensuring our adherence to the Human Tissue Act (HTA).

2.1..3 Chair of Haematology Development fund

The Development grant has been invaluable to cover the cost of travel, conference attendance, small items of equipment, and the increasing cost of publication charges particularly to allow for open access. The Development Fund has also been used to support scientists between grants, research students at the end of their studentship to complete research to enable publications, and for the short term support for specific projects / technologies such as bioinformatic analysis.

2.2 Queen's Foundation Funding Agreements

2.2..1 QF1 (2017-2022)

In 2017, the LLNI agreed a package of funding with the Queen's Foundation to support Blood Cancer Research. This package, referred to as QF1, was valued at £790,000 for a period of 5-years. Within the package was funding for a Lecturer / Senior Lecturer, protected time for Trust clinicians to

participate in research and the funding of a clinical research fellow. This section mostly maps to Aims 2 and 3.

The Lecturer / Senior Lecturer post was advertised in 2017 and following a competitive application, shortlisting and interview process, Dr Lisa Crawford was appointed from 1st January 2018 for a 5-year period. The value of the process via Queen's Foundation was that the funding for this position after 5 years would be taken on by the School. This appointment has been very successful with Dr Crawford obtaining funding for three PhD studentships, publishing high quality papers, and developing local, national, and international partnerships.

It turned out that the protected time funding was very difficult to implement; only one clinician showed any interest and then found it very difficult to fit into their current job plan. Following discussions with the LLNI and Queen's Foundation, this funding package was repurposed to fund two PhD students from 2019. These were awarded to Deirdra Venney, supervised by Prof Ken Mills and Dr Adone Mohd-Sarip and to Paul Strain, supervised by Dr Jaine Blayney and Prof Ken Mills.

The final package for a Clinical Research Fellowship was advertised in September 2018 and was offered to an excellent candidate. This candidate subsequently obtained a prestigious Irish Clinical Academic Training (ICAT) fellowship, which is co-funded by the Wellcome Trust, the Northern Ireland Public Health Authority (PHA) and the Health Research Board (HRB) in the Republic of Ireland. Fortunately, the candidate, Dr Graeme Greenfield, decided to undertake his ICAT fellowship within the BCRG; which enable the LLNI / QF1 funding to be re-advertised and Dr Phil Weir and it is planned that he will start in February 2021.

2.2..2 QF2 (2020-2024)

A further grant (QF2) was awarded, again via Queen's Foundation in July 2020. This was a package of £500,000 to cover the cost of a Research Fellowship, an associated technician, and consumables. The award of the Fellowship as opposed to another Lectureship was discussed with senior members of BCRG, the Central Committee, PGJCCR Director, the Head of School, and members of the Faculty Executive Board. The consensus was that in the current environment that the Fellowship would add value to the BCRG. This recruitment process for the Fellowship is currently in process and will be interviewed in early November 2020 with an anticipated start-date of 1st April 2021. The technician will be recruited following the appointment of the Fellow.

2.3 Research Grants

2.3..1 Golden Anniversary Grant

The 50th Anniversary Research Programme was awarded in 2014 with a total value of £496,000 and covered two project grants, two PhD studentships and one Clinical Fellowship The two project grants finished by August 2019 due to various extensions caused by staff leaving or no-cost extensions. Staff on these posts left to return to the USA to a commercial position (IG), to move to Oxford for another research position (LK), obtained a lecturer post at Ulster University (KM) or return to Spain at the end of their contract (AGS). There are currently no project grants covering staff costs awarded by the LLNI within the BCRG.

The two Golden Anniversary PhD students successfully completed their projects and have moved to posts in Randox in Northern Ireland (CJ) and the Institute of Cancer Research in London (JS). The Clinical Fellow (SM) successfully completed her MD and subsequently obtained a clinical consultant post at Antrim Area Hospital.

2.3..2 Clinical Research Support

In 2017, the Committee decided to fund a clinical research nurse in the BHSCT for three years. The first 6 months was co-funded with Myeloma UK. During the funding period, which now expires at the end of March 2021, three different research nurses have been involved in this role due to promotion and retirement. In addition, support has been granted to two Haematology trainees to spend time at the University Hospital in Southampton or a King's College Hospital, London. These periods have enabled them to develop skills in lymphoma and myelodysplastic syndromes, respectively. Both returned to Northern Ireland at the end of their placements and subsequently obtained consultant posts in Antrim or Craigavon hospitals.

