

3D printen van gepersonaliseerde medicatie

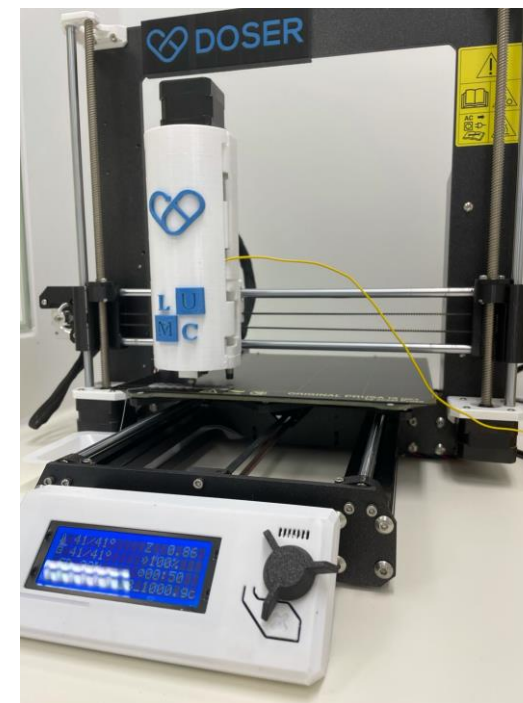


KJM Schimmel

Afd Klinische Farmacie en Toxicologie, LUMC



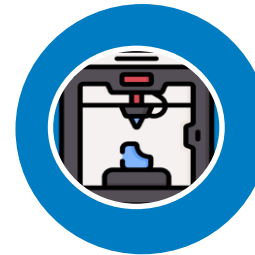
29 JUN 2021



Waarom 3D printing?



Toepassingen en Research



Techniek



Maatschappelijke aandacht:

3D printen wordt genoemd in top 10 pharmaceutical innovaties

(Cim Institute <https://www.giminstitute.org/index.php/2018/08/21/trends-pharmaceutical/>)

🏠 > [TNO Insights](#) > Medicijnen op maat make...

BLIK OP DE TOEKOMST

MEDICIJNEN OP MAAT MAKEN MET EEN 3D-PRINTER

17 juli 2020 • 3 min leestijd

Gezondheid & Zorg

Kennis- en Innovatieagenda 2020-2023

technologieontwikkeling? Welke soort beroepsinnovatie is er nodig in de preventie- en zorgberoepen, en in de beroepsstructuur als geheel?

Kennis- en innovatiecoalitie

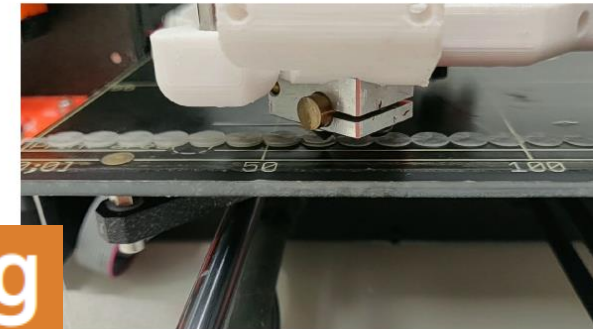
- Strategische PPP's: Preventiecoalitie, Extramuralisering,

Deliverables

- Samenwerking PPP's IMDI (waaronder CCTR, Neurocontrol, SPRINT) en Extramuralisering (technologie en therapie in de leefomgeving), incl. **3D-geprintte pillen**
- Bestaande/nieuwe PPP's verbonden met sleuteltechnologieën en -methodologieën, VWS-

Persoonlijke medicatie 3D-printer

Persoonlijke medicatie uit de 3D-printer



Close up van de printkop van de 3-D-printer. Beeld LUMC

...nieuwe technologie binnen de geneesmiddelenbereiding kan ervoor zorgen dat medicatie op maat krijgen.

1:00



NP-015: QUALITY ASSESSMENT OF 3D PRINTED SILDENAFIL AND FUROSEMIDE TABLETS FOR THE PAEDIATRIC POPULATION USING AN INNOVATIVE EXTRUSIONBASED TECHNIQUE

Seminar PC1 - Relax - your 3D printer is doing your work for you
ACPE UAN: 0475-0000-21-014-L07-P. A knowledge based activity.

Main auditorium

Pharm Res (2018) 35: 176
<https://doi.org/10.1007/s11095-018-2454-x>



EXPERT REVIEW

3D Printing in Pharmaceutical and Medical Applications – Recent Achievements and Challenges

Witold Jamróz¹ • Joanna Szafrańiec¹ • Mateusz Kurek¹ • Renata J.

