出國報告(出國類別：開會)

參加歐洲生物高峰會(4th Bio Summit: Europe)－第五屆定量 PCR 及數位 PCR 研討會 (5th qPCR & Digital PCR Congress)

服務單位：衛生福利部食品藥物管理署

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壹、 緣起及目的

定量 PCR (real-time PCR)利用在核酸增殖過程中螢光訊號同步放大之特性，具快速、即時偵測之效果，並搭配標準品配置之檢量線達到定量目的。該技術定量範圍廣、成本不高、操作流程可標準化，並可進一步發展為高通量(high throughput)檢測平台，廣為各研究領域使用，許多分子生物檢測試劑大廠皆發展、出售以定量 PCR 打造之檢測試劑套組，國際官方檢驗方法常以定量 PCR 方法作為快速篩檢或是定量檢測方法。然而，若 PCR 反應效能未達 100%，定量結果易有低估之情況，例如檢體中含有抑制 PCR 的物質、如遇成分較為複雜之檢體或核酸序列因變異而無法與引子或探針完全互補，將明顯降低螢光訊號強度，而唯螢光訊號強度有 2 倍以上差異才算是在定量上有意義的差異，因此明顯削弱定量 PCR 之定量範圍及解析度。

數位 PCR (digital PCR)又被稱作第三代 PCR，與定量 PCR 不同在於檢體進入 PCR 增殖反應前，先以油滴技術(droplet)或晶片平台(chip)將樣本劃分成百至上萬的反應小單元，以至有些小單元不含核酸分子，或僅含單一核酸分子。之後每個反應小單元同步進入 PCR 增殖反應，在反應結束後檢視每個小單元是否有螢光訊號，統計具有螢光訊號的小單元數目，而每個具有螢光的小單元並非皆均僅含單一

目標核酸分子，因此再以 Poission distribution 統計方式校正之，以接近真實中檢體含有目標核酸分子數量(copy number)。由於數位 PCR 數據無須借助檢量線等間接定量方式，以 copy number 直接呈現定量結果，且該系統可發展多色螢光系統，達到相對定量或多目標同步定量之目的，且因樣本進入 PCR 反應前已被劃分成眾多反應小單元，即使原先檢體中含有 PCR 反應抑制物，在檢體被劃分同時，最後留存於單一反應小單元的抑制物濃度已相對十分低，有效降低其對 PCR 效率的影響程度。因此，相對於過去的定量 PCR，數位 PCR 可有效改善原先存在於定量 PCR 的致命缺點，展現高靈敏性、高準確性且多目標的定量能力。

有鑑於數位 PCR 為新一代核酸定量檢驗技術，現為國際間分子生物檢驗之未來趨勢，亦為本署在食品生物檢測能力發展重點。本次參加之歐洲生物高峰會—第 5 屆定量 PCR 及數位 PCR 研討會將針對定量 PCR 及數位 PCR 技術檢測上之應用、方法開發及評估進行探討，會中出席者皆為新穎分子生物技術之國際知名專家學者，出席該會可即時與其交流獲其寶貴經驗並擴展國際人脈，以期提升本署於分子生物檢驗之研究開發與國際同步。

貳、 過程

日期	地點	行程
12/3	台北-泰國曼谷-英國倫敦	啟程
12/4-12/5	英國倫敦 Novotel London West	歐洲生物高峰會－第五屆定量 PCR 及數位 PCR 研討會
12/7-12/8	英國倫敦-泰國曼谷-台北	返程

參、 第五屆定量 PCR 及數位 PCR 研討會

本次筆者參加由 Global Engage 於英國倫敦 Novotel London West 飯店舉辦第四屆歐洲生物高峰會(4th Bio Summit – Europe)，係在 Novotel Lon West 二樓數間會議室同時進行「第五屆定量 PCR 及數位 PCR 研討會(5th qPCR & Digital PCR Congress)」、「第四屆合成生物學及基因編輯研討會(4th Synthetic Biology & Gene Editing)」、「第三屆微流體研討會(3rd Microfluid Congress)」及「次世代定序技術及應用研討會(NGS technique & application)」(如圖一、二、三)，凡選擇其中一項研討會，即可自由至其他 3 項研討會聆聽之，大會提供手冊亦以單一時間軸將 4 項研討會議程並列(如附件一)，並針對每位講者之背景、專長及當日講題摘要分別列出，使與會者在會議前快速瞭解每項講題重點，方便規劃安排想要聆聽的演講場次，以及會後向講者討論交流之議題。