2.3..3 PhD Studentships

The Committee are very supportive of developing and growing the pool of blood cancer researchers as indicated by all the aims outlined above. The LLNI funded students, date of award and supervisors are outlined in Appendix 1. Other students within the wider BCRG are RM (2018) and CM (2019) both funded by DfE, MaB (2018) funded by the Government of Oman and WW (2020) funded by MDS UK.

Several of grant awardees, (supervisors) are outwith the core BCRG but they have developed strong associations with members of the group and are part of a strategy to widen and expand the participation and membership of the BCRG to strengthen the outputs and grant income.

2.3..4 MyBLOCk and MyMATTERS

In 2019, the LLNI identified the need for a "flagship" project for their supporters and fundraisers to rally behind. The MyBLOCk (**My**eloid **Blo**od **C**ancer) initiative was developed and mostly funded by one specific supporter and a grant from Tesco. MyBLOCk aims at integrating mutational sequencing data from patients with myeloid malignancies with a programme of individualising drug combinations. The project started in October 2019 and KC was appointed but moved to the BHSCT as a registered clinical scientist in April 2020. LC will replace her from November 2020 after completing a BCRG project from by The Little Princess Trust and Children's Cancer & Leukaemia Group.

In 2020, a similar project, named MyMATTERS (**My**eloma **M**etabolic m**A**nipula**T**ion **T**o **E**nhance **R**espon**S**e) initiative was launched, but the progress of this project was dramatically slowed by covid19. MyMATTERS will profile resistant myeloma cells and aims to identify metabolic vulnerabilities that could be exploited therapeutically to overcome drug resistance. Dr Phil Weir has been appointed to the project and will commence in February 2020.

2.3..5 Pilot Research Grants

The Medical and Scientific Advisory Panel, led by Professor Terry Lappin, identified the need for small pilot grant funding to enable early stage researchers to obtain quality results for further grants for

external charity or research council funding. Several grants have been awarded during this review period with at least one under consideration, these are:

- Dr Fiona Furlong (Pharmacy), Dr Jaine Blayney and Professor Ken Mills
- Dr Effie Kostareli (CEM)
- Professor David Gonzalez-Sanchez
- Dr Dessi Malinova (CEM) (pending)

Three of these grants are led by principal investigators outside of the core BCRG based within the PGJCCR

2.3..6 MOSAICC

The MOSAICC study is an in-depth case-control study of myeloproliferative neoplasm patients. Myeloproliferative neoplasms (MPN) coordinated by Professor Mary Frances McMullin and Dr Charlene McShane (QUB) and Professor Lesley Anderson (recently relocated from QUB to the University of Aberdeen). This epidemiology study is a departure from the laboratory studies funded in recent times by the LLNI, however will have a major impact into the understanding the factors involved in the development of MPN. The initial support awarded in 2018 was supplemented following as further request in 2020. The second request was because of the failure or withdrawal of partner charities to identify sufficient funds to support the MOSAICC project.

2.3..7 External funding obtained by the BCRG

A policy within the BCRG has been to consider that the grant funding from the LLNI will enable further funding to be leveraged from other charities or organisations. During the past four years, the following grants, totalling over £960,000 have been obtained. These include charities who have not previously funded any research in Northern Ireland.

2.4 Dissemination

The BCRG has managed to publish numerous papers and reviews and presented at several conferences and workshops over the past four years. Most of these have been in association with full or partial funding from the LLNI.

2.4..1 Publications

In the period of 2016-2020, the BCRG have published 46 papers or reviews. Full details of these are included in Appendix 1 where past and present BCRG members are highlighted in **bold**

2.4..2 Presentations

Members of the BCRG have presented at numerous national and international meetings or invited seminars at external organisations including:

- Haematology Association of Ireland (HAI)
- British Society for Haematology (BSH)

- UK Myeloma Forum
- European Hematology Association (EHA)
- American Society for Hematology (ASH)
- International Conference for Myelodysplastic Syndromes
- International Workshop for CLL
- International Workshop for Myeloma
- European School for Hematology – MDS workshop
- European School for Hematology – AML workshop
- European School for Hematology – MPN workshop
- European School for Hematology – MM workshop

3 Impact of Covid-19

The PGJCCR was closed for all research from mid-March 2020 until mid-June 2020. This had an obvious impact on the laboratory research potential during this period. The BCRG moved rapidly to online laboratory meetings, supervisory meetings, and research planning meetings. The staff and students continued to analyse data that they had produced in the period prior to closure and lockdown. In many cases, computers were relocated from the PGJCCR offices to their homes to facilitate this analysis. In addition, all students and post-doctoral fellows were tasked with working on manuscripts of their research or literature review. As a result, over 5 papers and 4 reviews were written and submitted with several published during September – November 2020. The laboratory research recommenced in June with a shift pattern adhering to the distancing requirements. Three new PhD students started during this period and have adapted well to the restrictions. The closures meant that the summer studentship programme was suspended. However, recent operational recovery regulations have meant that 3-people per laboratory bay can be accommodated this will allow the inclusion of master level students in the laboratory from early November 2020. All research projects have been affected by the pause, but the impact on these and the studentships is being monitored particularly in view of any future restrictions and centre closures.