Review Article

3D Printing technologies for drug delivery: a review

Leena Kumari Prasad & H...
 Pages 1019-1031 | Received 31 Aug 2...
 13 Dec 2015

Download citation | <https://>

Full Article | Figures & data



Drug Discovery Today

Volume 23, Issue 8, August 2018, Pages 1547-1555



Review

Post screen

Reshaping drug development printing

Atheer Awad^{1,†}, Sarah J. Trenfield^{1,†}, Alvaro Goyanes², Simon Gaisford



International Journal of Pharmaceutics

Volume 567, 15 August 2019, 118471



Direct powder extrusion 3D printing: Fabrication of drug products using a novel single-step process

Trends in Pharmacological Sciences



Review

3D Printing Pharmaceuticals: Drug Development to Frontline Care

Sarah J. Trenfield,¹ Atheer Awad,¹ Alvaro Goyanes,² Simon Gaisford,^{1,2} and Abdul W. Basit^{1,2,*}



International Journal of Pharmaceutics

Volume 603, 15 June 2021, 120694

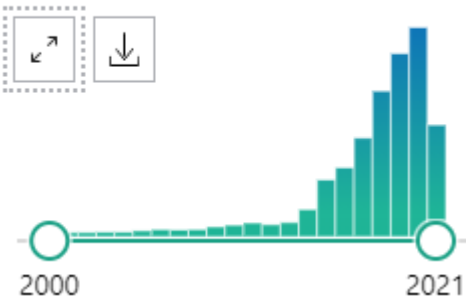
3D printed furosemide and sildenafil tablets: Innovative production and quality control

I. Lafeber^a, J.M. Tichem^a, N. Ouwerkerk^b, A.D. van Unen^b, J.J.D. van Uiter^b, H.C.M. Bijleveld-Olierook^a, D.M. Kweekel^a, W.M. Zaal^a, P.P.H. Le Brun^a, H.J. Guchelaar^a, K.J.M. Schimmel^a ✉

Show more

Pubmed: 3D printing pharmaceutical (20 juni 2021)

