*1- Use OMIM or Open Targets to investigate about Leprosy and Behcet’s disease:*

* *Summarize what is leprosy disease.*

According to Open target Leprosy is a granulomatous infection that is caused by a bacteria called “mycobacterium leprae”. The lesions are characterized for being in the skin, mucus membranes and peripheral nerves.

* *Summarize what is Behcet’s disease*

According to Open Target, Behcet’s syndrome is an autoimmune disease of the cardiovascular system which causes inflammation in the blood vessels in all the body which leads to ulceras on the mouth and sometimes in the genitals.

2- Use Open Targets to investigate about Thalidomide and answer the following questions:

* *Which are the targets of Thalidomide? (tip: query for “thalidomide” and find “Human targets” under the section “Mechanisms of Action”)*

The targets of Thalidomide are:

* + CRBN
  + DDB1
  + [CUL4](https://platform.opentargets.org/target/ENSG00000139842)A
  + RBX1
* *In which kind of diseases has Thalidomide shown to be effective? (tip: query for “thalidomide” and find “Indication”under the section “Indications*”

Thalidomide has a max phase IV. It seems that it’s more effective for multiple myeloma and immune system disease.

However, there are some other diseases that are in phase III such as colorectal neoplasm, [diffuse large B-cell lymphoma](https://platform.opentargets.org/disease/EFO_0000403), [fallopian tube cancer](https://platform.opentargets.org/disease/MONDO_0002158), [vascular malformation](https://platform.opentargets.org/disease/EFO_0006888), [peritoneum cancer](https://platform.opentargets.org/disease/MONDO_0002087), [malignant epithelial tumor of ovary](https://platform.opentargets.org/disease/MONDO_0018364), [extranodal nasal NK/T cell lymphoma](https://platform.opentargets.org/disease/MONDO_0019472) and [hepatocellular carcinoma](https://platform.opentargets.org/disease/EFO_0000182).

*3- Use the Open Targets and HumanMine to investigate about the targets you identified in the previous question (tip: create a list with all the identified targets):*

CRBN, DDB1, CUL4A, RBX1

* *To which key therapeutic areas do these targets belong?*

They all belong to Genetic, familiar or congenital disease / Cancer or benign tumor.

* *Which other drugs target the same genes (list just a few)?*
  + CRBN & CUL4A: Both of them can be also targeted with drugs like Lenalidomide and Pomalidomide (both in phase IV).
  + DDB1 & RBX1: according to Open Target they can be targeted only with Lenalidomide (in phase IV) apart from Thalidomide.
* *Do these genes interact physically? Do they interact genetically?*

The 4 genes interact physically, in any case they interact genetically.

* *Are all these genes located in the same chromosome?*

They are not located in the same chromosome. CRBN is located in chromosome 3, DDB1 is located in chromosome 11, CUL4A is in chromosome 13 and RBX1 in the 22nd chromosome.

* *Are there Gene Ontology terms enriched in this list of target genes?*

If we investigate the targets individually we can see that they have a section called Gene Ontology. From there we can see the following information (the biological processes and sometimes the cellular component involved with the specific targets).

* CRBN:
  + Biological process: [positive/negative regulation of protein-containing complex assembly](https://identifiers.org/GO:0031334), [proteasome-mediated ubiquitin-dependent protein catabolic process](https://identifiers.org/GO:0043161), [negative regulation of monoatomic ion transmembrane transport](https://identifiers.org/GO:0034766), [protein ubiquitination](https://identifiers.org/GO:0016567), [positive regulation of Wnt signaling pathway](https://identifiers.org/GO:0030177)…
  + Cellular component: Cytosol
* DDB1:
  + Biological process: [UV-damage excision repair](https://identifiers.org/GO:0070914), [apoptotic process](https://identifiers.org/GO:0006915), [biological process involved in interaction with symbiont](https://identifiers.org/GO:0051702), [cellular response to UV](https://identifiers.org/GO:0034644), [DNA damage response](https://identifiers.org/GO:0006974), [protein ubiquitination](https://identifiers.org/GO:0016567), [regulation of mitotic cell cycle phase transition](https://identifiers.org/GO:1901990)…
* CUL4A:
  + Biological Process: [regulation of nucleotide-excision repair](https://identifiers.org/GO:2000819), [in utero embryonic development](https://identifiers.org/GO:0001701), [proteasome-mediated ubiquitin-dependent protein catabolic process](https://identifiers.org/GO:0043161), [G1/S transition of mitotic cell cycle](https://identifiers.org/GO:0000082), [positive regulation of cell population proliferation](https://identifiers.org/GO:0008284), [T cell activation](https://identifiers.org/GO:0042110)…
* RBX1:
  + Biological Process: [SCF-dependent proteasomal ubiquitin-dependent protein catabolic process](https://identifiers.org/GO:0031146), [cellular response to UV](https://identifiers.org/GO:0034644), [positive regulation of protein catabolic process](https://identifiers.org/GO:0045732), [protein ubiquitination](https://identifiers.org/GO:0016567), [SCF-dependent proteasomal ubiquitin-dependent protein catabolic process](https://identifiers.org/GO:0031146), [T cell activation](https://identifiers.org/GO:0042110), [DNA damage response](https://identifiers.org/GO:0006974)…
* *Are there pathways enriched in this list of target genes?*

Yes, if we search in the pages of each individual target it is possible to see a section called Pathways with some info on it:

* CRBN: in this target there is only 1 pathway. It is about a disease, to be more specific it says that it has potential therapeutics for SARS.
* DDB1: We can see multiple enriched pathways for DDB1 but they are all related with DNA repair (and only one that is about protein metabolism).
* CUL4A: we can see the exact same information for pathway enrichment as in target DDB1.
* RBX1: this one has more variability. As we can see, it is involved in multiple pathways such as signal transduction, DNA repair, developmental biology, disease and the immune system.

*4- Finally, focus on the gene CUL4A and use HumanMineto investigate about this gene:*

* *Is the gene differentially expressed under any condition?*

Yes, the gene is differentially expressed under some conditions.

* *Do fruit flies have this gene in their genomes? What is its name?*

Yes, fruit flies have this same genome, the name of this genome is ohgt.