相較於去年第四屆定量 PCR 及數位 PCR 研討會議程內容偏重於定量 PCR 及數位 PCR 在醫療、植物、食品、環境等領域之研究及應用，本屆大會邀請國際知名在定量 PCR 及數位 PCR 技術之專家學者，分享定量 PCR 及數位 PCR 技術之特性、實驗設計、平台操作及數據分析須注意之細節，其中第一天上午議程為大會邀請在數位 PCR 方

法建置及確效評估有著豐富經驗的、任職於澳洲國家測量研究所(National Measurement Institute)的 Kerry Emslie 博士，分享澳洲國家測量研究所如何建立、評估數位 PCR 技術，以及如何將數位 PCR 技術應用至 DNA 參考物質進行精準定量，以及其他領域之檢測；下午議程數位 PCR 及定量 PCR 分別在 2 個會議室進行，其中定量 PCR 議程針對定量 PCR 使用策略及技術開發進行探討，數位 PCR 則是聚焦於數位 PCR 特性、技術優化、數據分析、該技術與其他新穎分子生物技術(如次世代定序技術)之結合及未來普遍使用於臨床診斷之可能性。

圖一、第四屆歐洲生物高峰會演講會場入口

圖二、進行「第五屆定量 PCR 及數位 PCR」之演講廳

圖三、進行「次世代定序技術及應用研討會」之演講廳

本屆大會邀請 Kerry Emslie 博士，以「Digital PCR for high accuracy measurement of DNA reference materials」為題，詳細說明 digital PCR 在核酸物質定量上的潛力、digital PCR 技術及數據分析可能產生的誤差，以及其所屬之澳洲國家測量研究所如何致力於 digital PCR 之方法建立及多項檢測領域之應用。澳洲國家測量研究所的任務

係建立參考檢驗方法(reference method)及提供確效用參考物質(reference materials)，因相中數位 PCR 具準確定量之特性，自 2006 年起，澳洲國家測量研究所致力於數位 PCR 技術之評估，及其在各檢測領域之應用潛力。在多年研究下，Kerry Emslie 博士所率領之研究團隊歸納會影響數位 PCR 準確性(accuracy)及精密性(precision)的各項因子，其中最重要為在進入 PCR 增殖前將樣本劃分成之反應小單元個數、每個反應小單元之體積是否一致、數據分析時劃分螢光正反應訊號及背景螢光訊號之閾值線(threshold)，以及操作人員熟練度、吸取檢體及試劑過程產生之體積誤差等。在針對數位 PCR 可能產生誤差之關鍵因子進行確認，Kerry Emslie 博士成功藉由油滴式數位 PCR 建立多項檢測領域之定量檢驗方法，並運用數位 PCR 技術完成多項過去不易精準定量之核酸參考物質之確效，並且在 2016 年在知名期刊發表核酸參考物質之建立流程[(1)(2)]，並闡述數位 PCR 在其中所扮演之角色。

另外，在其後發、來自冰島的 Jon Josson 博士發表有關核酸分子本身構形(conformation)在數位 PCR 定量數據上的影響，核酸分子若以超螺旋形式進入 digital PCR 反應，該構形明顯阻礙聚合酶，降低 PCR 反應效能，進而造成定量數據之低估，因此在進行數位 PCR 前，

Jon Josson 博士建議先以如 Northern Lights Assays 之二維核酸電泳技術分析樣本中核酸物質之構型，以確認是否需先破壞原有核酸分子構形之樣本前處理[3]。

