

I LOVE CHEMISTRY!
WHAT NOW?



Johannes van Tonder (PhD)



INTRODUCTION

- Years of dedication, sweat and tears
- Become expert in small field of study
- Next step: Academia or industry?
- **Is your knowledge even applicable in industry???**

My thesis is written in



WWW.PHDCOMICS.COM

ACADEMIA VS INDUSTRY

Academia

- Place of **novel** research
 - Publish aka “positive contribution to science”

Industry

- **Established/known** chemistry
 - Business plan can't be built on unknowns
 - Maybe optimise (R&D) but still established



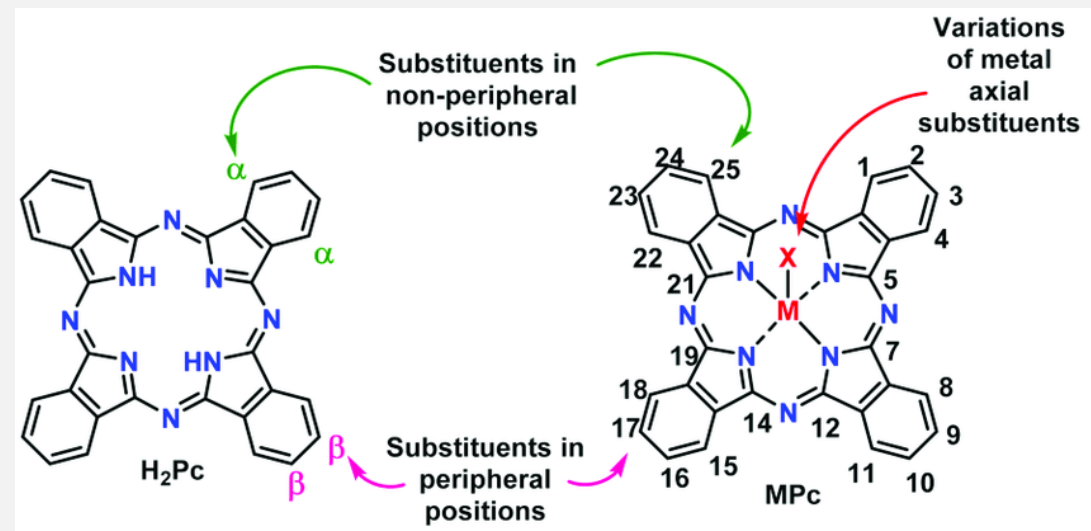
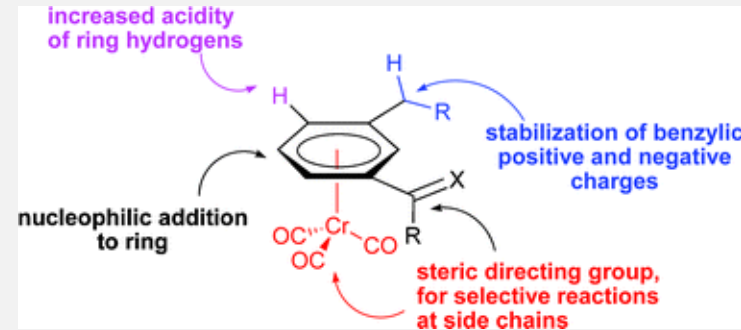
MY BACKGROUND...

- **MSc (3 years):**

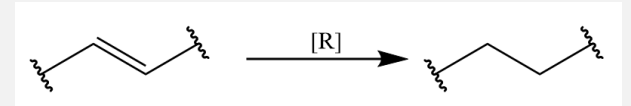
- Methodology development
- Chiral flavonoid synthesis – hydrogenation
- (flavonoid)Cr(CO)₃ complexes

- **PhD (1+4 years):**

- Methodology development
- Chiral flavonoid synthesis – epoxidation
- Alkene epoxidation
- Process optimisation – Pc catalysts
- Catalysis study – RuPc

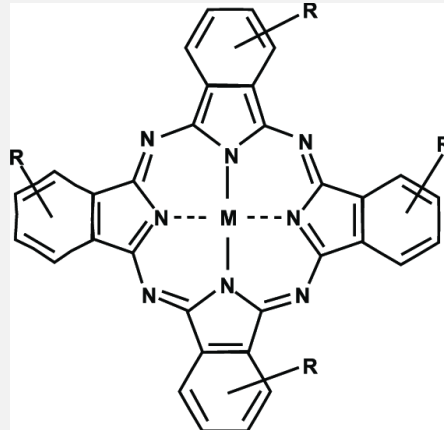


MY BACKGROUND...

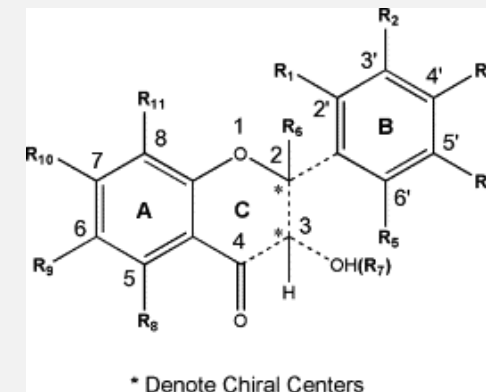
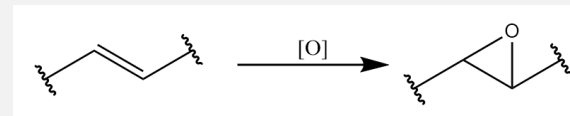


- Wealth of knowledge:

- Chiral synthesis
- Flavonoids
- Hydrogenation
- Phthalocyanines
- Epoxidation
- Catalysis
- And, and, and, and...



- Any of this useful outside of research???



VALUE OF POST-GRAD STUDIES

- Learn how to:
 - Approach **problem solving**
 - Do **research**
 - **Test** hypotheses
 - Generate **data**

- Honed **fundamental** chemistry knowledge!



VALUE OF POST-GRAD STUDIES

- Learn how to:
 - Approach **problem solving**
 - Do **research**
 - **Test** hypotheses
 - Generate **data**
- Honed **fundamental** chemistry knowledge!



!!!SOLVE THE PUZZLE!!!

VALUE OF POST-GRAD STUDIES

Why would an employer value you?



VALUE OF POST-GRAD STUDIES

- **Experience**
 - Group meetings / conferences
 - Individual work / grafting
- **Result: Effective employee**
 - Constructive contribution in a team
 - Independent worker



