

Biologics and Related Drugs - “Mids,” “Mibs,” “Nibs,” “Nabs” and “mAbs” A Discussion of Definitions, Naming and Examples

Busy Day Tool Kit Preceptor Instructions

Learner level: IPPE and APPE Students

Estimated time to complete: May take several hours and can be done intermittently while completing other assigned projects.

Preceptor Instructions: Request a review of the module and written completion of the module by answering the questions outlined. Ask the student to demonstrate understanding of the differences between the compounds. Set up time with your student to review the results. (Topic/module may lend itself to a broader staff presentation.)

Student Instructions: Read the module. Answer the outlined questions throughout the module. Set up a time with your preceptor to review the results of the completed module. Provide feedback to your preceptor on the usefulness of the points analyzed.

Biologics and Related Drugs - “Mids,” “Mibs,” “Nibs,” “Nabs” and “mAbs” A Discussion of Definitions, Naming and Examples

1. “Mids” or “IMids”

- a. Immunomodulatory drugs – class of medications that enhance the ability of immune cells to kill abnormal cells.¹
- b. These drugs adjust immune response and all contain an “imide” group.²
- c. The primary use of IMiDs is in the treatment of cancers and autoimmune diseases.³
- d. Major toxicities of approved IMiDs are peripheral neuropathy, thrombocytopenia, anemia, and venous thromboembolism.⁴
- e. There are three generations of IMiDs, with each successive generation being better tolerated and more active against inflammatory and malignant conditions.²
- f. Three well-known drugs in this class are thalidomide, lenalidomide and pomalidomide.
- g. Discussion questions regarding this class of drugs are listed below.

1. Describe the mechanism of action of thalidomide and how this drug caused birth defects when first marketed.
 - a. What lessons were learned from the adverse outcome regarding thalidomide?
 - b. Describe the REMS program for thalidomide and precautions patients and caregivers should take when receiving this drug.
2. Describe the mechanisms of action of lenalidomide and pomalidomide.
3. Describe more thoroughly the changes to the drugs in this class through the generations.

2. “Mibs”

- a. Small molecules that work inside cancer cells to slow proliferation and increase apoptosis (cell death.)⁵
- b. Examples include: ixazomib, bortezomib, carfilzomib.
- c. Discussion questions regarding these molecules are listed below.
 1. What are proteasome inhibitors and do they work?
 2. What are some of the indications/use of these “mib” drugs?

3. “Nibs”

- a. A small-molecule inhibitor (“nib” is verbal shorthand for “inhibit”) of kinase enzymes.⁵
- b. Tyrosine kinase inhibitors (TKI) share the same mechanism of action, namely competitive ATP inhibition at the catalytic binding site of tyrosine kinase.⁶
- c. These inhibitors however differ in the targeted kinases, pharmacokinetics and substance-specific adverse effects.⁶
- d. Although there are variations from drug to drug, these tyrosine kinase inhibitors cause skin toxicity in more than 50% of patients.⁶
- e. Hematological side effects of most TKIs are anemia, thrombocytopenia and neutropenia.⁶
- f. Most common other adverse effects of the TKIs are edema, nausea, hypothyroidism, vomiting and diarrhea.⁶
- g. Nibs are substrates of cytochrome P450 enzymes and therefore liable to drug interactions.⁵
- h. First generation compound in this class is imatinib. Three second generation TKIs include dasatinib, nilotinib and bosutinib. Third generation compound is ponatinib.⁷
- i. Discussion questions regarding this class of drugs are listed below.
 1. What is the indication for imatinib?
 2. What are the indications for sorafenib?
 - a. How does Sorafenib work?
 - b. What kind of monitoring is needed for patients taking Sorafenib?
 - c. Describe more thoroughly the changes to the drugs in this class through the generations.

4. **“Nabs”**

- a. Nanoparticle albumin-bound drugs. Drug formulations are bonded to albumin as a delivery vehicle.⁸
- b. An example is nab-paclitaxel.
- c. Discussion questions on this/these drugs are listed below.
 - 1. What are the indications for nab-paclitaxel?
 - 2. What monitoring parameters are needed for patients receiving nab-paclitaxel?
 - 3. Explain the differences between nab-paclitaxel and paclitaxel.

5. **“mAbs”**

- a. Stem used for monoclonal antibodies, antibody fragments and radiolabeled antibodies. For polyclonal mixtures of antibodies, “pAb” is used.⁹
- b. Monoclonal antibodies are immunoglobulins that are produced exogenously from a single parent cell. They are homogenous meaning they are all identical cells.¹⁰
- c. Monoclonal antibodies are proteins made in the laboratory that can bind to a substance in the body, including cancer cells.¹¹
- d. All “mAbs” are proteins, which means they must be administered parentally.⁵
- e. In 1986, the first commercially available mAb, orthoclone OKT3 (muromonab-CD3) was approved for use in preventing kidney transplant rejection.¹²
- f. This first mAb was therapeutically unsuccessful because after the first few treatments, patients began developing antibodies to the murine proteins.¹³
- g. In response to the unsuccessful murine monoclonal antibody, both chimeric and humanized antibodies were developed.¹³
- h. The chimeric antibodies are 70% human and so less likely to elicit an immunogenic response.¹⁴
- i. Previously naming conventions for these drugs used a substem preceding the stem denoting the animal from which the antibody was obtained. This substem preceded the source of the antibodies reference to the medicine’s target. Examples of these stems are listed below.
 - 1. –a- rat
 - 2. –e- hamster
 - 3. –i- primate
 - 4. –o- mouse
 - 5. –u- human
 - 6. –xi- chimeric (human/foreign)
 - 7. –zu- humanized¹⁵