另外，在有關高通量定量 PCR 的應用中，任職於法國食品，環境和職業健康與安全局(the French Agency for Food, Environmental and Occupational Health & Safety)的 Sara Moutailler 博士發表其所屬之 Vectotiq Team 如何運用 Fluidigm Biomarker real-time PCR system 搭配 96 x 96 或 48 x 48 晶片，發展出同步偵測由蜱為媒介傳播之細菌、病毒、寄生蟲及其他病原微生物。近年由於氣候變遷，在歐美地區以蜱為媒介傳播之疾病(tick-borne disease)比例明顯上升，蜱已成為許多國家病媒防治重點，由於以蜱為媒介傳播之病原微生物相當繁多，因此在進行相關流行病學調查或田野樣本檢驗時，繁重的檢驗工作花費大量的人力物資，因此發展出能同步偵測多件樣本、且單一樣本可同步偵測多項目標，實為迫切需求。因此 Sara Moutailler 博士所帶領的研究團隊利用 Fluidigm Biomarker real-time PCR system 可藉由晶片設計特性，彈性利用 2 種規格晶片，設計出一套針對蜱為媒介傳播之病原微生物快速檢測系統。以收集 5 個國家之 13 處田野採集，共計 19474 件蜱蛹檢體進行實測，結果顯示該系統單次反應可針對 94 個檢體，

同步檢測 50 種細菌、22 種寄生蟲、29 種病毒及另外 5 種微生物[4]。該平台之同步快速檢測能力顯著，Sara Moutailler 博士預計未來運用該平台建立以蚊子為傳播媒介之 58 種病毒(mosquito-borne virus)同步快速檢測方法。

肆、 次世代定序技術及應用研討會

除了聆聽定量 PCR 及數位 PCR 相關議題，由於署內近年亦著力於次世代定序技術之建立及應用，因此筆者在 2 天研討會中亦數度中途跑場至次世代定序技術及應用研討會，即時吸收目前國際間在次世代定序技術之發展現況。

在筆者報名前，即發現大會邀請我國中央研究院副研究員邱國平博士發表其近年建立之 T-oligo-primed PCR (TOP-PCR)技術及其應用至次世代定序技術之優勢。凡有送核酸樣本定序的人都知道，待測樣本之核酸濃度及品質須達到一定要求，才能獲得較為可信的定序品質；次世代定序技術的問世，除可提供定序較高的精確度，亦改善靈敏性，然而如想獲得優良的定序品質，以 illumina 平台為例，在上機前須將核酸樣本片斷化至一定範圍，落於該範圍的核酸分子才能與該平台設計的 adaptor 結合以進行後續核酸分子增殖反應，且核酸樣本至少需 0.5 奈克(ng)，且實驗設計不慎亦生成 primer dimer，降低定序感度。如面臨過於碎裂、濃度稀少如臨床之無細胞 DNA 檢體(cell-free DNA)，往往面臨難以上機或定序品質不佳的命運，甚至可說核酸檢體的優劣直接決定次世代定序數據品質亦不為過。有鑑於此，為解決上述問題，邱博士領導的研究團隊巧妙設計彼此部分互補的 T-oligo 及 P-oligo 以