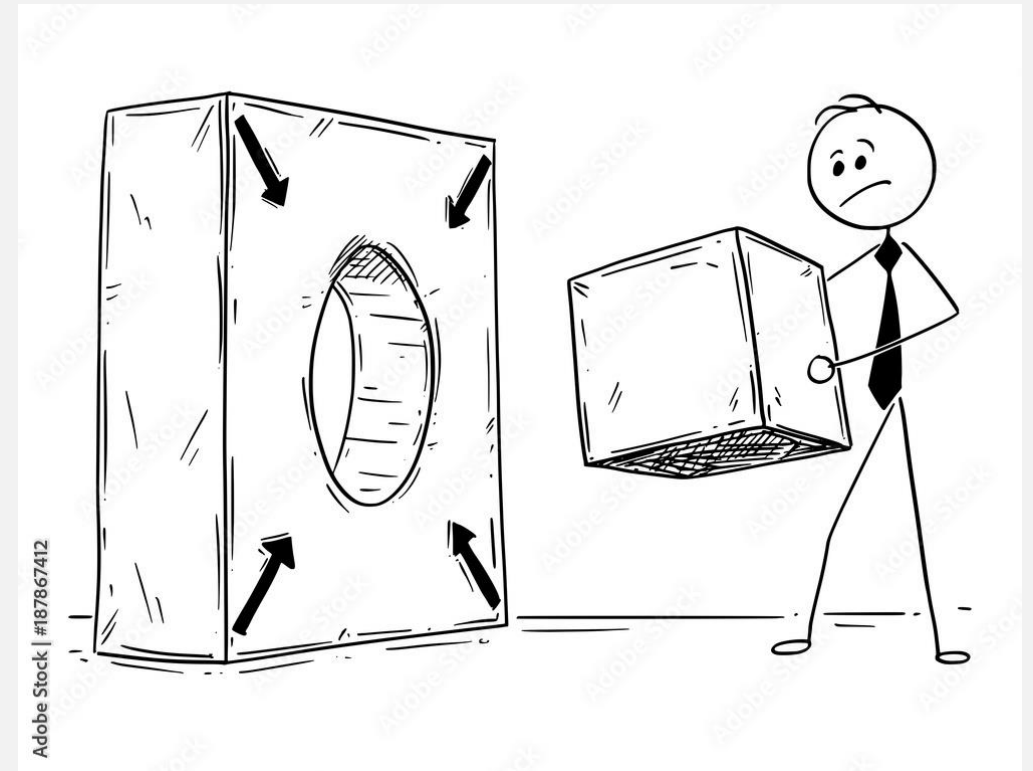
VALUE OF POST-GRAD STUDIES

- **Experience**
 - Literature procedures (half-truths)
 - Data analysis
 - Reaction mechanisms
- **Result: Critical thinker**
 - Root cause investigation
 - Identify areas of improvement
 - Hazard identification / prevention



VALUE OF POST-GRAD STUDIES

- **Experience**
 - Experimental setups
 - Reaction optimisation
- **Result: Problem solving**
 - Recommend corrective actions
 - Justify actions by literature/science



VALUE OF POST-GRAD STUDIES

- **Experience**
 - Thesis / Publications
 - Conferences / Presentations
 - Lab book
- **Result: Scientific communication**
 - Progress reports / presentation
 - Convey instructions / Training
 - Document procedures



THE PRESENT...

- Introduced to **Nuclear Medicine** industry 10 years ago.

PET vs. SPECT

- What is nuclear medicine?
- Tracers?
- Difference?

[Nuclear medicine]

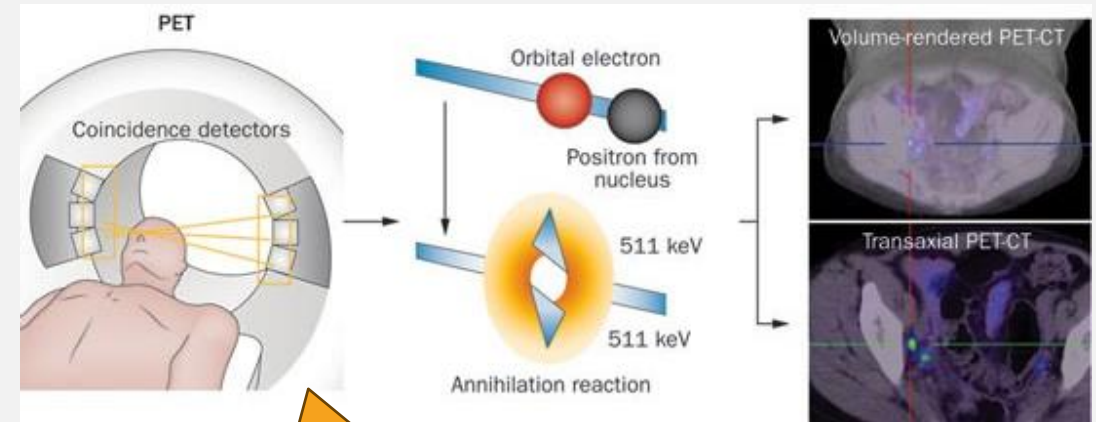
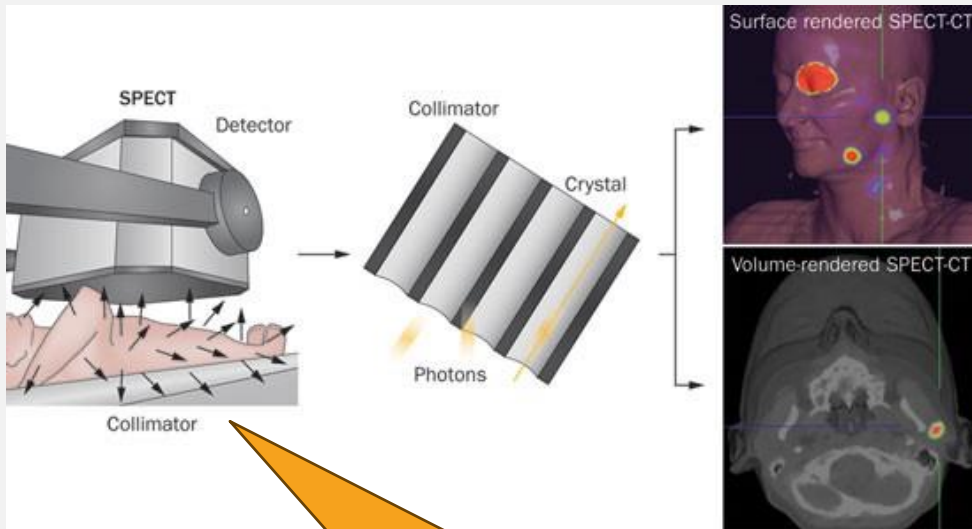
[Scanners]

[Radiation]

Dr. Paulien Moyaert

WHAT IS NUCLEAR MEDICINE?

IMAGING

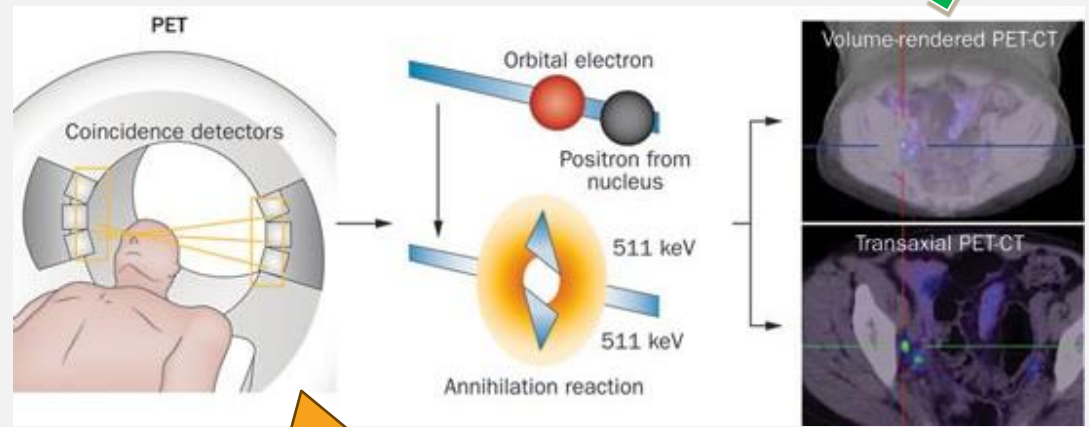
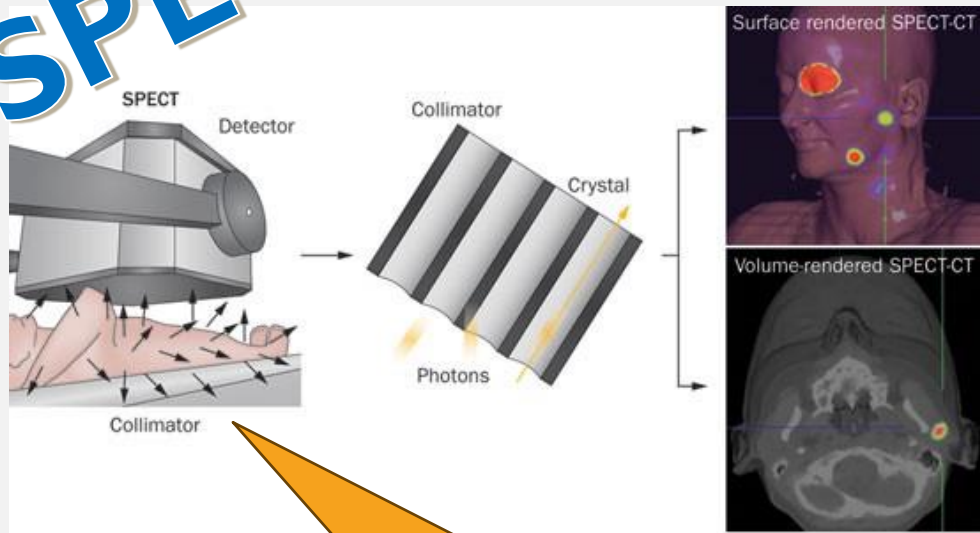