RESULTS BY YEAR

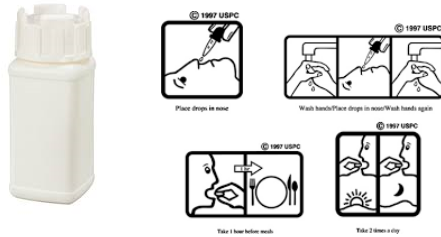


Individualiseren van farmacotherapie

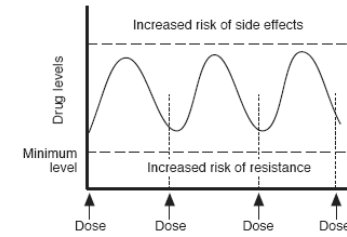
organ function



drug use



drug levels



special populations



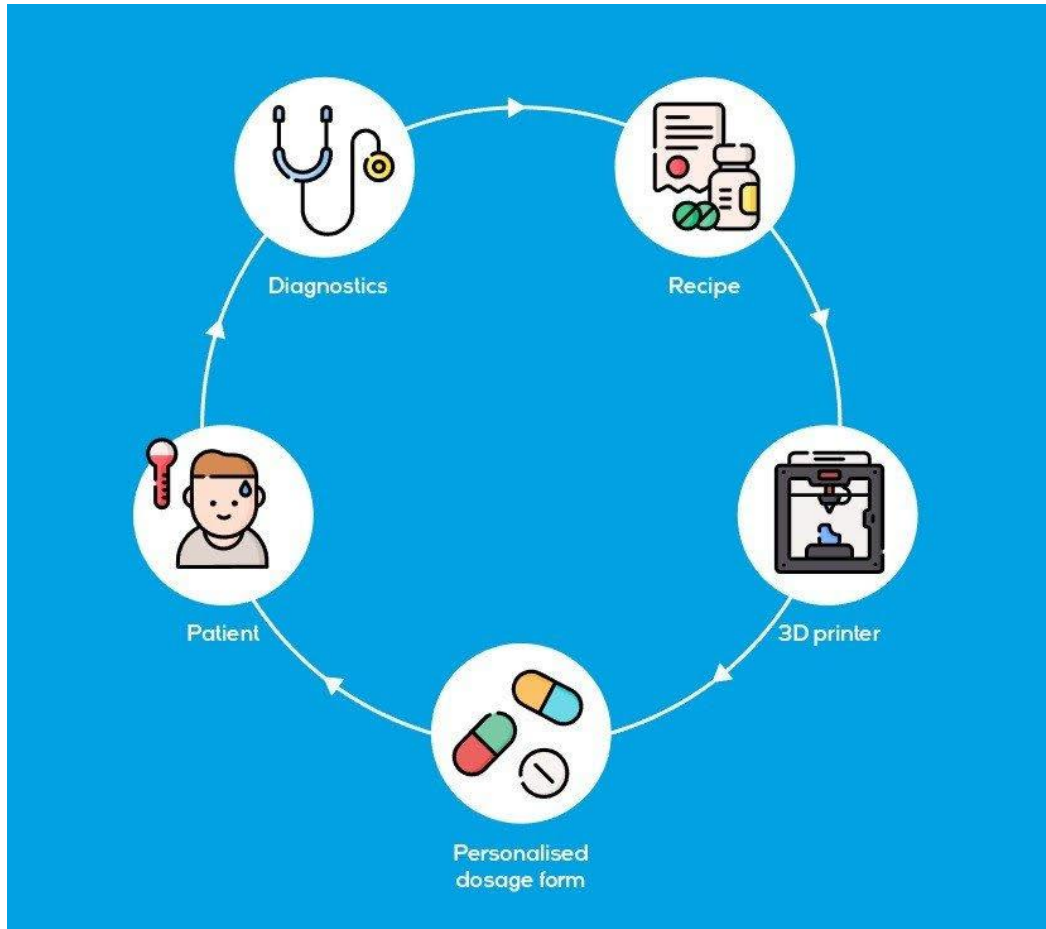
drug interactions

co-morbidity



Waarom 3D printen?

Gepersonaliseerde medicatie



Bron: dosermedical.com

Polypil



Geneesmiddel onderzoek en ontwikkeling



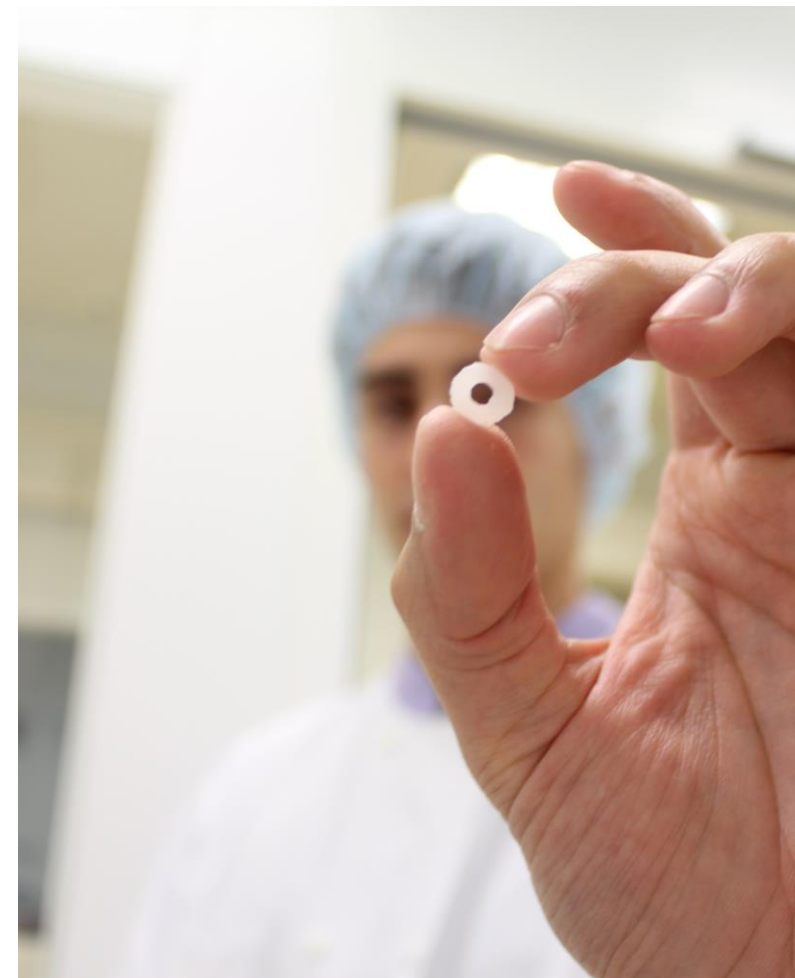
3D printen = flexibiliteit



Geneesmiddel A

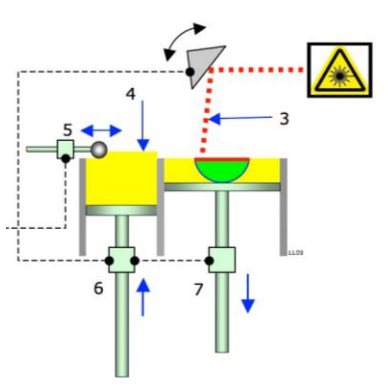


- Geneesmiddel A
- Placebo
- Geneesmiddel B
- Geneesmiddel C
- Geneesmiddel D
- Coating