- j. With the new conjugated Monoclonal Antibody Naming Policy, effective Jan. 1, 2019, the key elements of the monoclonal antibody name appear in the following order:
 1. Prefix – suggested prefixes should comply with the USAN Program’s rule for coining names.
 2. Target Infix representing the target- determined by the available information regarding clinical indications and antibody action. Examples include:
 - a) –ba- bacterial – *bamab*
 - b) –ci- cardiovascular – *cimab*
 - c) –fung- antifungal – *fungmab*
 - d) –ne- neural – *nemab*
 - e) –os- bone - *osmab*
 - f) –ta- tumor-*tamab*
 3. Stem used as a suffix (-mab or –pab)⁹
- k. There are no plans to retroactively change names already coined.⁹
- l. Discussion questions on these compounds are listed below.
 1. Describe varying ways monoclonal antibodies function to affect the immune system.
 2. What cancers can be treated with monoclonal antibodies and why.
 3. What are some of the side effects on these drugs and why.
 4. What are costs of these mAbs?
 5. What drugs in this class are available in clinical trials?

6. Additional Activities

- a. Review the current literature to determine/describe any updates/changes to naming conventions and class additions. Be prepared to discuss/present these.
- b. Prepare a chart listing the categories of biologics and other related drugs comparing and contrasting such categories of side effects, production methods, sites of action, stability, half-life, routes of administration, immunogenicity and drug interactions. (Present to staff as requested.)

7. Other references to review include:

- a. Revised monoclonal antibody (mAb) nomenclature scheme, Geneva, 26 May 2017; World Health Organization.
- b. Nonproprietary Naming of Biological Products: Update-Guidance for Industry-Draft Guidance; March 2019.
- c. Nonproprietary Naming of Biological Products: -Guidance for Industry-Draft Guidance; January 2017.

d. [Procedure for USAN Name Section/American Medical Association](#)

References

- ¹Tariman, Joseph D. "Changes in Cancer Treatment: Mabs, Mibs, Mids, Nabs and Nibs." *Nursing Clinics of North America*. Volume 52, Issue 1, March 2017, Pages 65-81.
- ²Knight, R (August 2005). "IMiDs: a novel class of immunomodulators." *Seminars in Oncology*. 32 (4 Suppl 5): S24-S30. <http://www.nci.nlm.nih.gov/pubmed/16085014>.
- ³Pan, B; Lentzsch S (October 2012). "The application and biology of immunomodulatory drugs (IMiDs) in cancer." *Pharmacology & Therapeutics*. 136 (1):56-68. <https://www.ncbi.nlm.nih.gov/pubmed/22796518>.
- ⁴Vallet, S; Witzens-Harig, M; Jaeger, D; Podar, K. (March 2012). "Updates on immunomodulatory drugs (IMiDs) in hematologic and solid malignancies." *Expert Opinion on Pharmacotherapy*. 14 (4): 473-494. <http://www.ncbi.nlm.nih.gov/pubmed/22324734>.
- ⁵Scott, Gayle Nicholas. "Sorting Through the Confusion of Biological Drug Names." *Medscape*. August 19, 2016. Article 867446_3.
- ⁶Hartmann JT, Haap M, Kopp HG, Lipp Hp. "Tyrosine Kinase Inhibitors-A review on pharmacology, metabolism and side effects." *Current Drug Metabolism*. 2009 Jun 10(5):470-81.
- ⁷Jabbour, E, Kantarjian H, Cortes J. Use of second- and third-generation tyrosine kinas inhibitors in the treatment of chronic myeloid leukemia: an evolving treatment paradigm. *Clin Lymphoma Myeloma Leuk*. 2015 Jun: 15(6):323-34. <http://www.ncbi.nlm.nih.gov/pubmed/25971713>.
- ⁸"Paclitaxel Albumin-stabilized Nanoparticle Formulation" National Cancer Institute Drug Information.
- ⁹ <http://ama-assn.org/about/united-states-adopted-names/monoclonal-antibodies>.
- ¹⁰Carroll KC, Hobden JA, Miller S, Morse SA, Mietzner TA, Detrick B, Mitchell TG, McKerrow JH, Sakanari JA. Jawetz, Melnick, & Adelberg's Medical Microbiology, 27th edition. New York (NY): McGraw Hill, 2015.
- ¹¹NCI Dictionary of Cancer Terms.
- ¹²Liu, JKH. The history of monoclonal antibody development –Progress, remaining challenges and future Innovations. *Ann Med Surg*. 2014 Dec 3; 3(4):113-116.
- ¹³Parham, P. *The Immune System*, 3rd edition. London: Garland Science, 2009.

¹⁴Chame P, Regenmortel MV, Weiss et al. Therapeutic antibodies: successes, limitations and hopes for the future. *Br J Pharmacol*. 2009 May; 157(2):220-233.

¹⁵ Revised monoclonal antibody (mAb) nomenclature scheme, Geneva, 26 May 2017; World Health Organization.