WHAT IS NUCLEAR MEDICINE?

SPECT

IMAGING

PET



WHAT IS NUCLEAR MEDICINE?

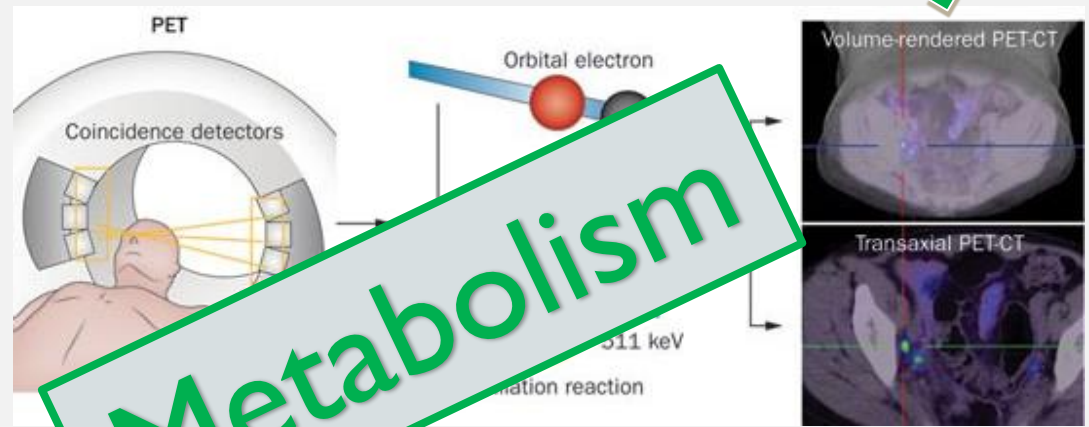
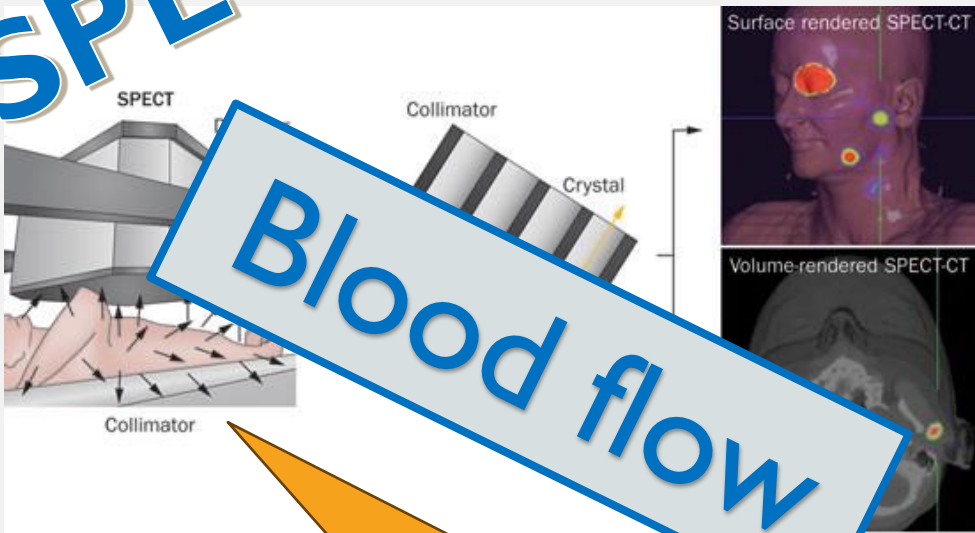
SPECT

IMAGING

PET

Blood flow

Metabolism



WHAT IS NUCLEAR MEDICINE?

SPECT

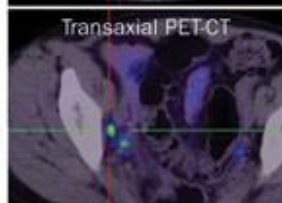
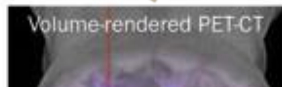
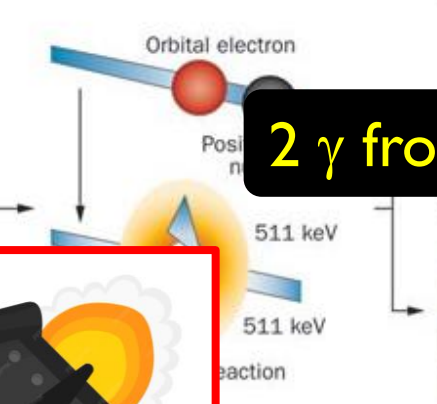
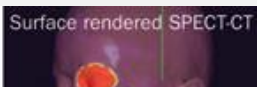
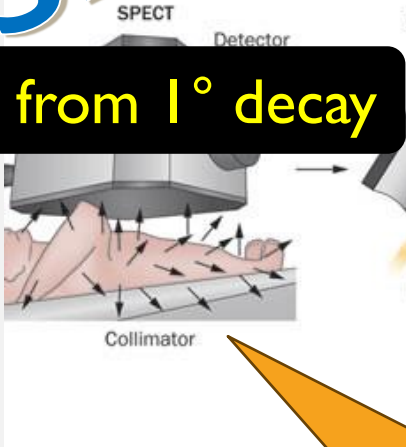
IMAGING