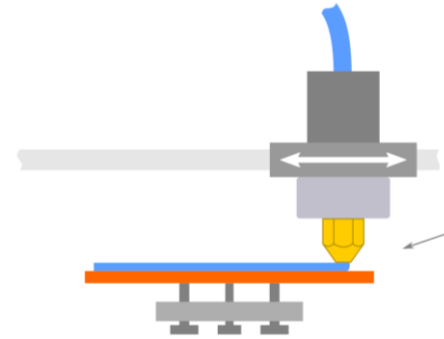


Technieken

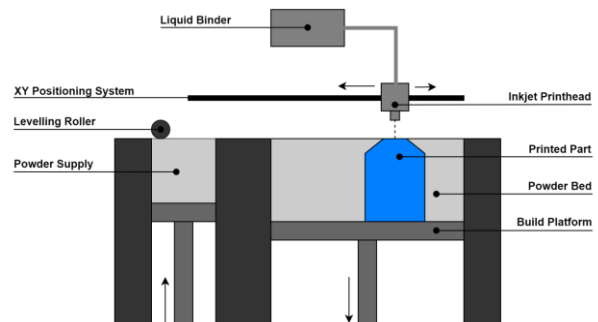
Selective laser sintering



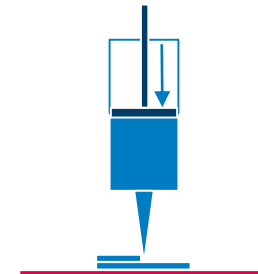
Fused deposition modelling



Binder jetting



Semi-solid extrusion



Voor wie? Polyfarmacie

- Poly-pil: nadelen nu:
 - Vast combinatie, inflexibel



- 3D geprinte polypil:
 - Dosis per middel aan te passen



Khaled SA, Burley JC, Alexander MR, Yang J, Roberts CJ. 3D printing of five-in-one dose combination polypill with defined immediate and sustained release profiles. *J Control Release*. 2015 Nov 10;217:308-14

Siyawamwaya M, du Toit LC, Kumar P, Choonara YE, Kondiah P, Pillay V. 3D printed, controlled release, tritherapeutic tablet matrix for advanced anti-HIV-1 drug delivery. *European journal of pharmaceutics and biopharmaceutics : official journal of Arbeitsgemeinschaft fur Pharmazeutische Verfahrenstechnik eV*. 2018



Geneesmiddelen op de markt:

- Te groot
- Verkeerde dosering

Drankjes en suspensies:

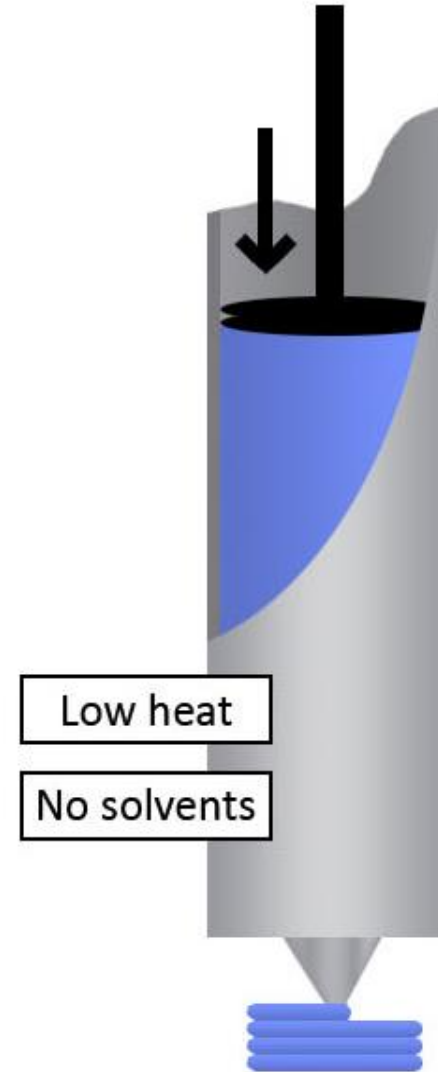
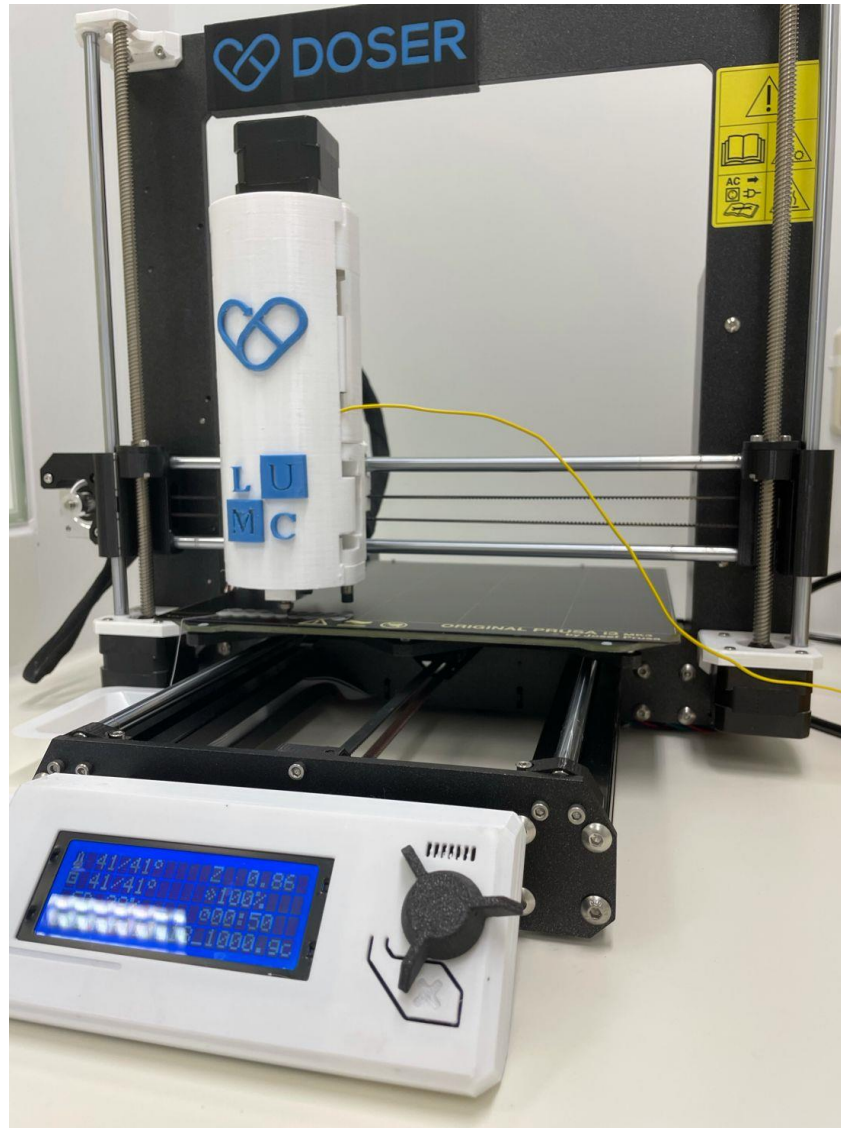
- Smaak
- Oplosmiddelen