4 Future research plans

4.1 Succession planning

Over the next year or two, the major issue to consider is the future leadership of the BCRG. Both Professor Mills and Professor McMullin are moving towards retirement ages. The appointment of Dr Lisa Crawford, as lecturer in 2018, this was a significant step towards ensuring the future continuity of the BCRG. Two further developments should be noted that will have an impact towards the future strategy.

4.1..1 QF / LLNI Research Fellowship

The appointment of the LLNI / QF2 funded Research Fellowship (Section 2.2..2) in November 2020 will strengthen and expand the research leadership in the group albeit at a junior level and the need for mentorship and development is recognised. It would be anticipated that the person appointed would eventually meet the criteria for applying a lectureship within the PGJCCR in Blood Cancer funded by either the School or any future investment from the LLNI.

4.1..2 Clinical Academic

The second development would be the appointment of a senior Clinical Academic. This would benefit the BCRG at several levels: improved and increased clinical / laboratory interactions; educational contributions to the Biomedical and Medicine undergraduate courses and supervision of research laboratory students and clinical academics; and access to early phase trials and new therapeutic agents. The PGJCCR and the School are aware of this need. At the time of this report (November 2020), there are two potential candidates who would be interested in relocating to Belfast. One candidate, located in the USA, has visited Belfast on two occasions and appears keen to relocate to Northern Ireland. The second candidate, originally from NI, but currently working in the UK, is at an early stage of approach. Both these need to be followed up prior to any consideration of interview and appointment but should be recognised that this dependent on university funding which may be impacted by covid-19 and input from the QUB / Trust Clinical Academic panel. Both candidates are clinical research focused, which would give important input to the BCRG, but they may need support in terms of non-clinical investigator(s) to actively work and support their research.

4.2 Change in role

One of the core recurring grants includes that for a research technician, and as indicated in Section 2.1..2, whose responsibilities include the processing and storage of the samples obtained from patients with haematological malignancies for the NI BioBank. The Committee has agreed that this portion of the time will be more aligned with the Biobank allowing cover for the LLNI technician and expanding and developing the technician into other roles associated with the Biobank

4.3 PhD studentships

Studentships have represented excellent value for the charity – as they can be the “face” of the charity’s research and interact with the fundraisers and public. In addition, several studentships, over

the past four years, have been co-badged by a specific donor name along with the LLNI. This has the advantage that the donor or fundraiser has a vested interest in "their student" and that student is perhaps more inspired about their research. Although we have been very fortunate that we have had a pool of talented and dedicated students. The flow of 1, 2 or 3 studentships each year funded by the LLNI, and other sources, has been a fertile area of research producing data for papers and further research grant applications. Despite the rightful caution of the LLNI committee around funding income in this current environment, it would be highly beneficial, and if sufficient funds were available, for the LLNI to consider maintaining this pipeline.

4.4 Research projects

Post-doctoral scientists are an invaluable asset in the research laboratory as they maintain the research potential whilst creating a link between the research students and the Principal Investigator. However, it is recognised that these are also a heavy financial investment from the charity. If the Centre or School supports the appointment of a senior Clinical Academic (Section 4.1..2), then the LLNI should consider a package of laboratory research support.

4.5 Clinical Research

The charity took its first steps into funding clinical research with the award of £30,000 in 2015 to part fund the drug costs of the AML18 UK trial and then funding the Clinical Research Nurse. The financial pressures from the BHSCT may not allow funding of this post after March 2021. This was a change from the expected or stated at the time of negotiations over the future funding for this post. If this is the case, then the LLNI may need to consider how it could continue funding this post as it allows input in the Bridgewater suite and facilitates clinical trials.

5 Summary

This report has summarised the grants, personnel, and outputs during the period 2016-2020. It has been relatively successful in terms of income and publications and has raised the profile of blood cancer research within the Centre, School, with our collaborators and networks.