PET

Different nuclear properties

1 γ from 1^o decay

2 γ from 2^o decay

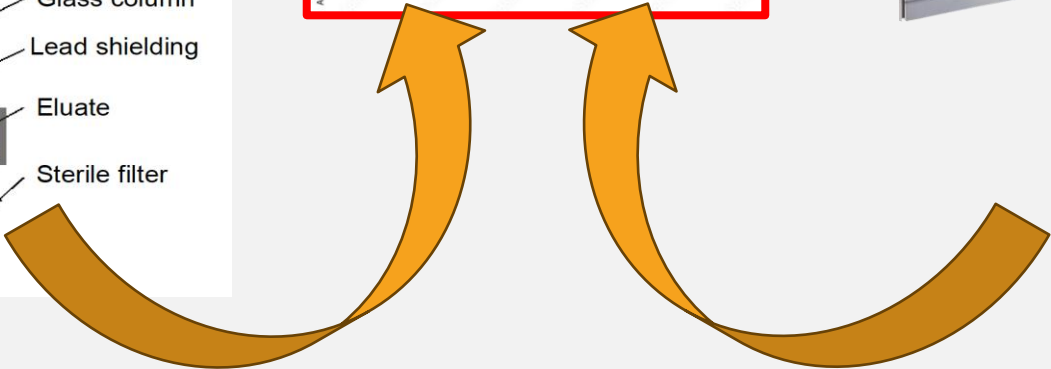
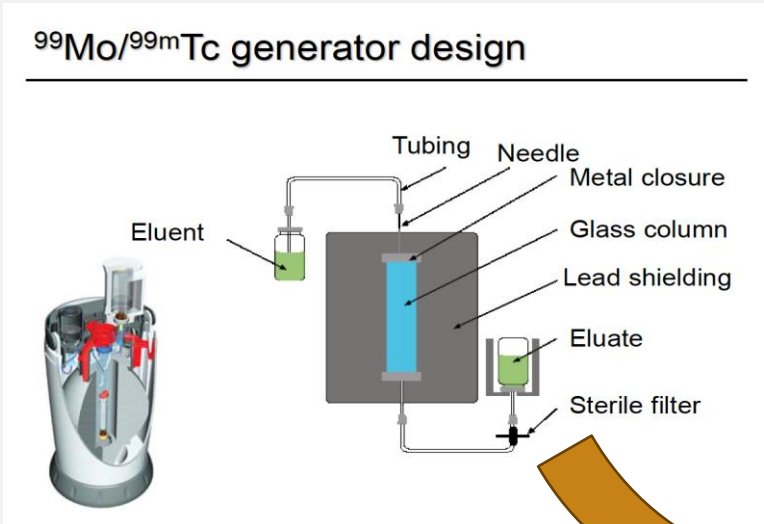


WHAT IS NUCLEAR MEDICINE?

SPECT

PRODUCTION

PET



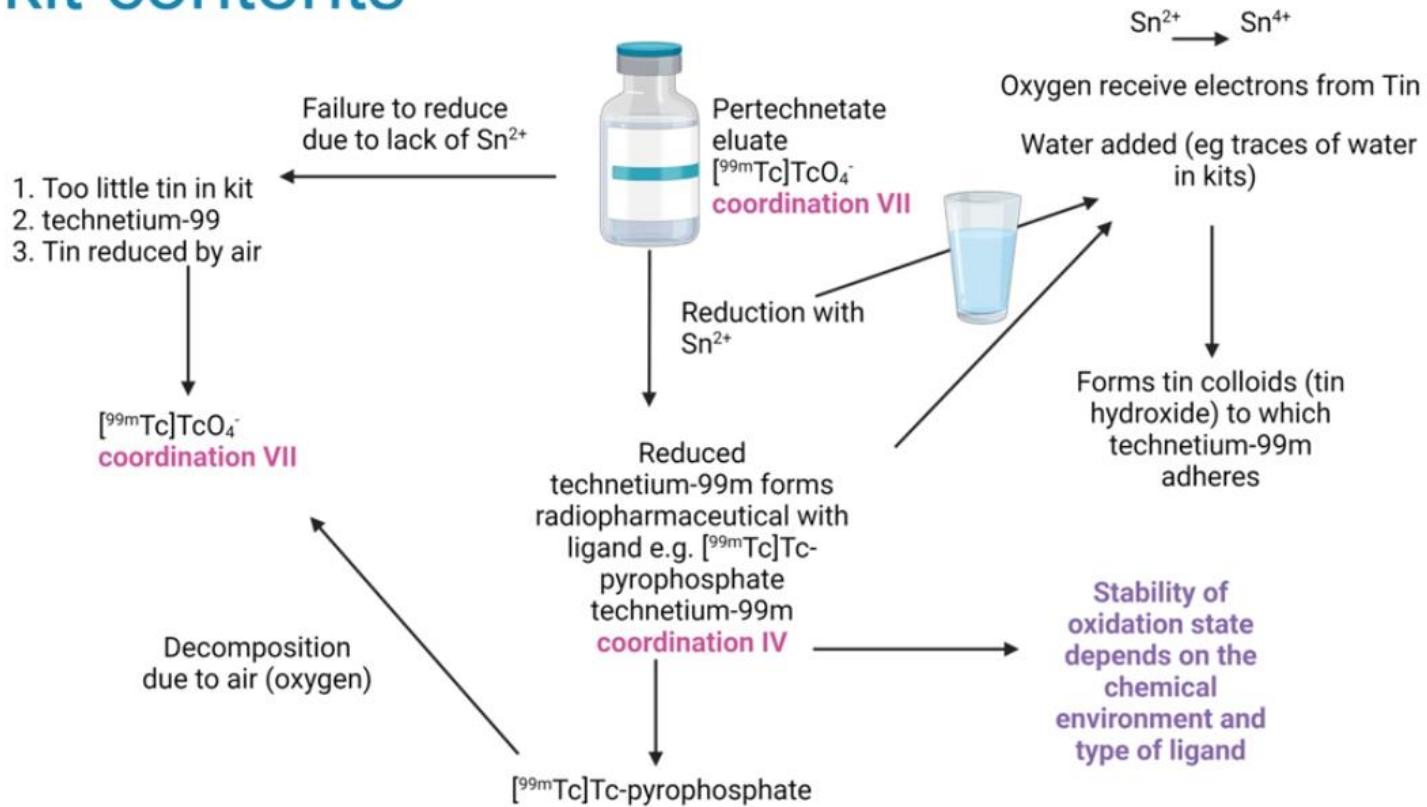
WHY ALL THE “NON-CHEMISTRY”?



SPECT LABELLING BASICS LECTURE...