Kinderen hebben liever minitabletten¹

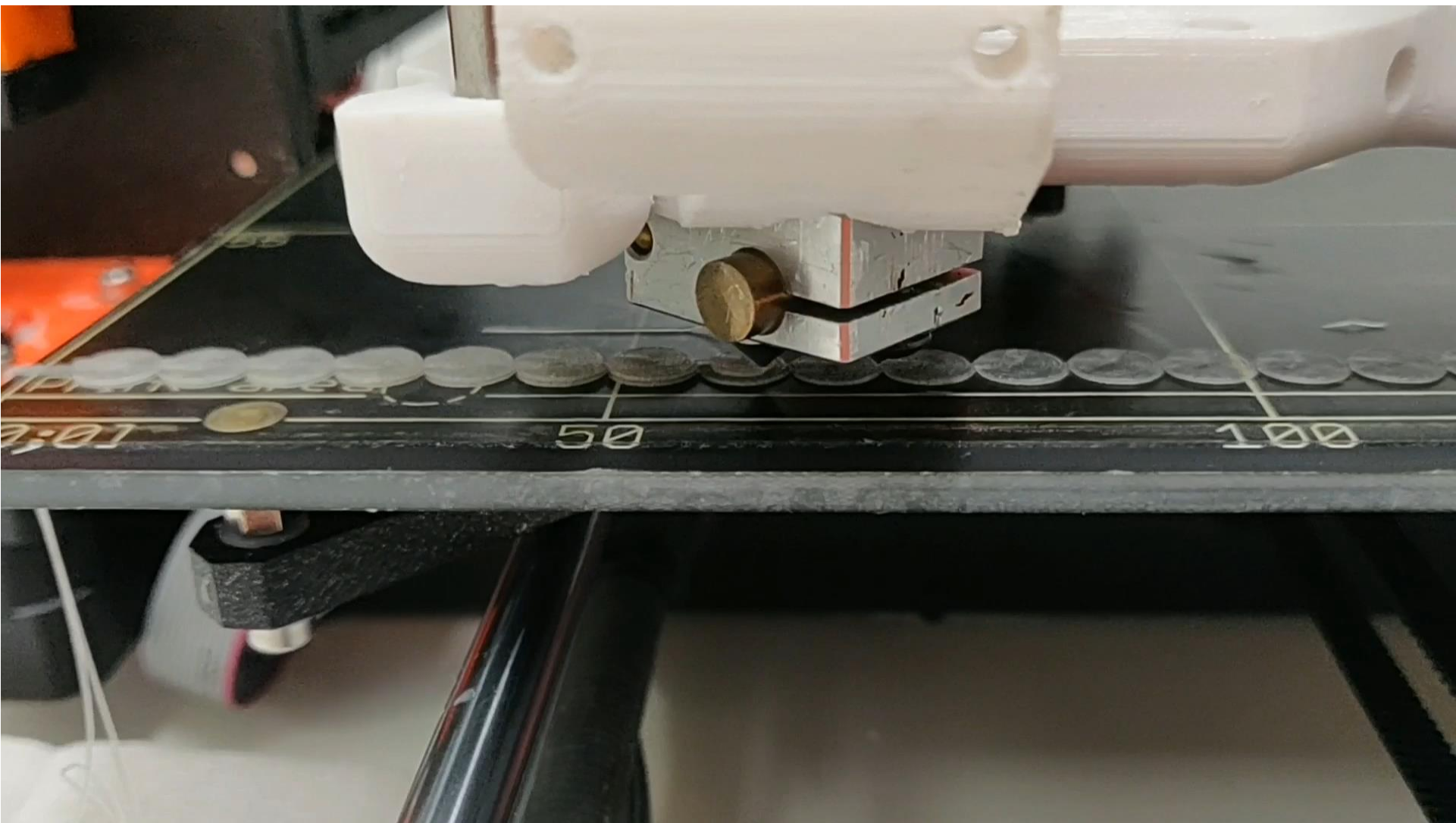


¹Van Riet-Nales DA, de Neef BJ, Schobben AFAM, Ferreira J, Egberts TCG, Rademaker CMA. Acceptability of different oral formulations in infants and preschool children. Arch Dis Child 2013 Sep;98(9):725-731

Hoe werkt de techniek in het LUMC?

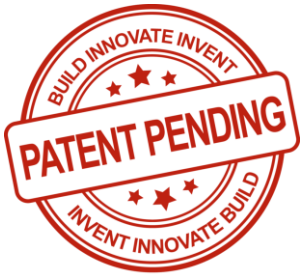