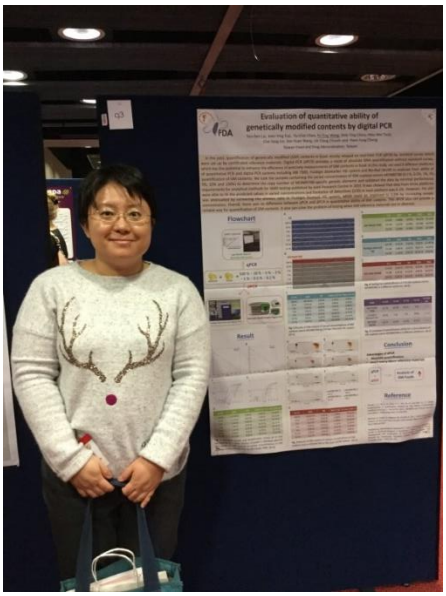
形成 Half Adaptor (HA)，片段僅 11 bp，易於水溶液中散布及結合核酸分子，且 HA 無選擇性結合任何長度的核酸分子，結合能力為 illumina 原有平台使用之 adaptor 之 2-3 倍，且由於序列特性，HA 沒有自身結合(self-ligation)的問題，僅由 HA 中的 T-oligo 作為單一引子進行後續反應。該技術除可應用至傳統 PCR，亦可直接改善前述 illumina 系統在樣品要求上的困難點，目前 TOP-PCR 除在 2017 年 1 月發表在知名期刊[5]，並已在台灣及美國成功申請專利，顯示 TOP-PCR 已獲得國際認可。未來邱博士將著眼於 TOP-PCR 在臨床體液檢體之檢測，例如細菌鑑定等應用。

另一有趣議題為國際知名美粧大廠 L'Oréal 萊雅集團旗下的研究團隊運用次世代定序技術在皮膚微生物群落(Skin Microbiome)之研究成果，會議中由 Ahmad Khodr 博士代表報告。由於人類基因體計畫(Human Genome Project)之進行，運用次世代定序技術可有效、快速、系統性解析人體各部位微生物群落生態，其中發現皮膚健康與否和皮膚表面微生物群落是否達到生態平衡、好菌是否存在優勢有相當直接的關聯，例如粉刺的生成即 *Propionibacterium* spp.等壞菌過度生長有關，甚至在國際美粧新聞內容中亦曾提到未來益生菌可能作為臉部保樣品強效成分，運用益生菌重塑臉部微生物群落，有效恢復皮膚

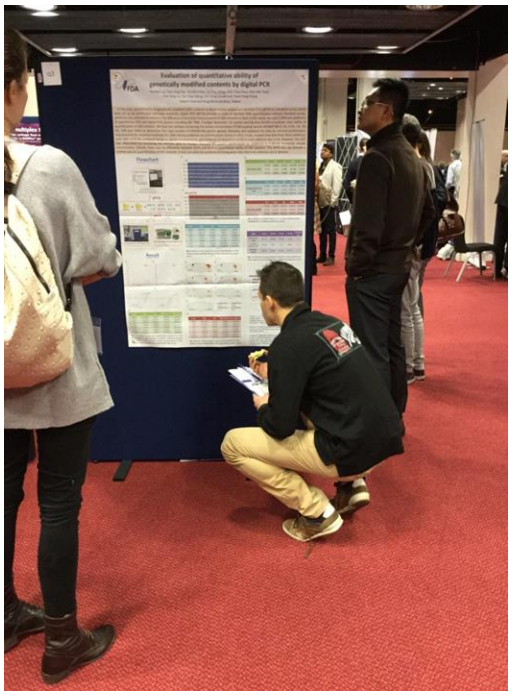
健康狀態，因此近年國際多家美妝、保健大廠如 L'Oréal 及 Johnson & Johnson 紛紛投入皮膚微生物群落之相關研究，並與知名研究中心如法國巴斯德研究室合作，試圖解開皮膚微生物群落之奧秘。Ahmad Khodr 博士分享 L'Oréal 研究中心在運用次世代定序技術於揭密皮膚微生物群落的經驗分享，發現以往在微生物群落常以 16S rRNA 序列解析微生物群落之菌種分布，其中在皮膚微生物群落分析以 16S rRNA 的 V1 及 V3 序列區域之解析度為較佳;然而後來發現 16S rRNA 解析度僅能闡述菌種分布，然而在年長者及年輕者的皮膚分析，發現其菌種分布差異不大，進一步以 whole metagenome sequencing 分析之，發現雖然菌種分布大致相同，但這些微生物群落在年長者及年輕者的基因表現樣態大不相同，因此在研究皮膚微生物群落時，應帶入基因表現是否具有差異之觀點，以功能註解(functional annotation)的角度進行分析，而且在分析時數據資料庫亦要慎選，以免造成分析偏差[(6)]。