Cold kit contents



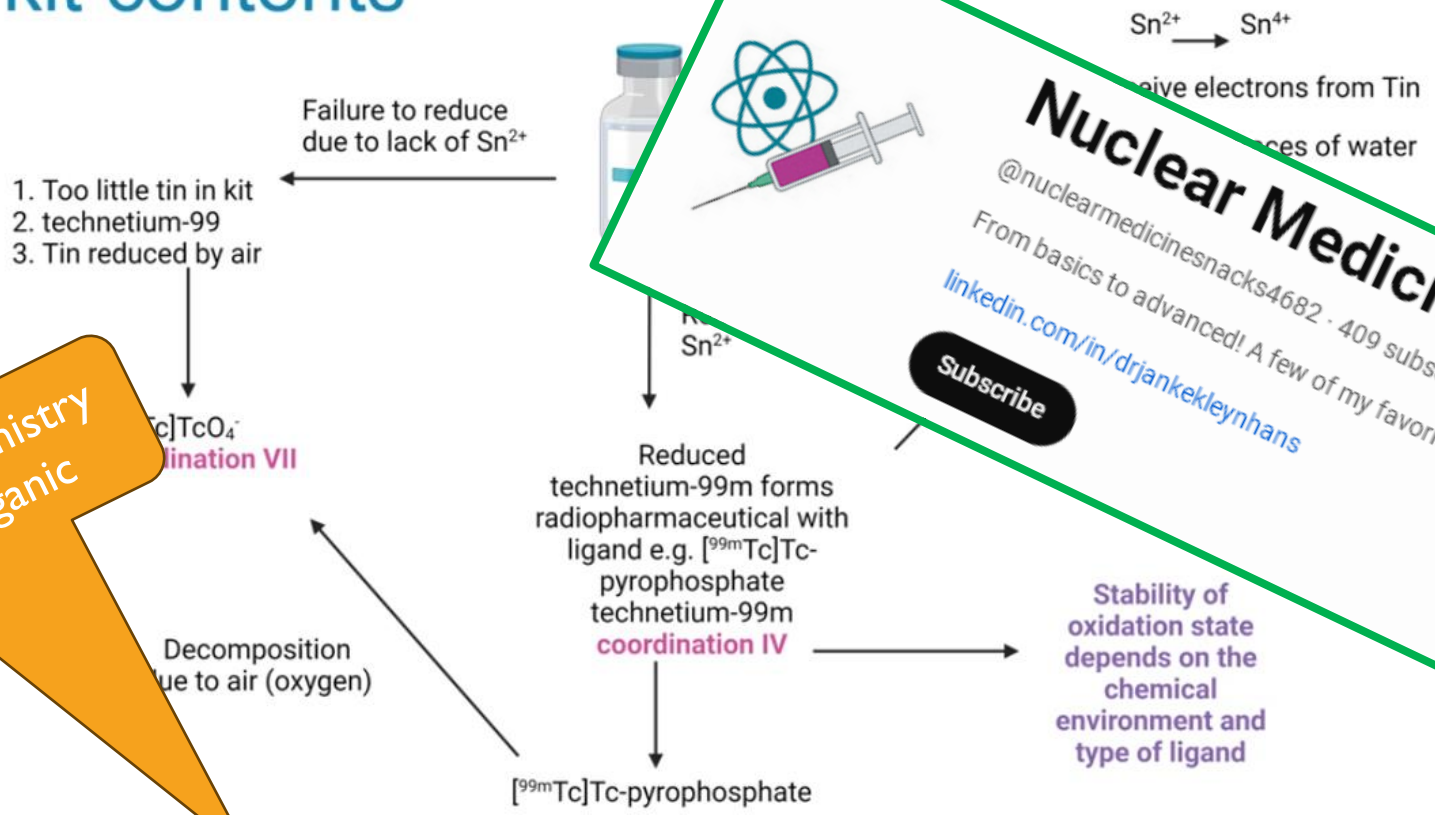
SPECT LABELLING BASICS LECTURE...



Cold kit contents



PhD Pharmaceutical chemistry
Busy with PhD in Organic



Nuclear Medicine Snacks

@nuclearmedicinesnacks4682 · 409 subscribers · 23 videos

From basics to advanced! A few of my favorite things in Nuclear Medicine. >

[linkedin.com/in/drjankekleyhans](https://www.linkedin.com/in/drjankekleyhans)

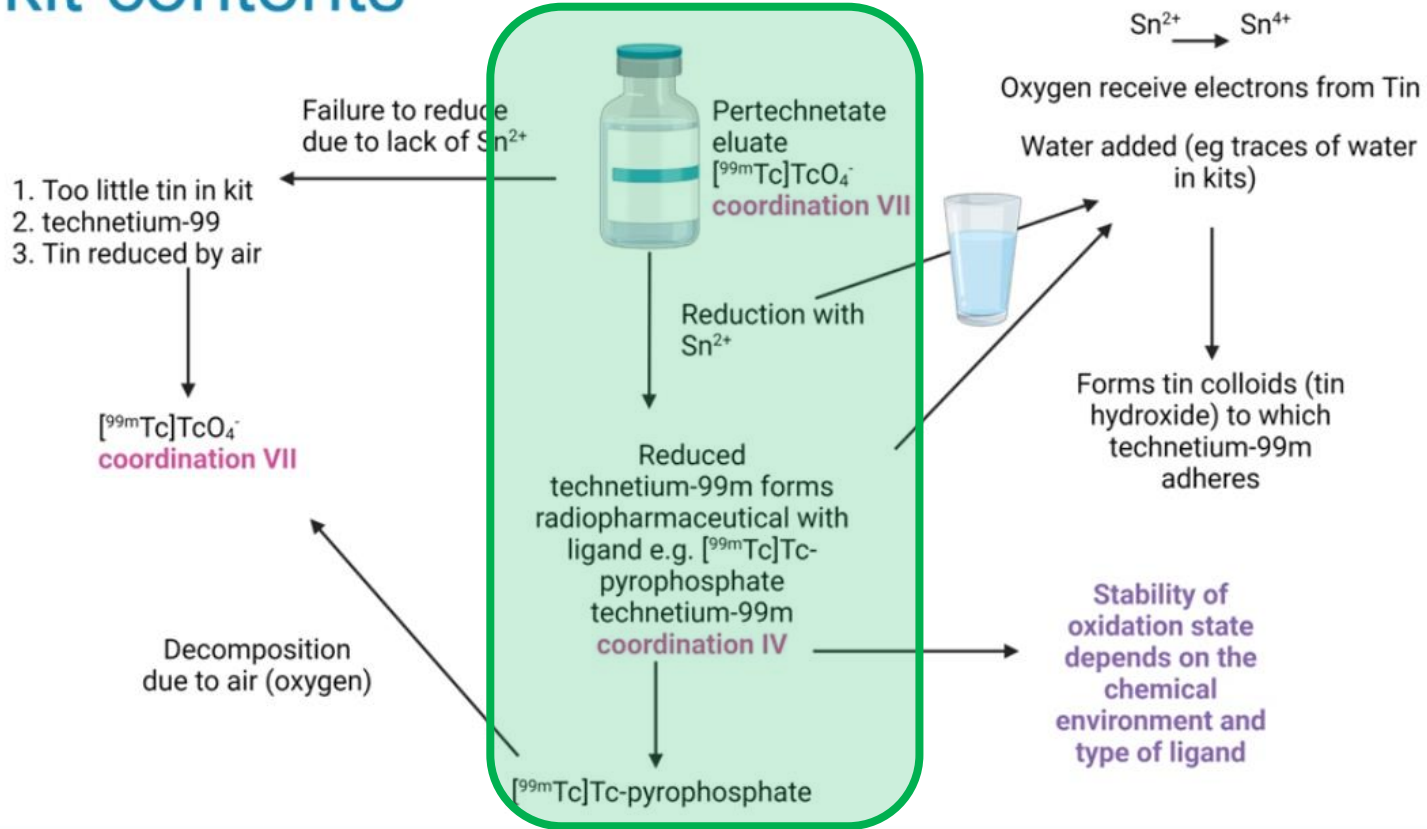
Subscribe



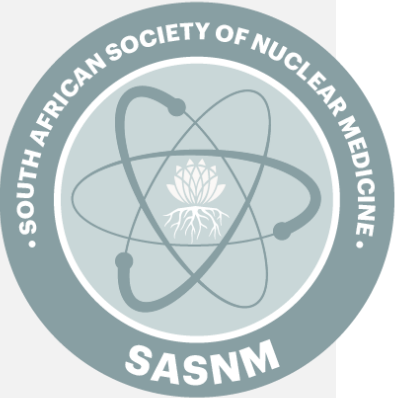
SPECT LABELLING BASICS LECTURE...



Cold kit contents



SPECT LABELLING BASICS LECTURE...