Hoe werkt de techniek in het LUMC?



Uitrol naar bredere inzetbaarheid:

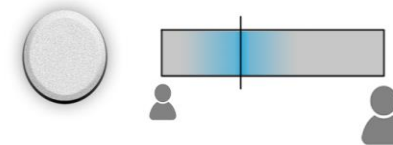
place medicine cartridge



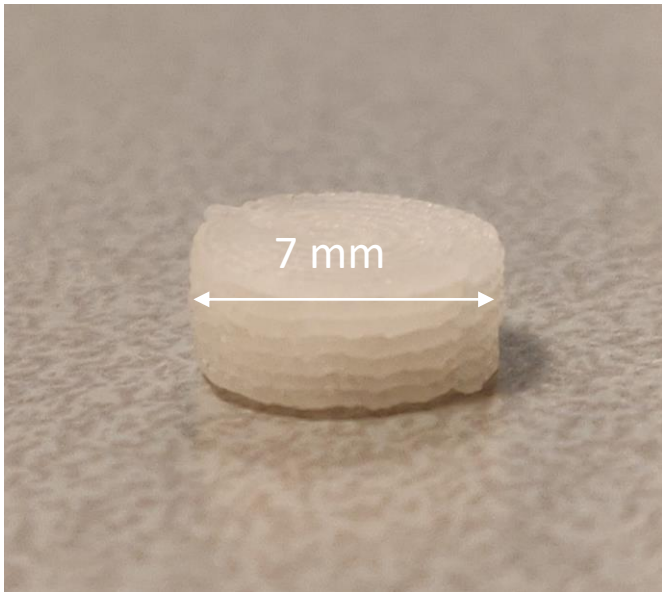
Unique features:
Low temperature
Formulation base
Prototype operates @LUMC



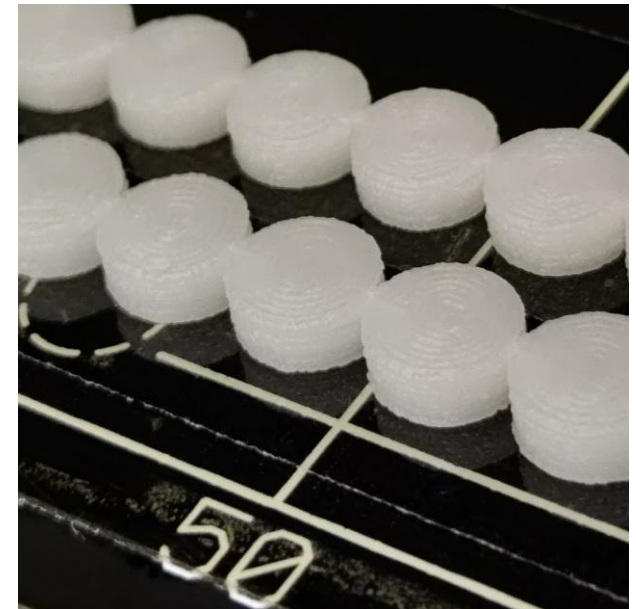
medication with
personal optimized dose



Wat kan er al gemaakt worden?