The immediate future is good particularly under the expanding leadership from Dr Crawford and the appointment of the Research Fellow who it is hoped can be nurtured into independence as one of the BCRG research leaders. However, the longer-term future funding potential from the LLNI, and indeed all other charities and research agencies, is uncertain. This will undoubtedly have an impact on research grant income, reducing the critical mass of the group leading to reduction in research activity, outputs and group and charity visibility.

6 Appendices

6.1 Appendix 1: LLNI funded PhD students

* indicates supervisors out with BCRG

Start Date	Award title	Student	Supervisors	Post-studentship
Oct 2014	Golden Anniversary studentship	CJ	Dr Sandra Irvine, Dr Lisa Crawford & Prof Ken Mills	Randox
Oct 2014	Victoria Montgomery / Golden Anniversary studentship	JS	Dr Alex Thompson (replaced by Dr Kienan Savage*) and Prof Ken Mills	Institute for Cancer Research, London
Oct 2016	LLNI studentship	CC	Dr Kienan Savage* (replaced by Prof Kevin Prise*) and Prof Ken Mills	Clinical Scientist training (NI)
Oct 2017	Alison Williamson / LLNI studentship	HB	Dr Kienan Savage* (replaced by Dr Adone Modh-Sarip*) and Prof Ken Mills	RCSI, Dublin
Oct 2018	LLNI studentship	JM	Dr Lisa Crawford and Prof Ken Mills	3rd year, completes Oct 2021
Oct 2019	LLNI studentship	JB	Prof Karen McCloskey* and Prof Ken Mills	2nd year, completes Oct 2022
Oct 2019	QF1 Studentship	DV	Dr Adone Mohd-Sarip* and Prof Ken Mills	2nd year, completes in Oct 2022
Oct 2019	QF1 studentship	PS	Dr Jaine Blayney* and Prof Ken Mills	2nd year, completes in Oct 2022
Oct 2020	Eda Quirke / LLNI studentship	AM	Prof Kevin Prise* and Prof Ken Mills	1st year, completes in Oct 2023
Oct 2020	LLNI Studentship	BK	Dr Lisa Crawford and Dr Rich Williams*	1st year, completes in October 2023

6.2 Appendix 2: Additional Funding obtained (2016-2020)

Year	Funder	Duration	Amount	PI's	Title
2016	Myeloma UK	6 months	£16,387	Prof Ken Mills	Clinical Trial Research Nurse
2017	Children's Cancer and Leukaemia Group (CCLG) and The Little Princess Trust (LPT)	18 months	£98,712	Prof Ken Mills and Dr Kyle Matchett	Facing the MuSIC - identification of synergistic repurposed drug combinations as novel therapies in paediatric acute myeloid leukaemia
2018	Children's Cancer and Leukaemia Group (CCLG)	18 months	£74,997	Prof Ken Mills and Dr Katrina Lappin	Identifying Combination Therapies Targeting Apoptosis Pathways in Paediatric AML (CAuSAL study)
2018	Leukaemia UK	3 years	£237,443	Prof Ken Mills, Dr Kienan Savage, Dr Katrina Lappin	Targeting DNA Damage Repair Deficiency in AML
2018	IMI2/EU	4 years	£25,000	Prof Ken Mills and Dr Mark Catherwood	HARMONY - big data in blood cancers
2019	Cure Leukaemia	3 years	£146,000	Professor Ken Mills and Professor Mary Frances McMullin	Therapeutic Acceleration Programme (TAP)
2019	Erasmus Plus Knowledge Exchange Network (EU)	3 years	€ 190,000	Prof Ken Mills, Dr Mark Catherwood, Dr Jaine Blayney and Prof David Gonzalez Sanchez	NEMHESYS – NGS Establishment in Multidisciplinary Healthcare Education System
2020	MDS Patient Forum	4 years	£173,000	Prof Ken Mills, Dr Kienan Savage, Dr Katrina Lappin	Targeting DNA damage repair deficiency in MDS