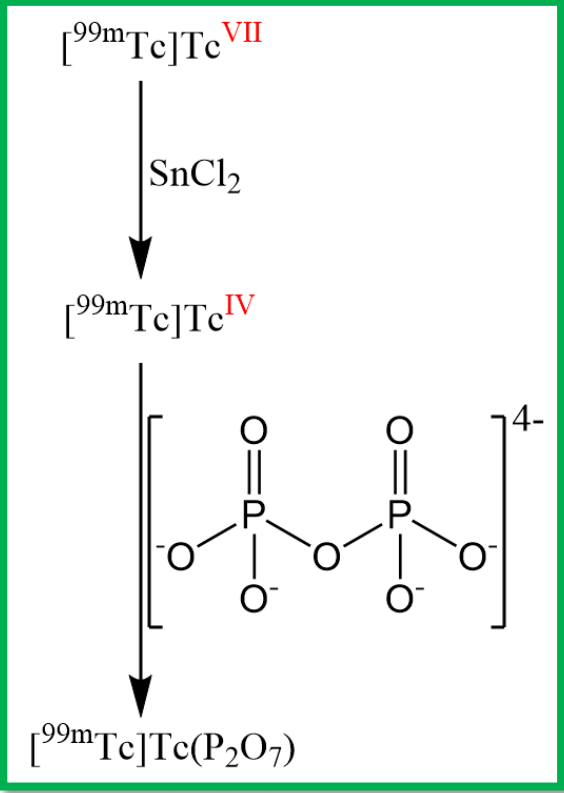
Cold kit contents

1. Too little tin in kit
2. technetium-99
3. Tin reduced by air



Decomposition due to air (oxygen)

Failure to due to lac



Oxygen receive electrons from Tin

Water added (eg traces of water in kits)

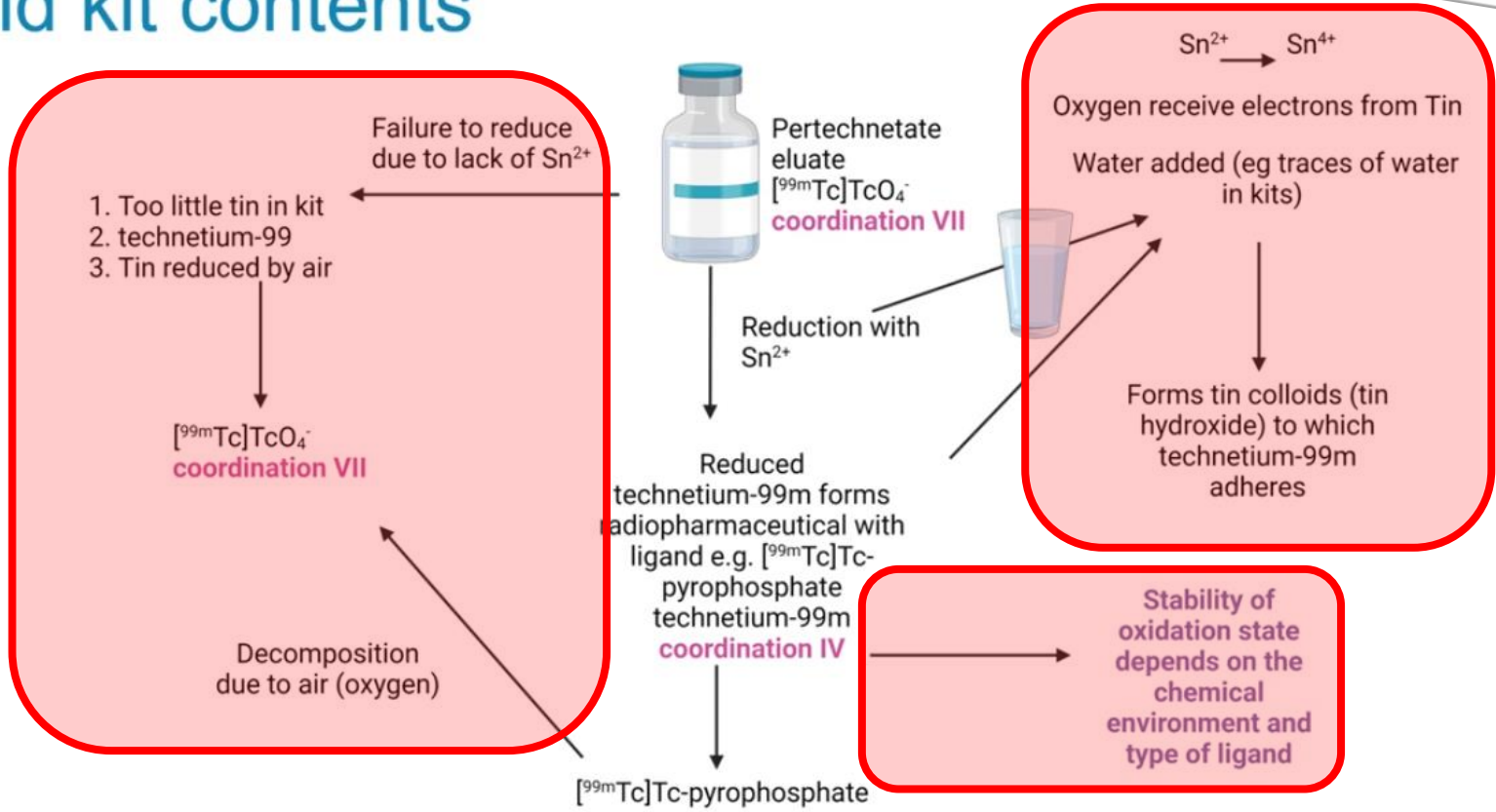
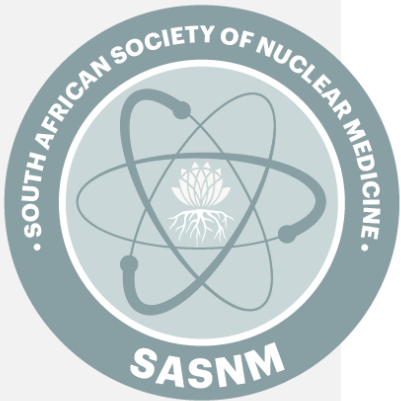
Forms tin colloids (tin hydroxide) to which technetium-99m adheres

Stability of oxidation state depends on the chemical environment and type of ligand

SPECT LABELLING BASICS LECTURE...



Cold kit contents



SPECT LABELLING BASICS LECTURE...

- **Fundamental chemistry!**
- Common **root causes** for product issues:
 - **Too little reducing agent** does not fully reduce metal centre.
 - **Exposure to air** depletes reducing agent.
 - **Presence of EtOH** during preparation displaces ligand.
 - Reagents not thawed prior to **temperature** dependent reaction.



SPECT LABELLING BASICS LECTURE...



- **Fundamental chemistry!**

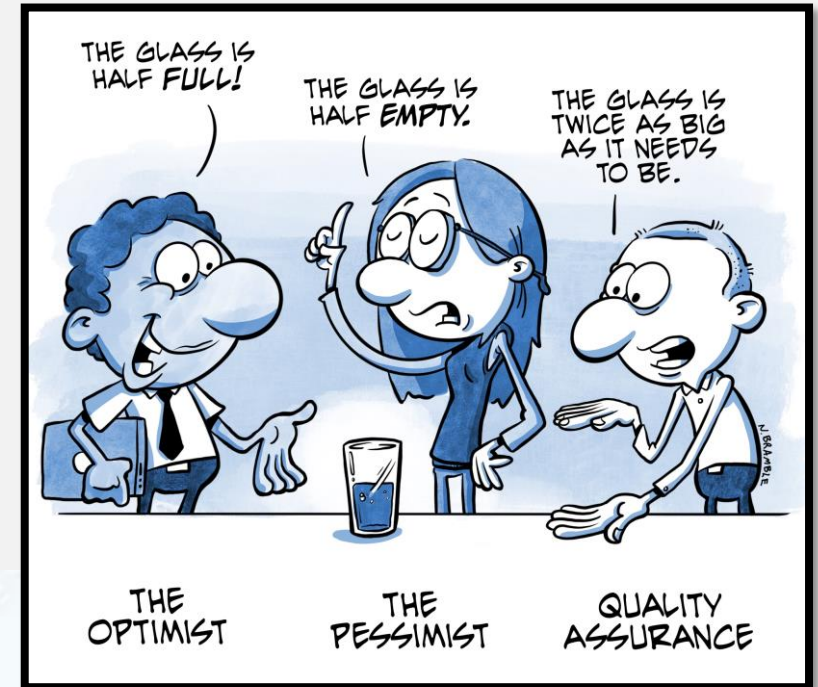
- Common **root causes** for product failure
 - Too little reducing agent
 - Excess oxidizing agent
 - Poor reagent preparation displaces ligand
 - Reagents not thawed prior to **temperature dependent**

Peanuts for proficient chemist



MY RESPONSIBILITIES

- Job title: **Quality Assurance Manager**
 - Ensure quality of product (safety of patient)
 - Constant evaluation and improvement
- How???