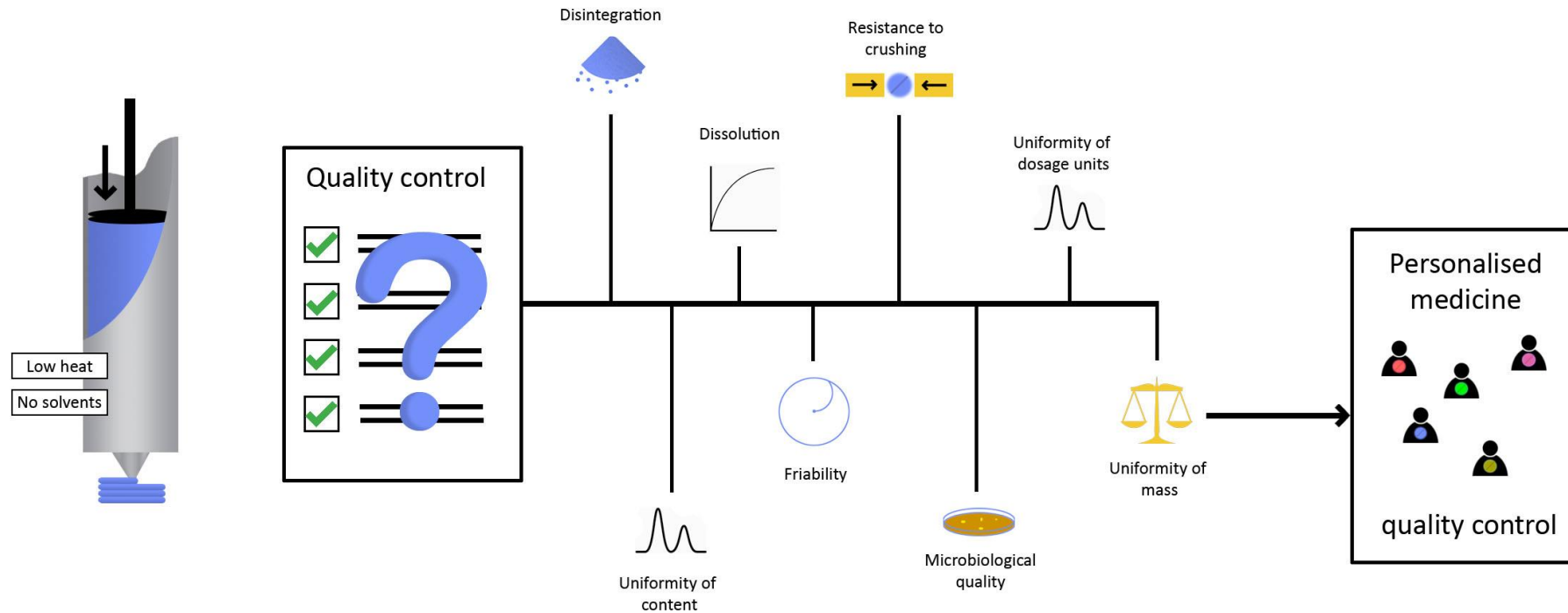


- Furosemide (2 mg; 10 mg)
- Sildenafil (4 mg; 7 mg; 10 mg)
- Toegepast bij kinderen:
- Bestaande formuleringen:
 - Vloeibaar
 - Of vaste hoge dosis



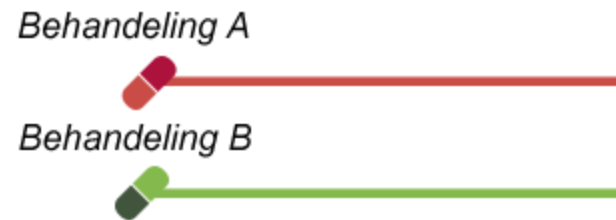
Zijn de 3D geprinte tabletten net zo goed als geregistreerde tabletten?

Research: Quality Control



Zijn de 3D geprinte tabletten net zo goed als geregistreerde tabletten? Research: Pharmacokinetisch

Cross-overonderzoek





Wat moeten we verder nog uitzoeken: Objectives LUMC



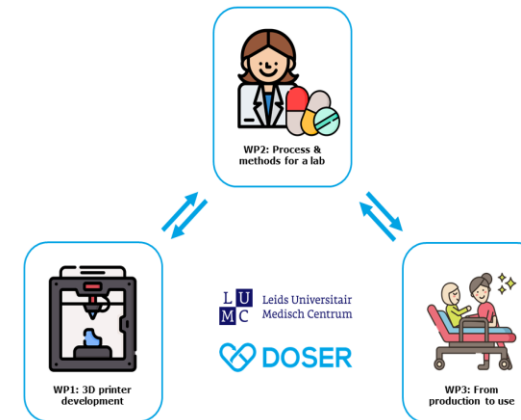
- 3D Printer optimaliseren
 - Meerdere koppen
 - Software optimalisatie
 - Simpele interface
 - GAMP compliant