6.3 Appendix 3: Publications (2016-2020)

1. Borland G, Kilbey A, **Hay J**, Gilroy K, Terry A, Mackay N, Bell M, McDonald A, **Mills K**, Cameron E, Neil JC. Addiction to Runx1 is partially attenuated by loss of p53 in the Emicro-Myc lymphoma model. Oncotarget. 2016.
2. **Catherwood MA**, McGrattan P, Lawless S, McConville C, Robson N, Lundy B, Humphreys M, Soverini S, **Mills KI, McMullin MF**. Coexistence of inversion 16 in chronic myeloid leukaemia in blast crisis. Journal of Hematopathology. 2016;9(4):155.
3. **Crawford LJ, Anderson G, Johnston CK, Irvine AE**. Identification of the APC/C co-factor FZR1 as a novel therapeutic target for multiple myeloma. Oncotarget. 2016;7(43):70481.
4. **Crawford LJ, Irvine AE**. The role of the CCN family of proteins in blood cancers. J Cell Commun Signal. 2016;10(3):197.
5. Dolatshad H, Pellagatti A, **Liberante FG**, Llorian M, Repapi E, Steeples V, Roy S, Scifo L, **Armstrong RN**, Shaw J, Yip BH, Killick S, Kusec R, Taylor S, **Mills KI**, **Savage KI**, Smith CW, Boultwood J. Cryptic splicing events in the iron transporter ABCB7 and other key target genes in SF3B1-mutant myelodysplastic syndromes. Leukemia. 2016;30(12):2322.
6. Guerenne L, Beurlet S, Said M, Gorombei P, Le Pogam C, Guidez F, de la Grange P, Omidvar N, Vanneaux V, **Mills K**, Mufti GJ, Sarda-Mantel L, Noguera ME, Pla M, Fenaux P, Padua RA, Chomienne C, Krief P. GEP analysis validates high risk MDS and acute myeloid leukemia post MDS mice models and highlights novel dysregulated pathways. J Hematol Oncol. 2016;9:5.
7. Haslam K, **Catherwood MA**, Dobbin E, Sproul A, Langabeer SE, **Mills KI**. Inter-Laboratory Evaluation of a Next-Generation Sequencing Panel for Acute Myeloid Leukemia. Mol Diagn Ther. 2016;20(5):457.
8. **Liberante FG**, **Pouryahya T, McMullin MF**, Zhang SD, **Mills KI**. Identification and validation of the dopamine agonist bromocriptine as a novel therapy for high-risk myelodysplastic syndromes and secondary acute myeloid leukemia. Oncotarget. 2016;7(6):6609.
9. **Mills K**. Persistence of DNMT3A does not influence clinical outcome in acute myeloid leukaemia. Br J Haematol. 2016.
10. O'Reilly PG, Wen Q, Bankhead P, Dunne PD, McArt DG, **McPherson S,** Hamilton PW, **Mills KI,** Zhang SD. QUADrATiC: scalable gene expression connectivity mapping for repurposing FDA-approved therapeutics. BMC Bioinformatics. 2016;17(1):198.
11. Rea IM, **Dellet M**, **Mills KI**. Living long and ageing well: is epigenomics the missing link between nature and nurture? Biogerontology. 2016;17(1):33.
12. **Roulston GD, Burt CL, Kettyle LM, Matchett KB, Keenan HL, Mulgrew NM, Ramsey JM**, Dougan C, McKiernan J, **Grishagin IV, Mills KI, Thompson A**. Low-dose salinomycin induces anti-leukemic responses in AML and MLL. Oncotarget. 2016;7(45):73448.
13. Al-Asadi MG, Brindle G, Castellanos M, May ST, **Mills KI**, Russell NH, Seedhouse CH, Pallis M. A molecular signature of dormancy in CD34(+)CD38(-) acute myeloid leukaemia cells. Oncotarget. 2017;8(67):111405.
14. Chan KK, **Matchett KB**, Coulter JA, Yuen HF, McCrudden CM, Zhang SD, Irwin GW, Davidson MA, Rulicke T, Schober S, Hengst L, Jaekel H, Platt-Higgins A, Rudland PS, **Mills KI,** Maxwell P, El-Tanani M, **Lappin TR**. Erythropoietin drives breast cancer progression by activation of its receptor EPOR. Oncotarget. 2017;8(24):38251.
15. **Crawford LJ, Irvine AE**. Separation and Enrichment of Hematopoietic Stem Cells for CCN Studies. Methods Mol Biol. 2017;1489:261.
16. **Gaine ME, Sharpe DJ, Smith JS, Colyer HAA, Hodges VM, Lappin TR, Mills KI**. GATA2 regulates the erythropoietin receptor in t(12;21) ALL. Oncotarget. 2017;8(39):66061.
17. **Hay JF, Lappin K, Liberante F, Kettyle LM, Matchett KB, Thompson A, Mills KI**. Integrated analysis of the molecular action of Vorinostat identifies epi-sensitised targets for combination therapy. Oncotarget. 2017;8(40):67891.

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21. **Young CS, Clarke KM, Kettyle LM, Thompson A, Mills KI**. Decitabine-Vorinostat combination treatment in acute myeloid leukemia activates pathways with potential for novel triple therapy. Oncotarget. 2017;8(31):51429.
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