伍、海報展覽

本次大會在定量 PCR 及數位 PCR 領域共接受 11 份海報發表，本署在數位 PCR 於食品中基因改造成分檢測知應用及評估研究以「Evaluation of quantitative ability of genetically modified contents by digital PCR」為題發表(如附件二、三及圖四)，在展場中亦吸引不少與會者前來觀看，更有與會者十分有興趣地詳細作筆記(如圖五)。



圖四、筆者與本署海報合影



圖五、對於本署海報認真筆記的與會者

在這次海報展覽中，亦遇見同為來自亞洲的日本、韓國的與會者，其中來自日本國家度量衡研究所(National Metrology of Institute)的柴山祥枝(Sachie Shibayama)博士，其發表主題為「Accuracy validation of chip-based digital PCR by DNA certificated reference material, including the evaluation of partition volume on the chip by SEM」，柴山博士在會場中看到同為東方臉孔的筆者亦相當開心，因柴山博士之發表為會場中少數針對晶片式數位 PCR 應用於 DNA 參考物質之定量評估，筆者好奇在詢問柴山博士有關其研究起緣，柴山博士表示過去在數位 PCR 尚未問世前，由於定量 PCR 解析度不足，關於核酸參考物質之精準定量多仰賴如同位素稀釋超高效液相層析串聯質譜技術(Liquid

chromatography–isotope dilution tandem mass spectrometry, LC-IDMS)或感應耦合電漿質譜儀(Inductively coupled plasma mass spectrometry, ICP-MS)生物化學技術，流程相當繁瑣；在數位 PCR 問世後，其高靈敏度及精準定量之特性，國際間相當多研究團隊(如以 Kerry Emslie 及歐盟合作的網絡實驗室)紛紛發表關於數位 PCR 在 DNA 分子定量之可能性，但由於成本因素，目前油滴式數位 PCR 市占率較高，因此近年文獻大多針對油滴式數位 PCR 進行方法評估及確效，然而油滴式數位 PCR 亦在油滴產生後發生油滴體積改變而不一致，此因素已證實為造成數位 PCR 發生誤差主要因素之一。有鑑於此，因著眼於晶片式數位 PCR 以晶格取代油滴，將單一樣本區分近 2 萬個反應單元，較於油滴，晶格具規格一致、體積固定、晶格製程可標準化減少誤差之特性，而日本國家度量衡研究所擔負生產國家級核酸參考物質之任務，因此柴山博士隸屬之研究部門針對萊富公司生產之 QuantStudio 3D Digital PCR 進行分析，首先以掃描式電子顯微鏡分析確認 QuantStudio 3D Digital PCR 平台使用之晶片中各晶格體積是否一致，之後再以已知、經 ICP-MS 及 LC-IDMS 確效後之 DNA 參考物質進行測試，結果顯示雖晶片式數位 PCR 在眾多晶格之體積亦存在些許誤差，但該平台在定量 DNA 分子上表現不錯。

另，國立南韓科技技術院(Korea Advanced Institute of Science and

Technology)之 Chang Yeol Lee 發表「Electrochemical real-time PCR based on intercalation of methylene blue and its diagnostics application for influenza virus」，係以生物工程的角度，以電化學法取代過去 real-time PCR 使用之螢光反應，以免除過去 real-time PCR 需仰賴體積大、售價較高的反應儀器，其研究在玻片上塗布甲基藍，由於甲基藍具氧化還原特性，而甲基藍本身又能與核酸分子結合，因此利用甲基藍在與核酸分子結合後造成電位改變之特性，達到定量核酸分子之能力，該研究並實際以臨床 H1N1 核酸檢體實際檢測，結果顯示能達到不錯的檢測能力，且該反應無需偵測螢光，因此檢測儀體積可大幅縮小，利於攜帶，未來可應用至床邊檢驗(point-of-care testing)。