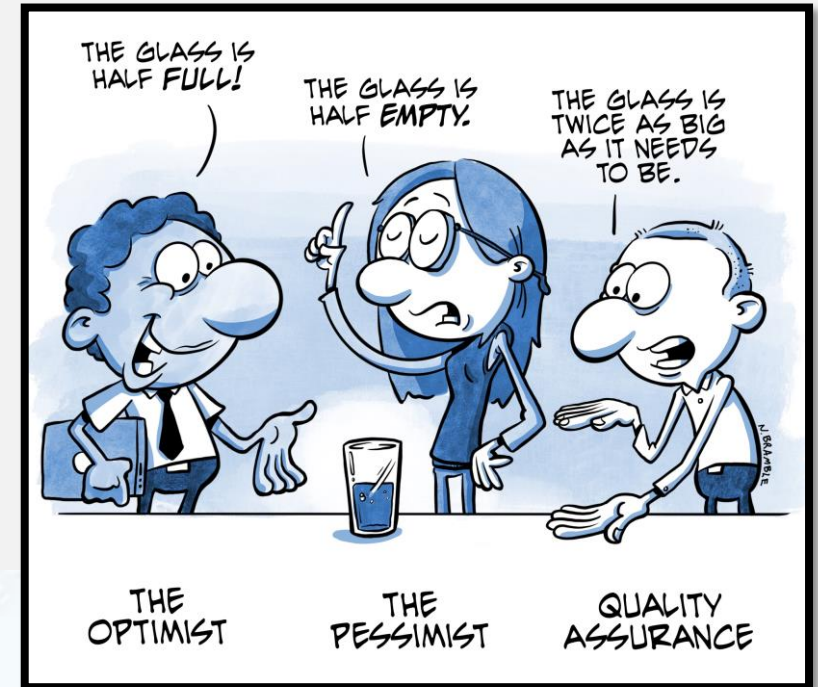
QUALITY ASSURANCE



Adobe Stock | #331682758

MY RESPONSIBILITIES

- Job title: **Quality Assurance Manager**
 - Ensure quality of product
 - Constant evaluation and improvement
- Use a **QMS** to manufacture according to **GMP**



QUALITY ASSURANCE



Standard



Quality



Guarantee



Improvement



Service



Satisfaction



Customer

Adobe Stock | #331682758

GOOD MANUFACTURING PRACTICE



- Good Manufacturing Practices (**GMP**) principles:
 - International regulations; locally enforced by SAHPRA



GOOD MANUFACTURING PRACTICE



- **Get More Paper** (GMP) principles:
 - International regulations; locally enforced by SAHPRA



GOOD MANUFACTURING PRACTICE



- Good Manufacturing Practices (**GMP**) principles:
 - International regulations; locally enforced by SAHPRA
- Quality Management System (**QMS**) ensures:
 - **Data integrity** – un-editable traceability from start to finish
 - **Validation** – consistent and repeatable result
 - **Procedures** – who must do what, how, when and where?



QUALITY MANAGEMENT SYSTEM



- Procedural **system** used to **manage quality** / risk

**Apply prof Pilcher's
holistic approach to systems**



QUALITY MANAGEMENT SYSTEM

- Procedural **system** used to **manage quality** / risk
- Examples of applying my skills:

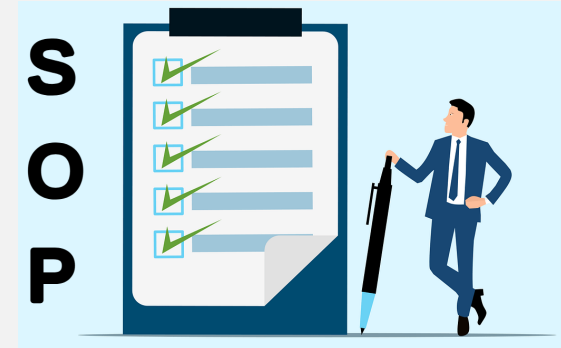


QUALITY MANAGEMENT SYSTEM

- Procedural **system** used to **manage quality** / risk
- Examples of applying my skills:
 - **Standard Operating Procedure (SOP)**

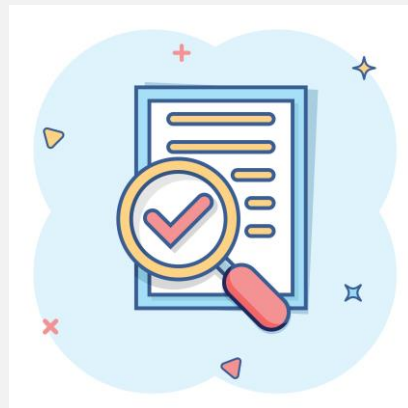
Document procedures:
Clear instructions
Structured documents
(Thesis; Publications)

Training:
Practical
Theoretical
(Demonstrator; Lecturer)



QUALITY MANAGEMENT SYSTEM

- Procedural **system** used to **manage quality** / risk
- Examples of applying my skills:
 - Standard Operating Procedure (SOP)
 - **Incident and Deviation reporting**



Independent work:
Unforeseen event; what do you do?
Crisis management
Attention to detail
(Lab work; Conference Q&A)

QUALITY MANAGEMENT SYSTEM

- Procedural **system** used to **manage quality** / risk
- Examples of applying my skills:
 - Standard Operating Procedure (SOP)
 - Incident and Deviation reporting
 - **Corrective / Preventative actions (CAPA)**



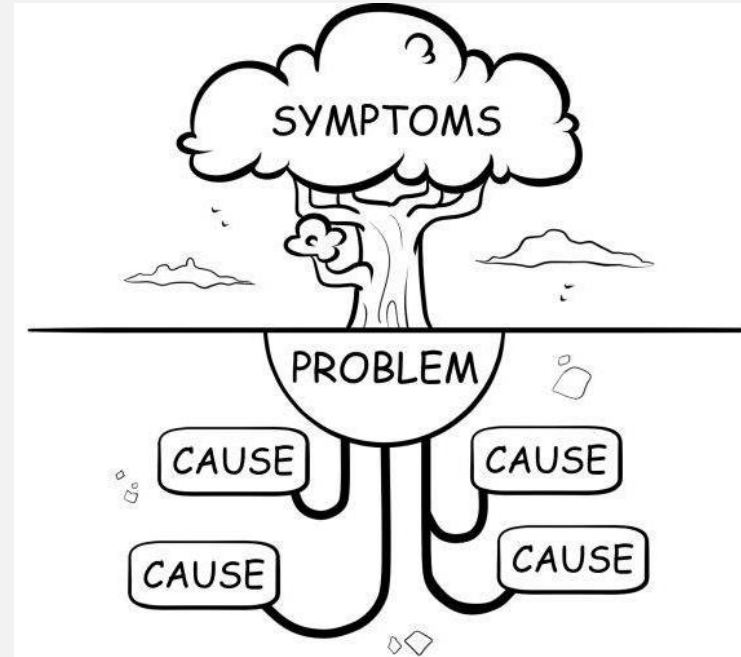
Team work:
Why did it happen?
Can it be prevented / improved?
(Literature search; Lab work)