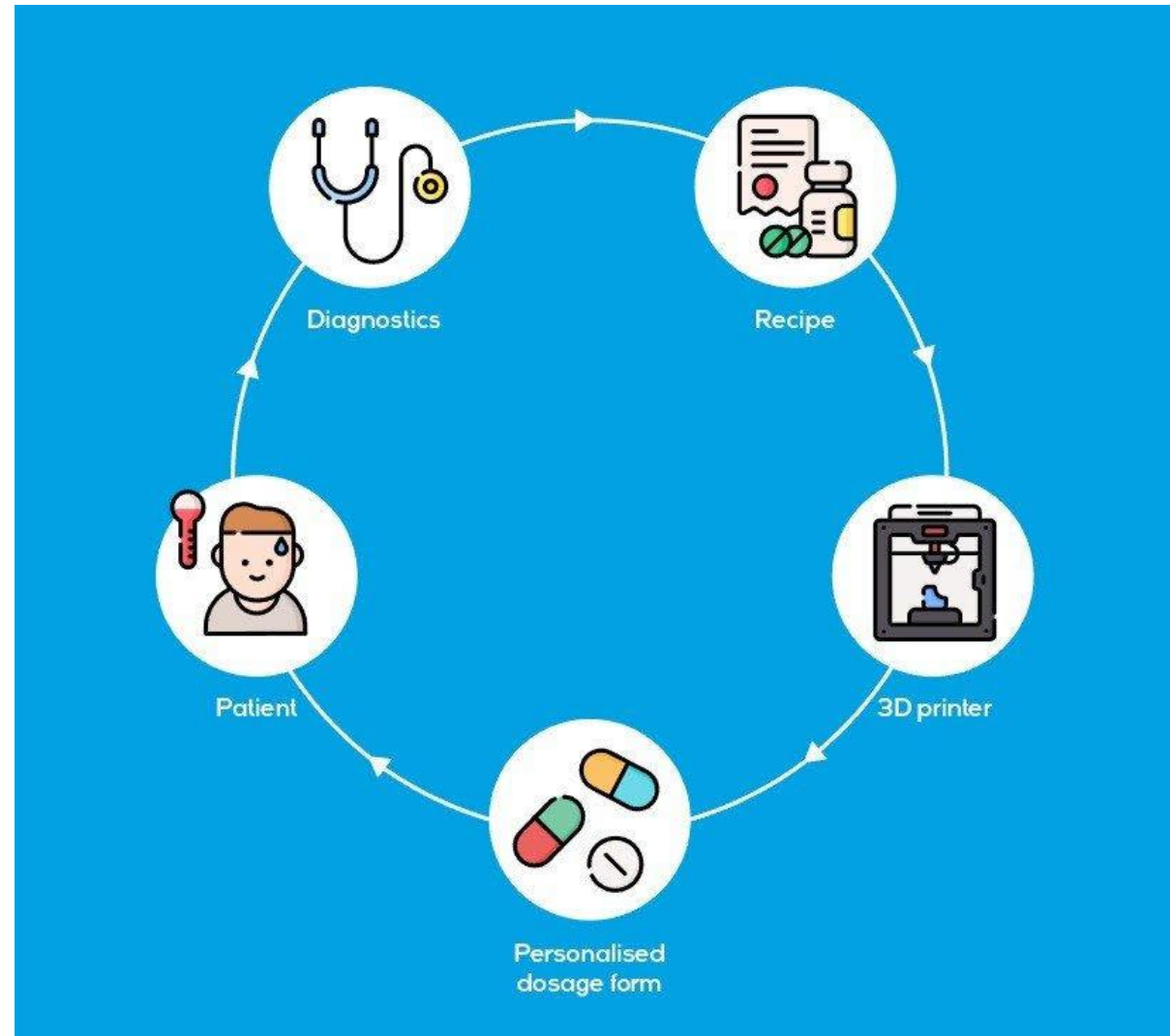


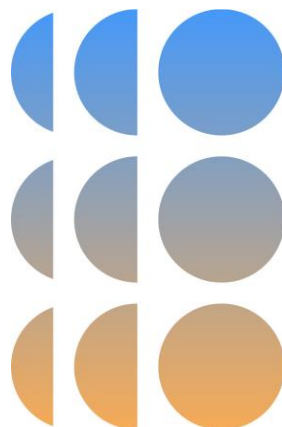
- Formulering optimaliseren
 - Invloed van temperatuur, printsnelheid
 - Invloed van de ingredienten



- Van product naar mensen
 - Farmacokinetisch onderzoek: Bioequivalentie
 - Proof of principle personalised 3D geprinte tabletten obv pharmacogenetische mutaties
 - Regulator: waar wordt techniek ingezet, registratie ja/nee?







Nationaal
Farmaceutisch
Kenniscentrum



BACKUP SLIDES