Project:	Nanomedicine Synthesis	**Date:**	July 5, 2026
Researcher:	Dr. Evelyn Vance	**Entry No:**	104-A

Objective

To synthesize spherical silver nanoparticles (AgNPs) via chemical reduction of silver nitrate using sodium citrate as both the reducing agent and stabilizing capping agent. Size target is $20\,\text{nm}$.

Materials & Reagents

Silver Nitrate ($AgNO_3$):	$1.0\,\text{mM}$ aqueous stock solution, 99.9% purity (Sigma-Aldrich).
Sodium Citrate:	1% (w/v) tribasic dihydrate aqueous solution (Analytical Grade).
Solvent:	Ultra-pure deionized water ($18.2\,\text{M}\Omega \cdot \text{cm}$ resistivity).
Apparatus:	Cleaned 250 mL Pyrex Erlenmeyer flask, magnetic stirrer, thermometer.

Procedure

1. Clean all glassware with aqua regia followed by thorough rinsing with deionized water to prevent premature seeding and contamination.
2. Prepare $100\,\text{mL}$ of $1.0\,\text{mM}$ aqueous solution of silver nitrate ($AgNO_3$) in the 250 mL Erlenmeyer flask.
3. Heat the solution on a magnetic stirrer hotplate to a vigorous boil under constant stirring ($600\,\text{rpm}$).
4. Quickly add $10\,\text{mL}$ of 1% (w/v) sodium citrate solution to the boiling mixture.
5. Maintain boiling temperature and constant stirring for 25 minutes. Note the color changes at 5-minute intervals.
6. Remove from heat and allow the colloidal suspension to cool to room temperature. Store in a dark amber vial.

Observations

- **0 min:** Initial solution is completely colorless and clear.
- **5 min:** A faint yellow hue begins to develop, indicating nucleation.
- **12 min:** Color intensifies to a bright, golden yellow, indicating excitation of the surface plasmon resonance (SPR).
- **25 min:** Stable deep yellow/amber colloidal suspension. No precipitate or silver mirroring on the flask walls.

Project:	Nanomedicine Characterization	**Date:**	July 6, 2026
Researcher:	Dr. Evelyn Vance	**Entry No:**	104-B

Objective

To characterize the synthesized silver nanoparticles from Entry 104-A using UV-Vis spectrophotometry to determine peak absorption ($\lambda_{\max}$) and evaluate size distribution and monodispersity.

Materials & Reagents

Colloidal AgNPs: Synthesized solution from Entry 104-A (stored at $4\,^{\circ}\mathrm{C}$).
Blank Solvent: Deionized water ($18.2\,\mathrm{M\Omega \cdot cm}$ resistivity).
Apparatus: UV-Vis Spectrophotometer (Shimadzu UV-1900i), 10 mm quartz cuvettes.

Procedure

1. Turn on the spectrophotometer and warm up the light source for 15 minutes.
2. Perform baseline calibration using deionized water in both reference and sample cuvettes from $350\,\mathrm{nm}$ to $700\,\mathrm{nm}$.
3. Dilute the synthesized AgNP colloidal suspension 1:5 with deionized water to prevent detector saturation.
4. Rinse the sample cuvette with a small aliquot of the diluted suspension, then fill.
5. Run the wavelength scan and record the absorbance spectra.
6. Identify the wavelength corresponding to peak absorbance ($\lambda_{\max}$) and calculate the full width at half maximum (FWHM).

Results & Data Analysis

A summary of the spectrophotometric analysis for three consecutive dilution runs is tabulated below:

Sample Run	Peak $\lambda_{\max}$ (nm)	Absorbance (a.u.)	FWHM (nm)	Est. Size (nm)
AgNP-104A-Run1	418.5	0.842	54.2	18.5
AgNP-104A-Run2	420.1	0.865	55.0	20.2
AgNP-104A-Run3	419.8	0.859	54.8	19.8
Mean ($\pm$ SD)	**419.5 $\pm$ 0.8**	**0.855 $\pm$ 0.012**	**54.7 $\pm$ 0.4**	**19.5 $\pm$ 0.9**

Conclusion & Next Steps

The UV-Vis spectrum shows a sharp, symmetrical SPR peak at $419.5\,\mathrm{nm}$, indicating the successful synthesis of spherical silver nanoparticles with an estimated diameter of $\sim 20\,\mathrm{nm}$. The low FWHM ($54.7\,\mathrm{nm}$) confirms a narrow size distribution and good monodispersity.
Next steps: Perform Transmission Electron Microscopy (TEM) and Dynamic Light Scattering (DLS) to confirm nanoparticle morphology and hydrodynamic size.