QUALITY MANAGEMENT SYSTEM



- Procedural **system** used to **manage quality** / risk
- Examples of applying my skills:
 - Standard Operating Procedure (SOP)
 - Incident and Deviation reporting
 - Corrective / Preventative actions (CAPA)
 - **Root Cause Investigation (RCI)**

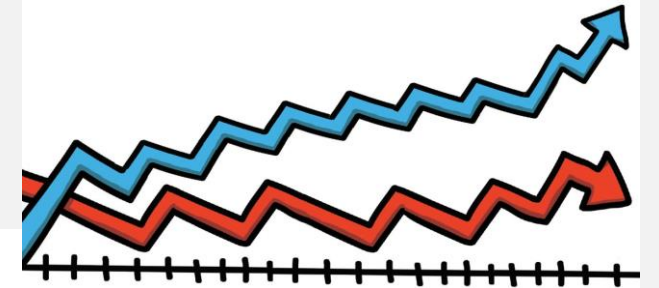
Team work:
Problem solving
Critical thinking
Evaluate evidence
(Group meetings)



QUALITY MANAGEMENT SYSTEM

- Procedural **system** used to **manage quality** / risk
- Examples of applying my skills:
 - Standard Operating Procedure (SOP)
 - Incident and Deviation reporting
 - Corrective / Preventative actions (CAPA)
 - Root Cause Investigation (RCI)
 - **Data analysis / Trending**

Independent work:
Problem solving
Critical thinking
(Lab work; Results & Discussion)



ALFRED. I ANALYZED CRIME TRENDS AND PATTERNS
AND IT LOOKS LIKE A SECOND WEEK OF MAY
WILL BE THE BEST TIME FOR A QUICK HOLIDAY.

 Dataedo /cartoon

Prot@Dataedo

ROLE OF THE CHEMIST

**“Everybody wants to do chemistry.”
Prof. Hlongathi, FW 2023**

- Why does the industry need proficient chemists?

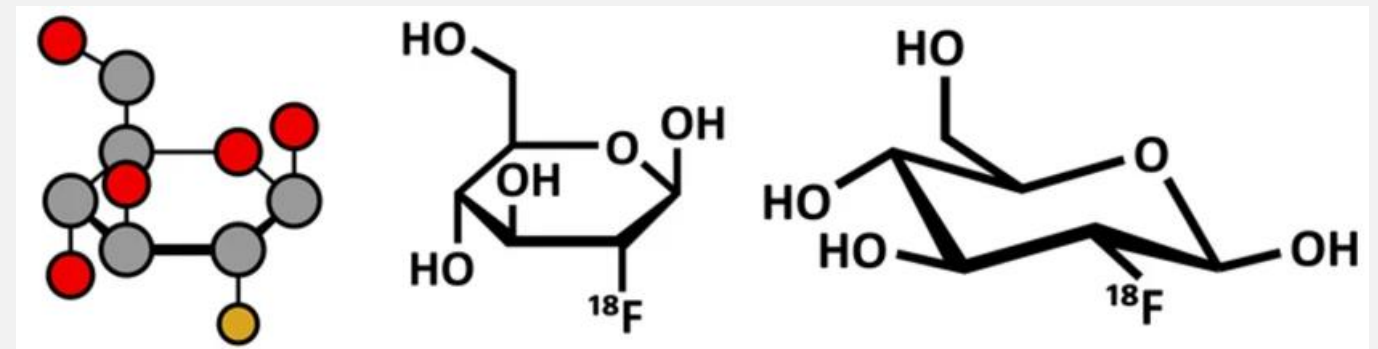
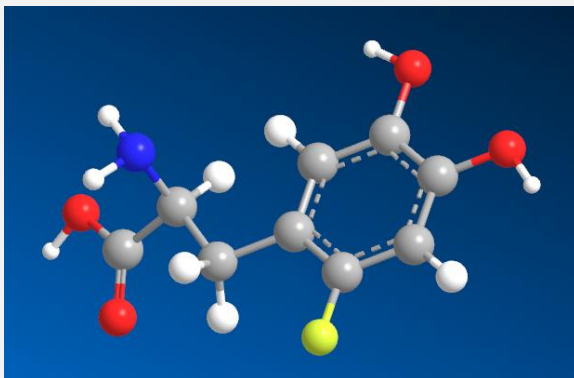


ROLE OF THE CHEMIST

Thank you, prof Ritter for
your introduction to PET

- Manufacture sterile injectables
 - ^{18}F -analogues (radioactive)
- Ensure safety, quality, efficacy

- *Would you inject yourself?*



ROLE OF THE CHEMIST

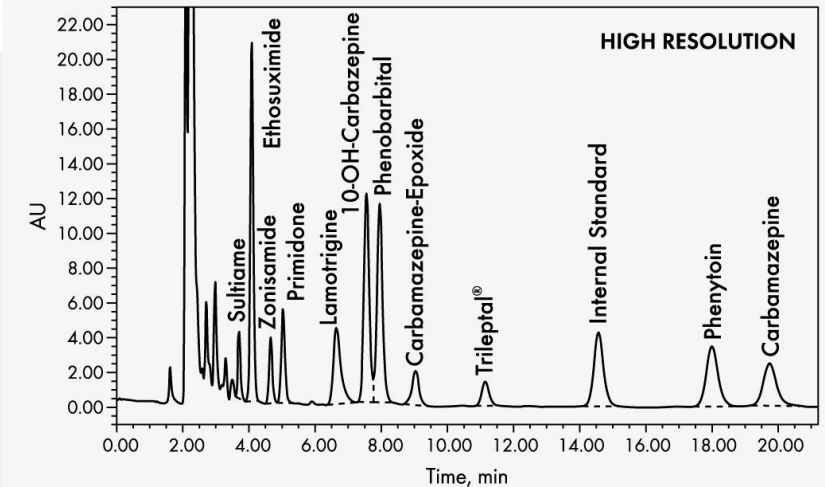
Chat with MICROSEP and mr Samuwi on method validations

- Analyse pharmaceuticals
 - Mainly cannabis
- Ensure accurate results

- *Do you trust the results?*



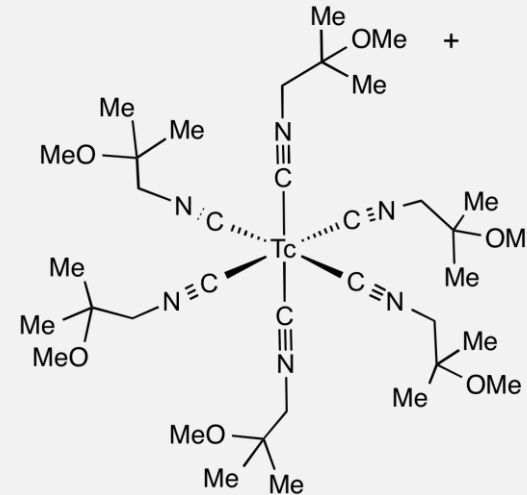
NAFS



ROLE OF THE CHEMIST

Next up...

- API synthesis
 - E.g. SPECT ligands (cold kits)
- Consistent quality products
- *Good enough for medicine?*



THANK YOU

NAFS

ASP isotopes



Custom
Chemical
Synthesis

CV submissions to Jenny de Villiers
jenny@connold.co.za