陸、 心得與建議

2017 年 9 月林澤揚科長與筆者赴義大利參加歐盟基因改造實驗室聯盟年度會議，於會議中得見歐洲各國已將數位 PCR 技術廣泛應用在各項檢測領域，然而過程中發現因數位 PCR 在核酸定量上的高解析度，因此以數位 PCR 重新定量歐盟先前已建立之基因改造成分之核酸標準品，發現核酸標準品中有 heterozygote 存在，如持續使用該標準品將顯著造成基因改造成分定量上的誤差，因此目前歐盟審慎重新評估過去已建立之標準品，並以數位 PCR 重新檢測一次，由此可預見未來數位 PCR 無疑將在分子生物檢測領域劃下嶄新的一頁；而數位 PCR 直接以核酸分子數量(copy number)作為檢測單位，但現行法規或標準大多以其他單位呈現，因此歐盟正為數位 PCR 技術其應用領域相關之法規及標準該如何調和積極討論中。

在此次研討會中，諸位數位 PCR 專家深入剖析數位 PCR 可能產生的誤差來源，雖目前歐盟有關數位 PCR 技術的官方制定確效規範尚未發布，但在 2013 年包含 Kerry Emslie 博士等 15 位國際知名數位 PCR 專家已在 Clinical Chemistry 期刊發表篇名「The digital PCR MIQE guideline: minimum information for publication of quantitative digital PCR experiments」[(7)]，內容以深入淺出說明數位 PCR 技術之特性，更以查檢表(checklist)形式提醒數位 PCR 操作者在實驗進行前須先

確認哪些流程及細節，不啻為初學者入門數位 PCR 最佳教材。

筆者在 9 月份赴義大利參加歐洲 GMO 實驗室聯盟第 28 屆年度大會時巧遇任職於日本國家農業與食品研究組織(National Agriculture and Food Research Organization)的橘田和美(Kazumi Kitta)博士，橘田博士亦表示其任職單位近年亦針對晶片式平台在基因改造成分檢驗分析之能力進行評估，由橘田博士及柴山博士的經驗分享，可大致窺見日本國家實驗室近年逐漸引進數位 PCR 作為其檢驗方法開發、核酸參考物質精準定量之目的及期許。

本署在數年前引入數位 PCR-高通量定量 PCR 雙模組，然而該系統之數位 PCR 模組因其晶片僅能將樣本劃分至 770 個反應小單元，定量能力遠不及油滴式數位 PCR 及新式晶片式數位 PCR。有感國際間已普遍使用數位 PCR，許多國家皆已將數位 PCR 運用於檢驗業務，本署作為國家實驗室，實需另外引進能將樣本劃分為上萬反應小單元之數位 PCR，善用數位 PCR 高靈敏度及高解析度定量之特性，有效提升本署於生物性分子檢測能力。

因嗅到數位 PCR 技術帶來的商機，已有相當多儀器及檢測公司紛紛投入數位 PCR 的研發，不僅將機械手臂導入數位式 PCR 操作流

程以降低人為誤差，同時大幅提升檢測通量(throughput)，並針對現行油滴式數位 PCR 的缺點加以改善，推出成本更低、無須檢體前處理、具一致體積之反應小單元等新式數位 PCR 平台，可謂百家爭鳴。筆者建議在導入數位 PCR 新機前，先確認自身業務在核酸定量上的需求，並追蹤國際間有關各項數位PCR平台檢測能力評比之相關報導，方能選擇出適合的數位 PCR 平台。

為有效提升生物性成分檢測能力，本署近年致力於發展數位 PCR 及次世代定序技術，以數位 PCR 為例，在本次研討會所發表以基因改造成分為分析標的，同時評比 3 項數位 PCR 平台之定量範圍，海報發表當日吸引相當多與會者前來觀看並作筆記，此景反映出本署之研究成果已獲得國際關注；本署亦運用高通量定量 PCR 技術成功建立基因改造黃豆品系快速鑑定，預期其應用至在過去需大量人力物力檢測之港埠監測調查，將能大幅降低檢測成本及檢測時間。在研討會中看到其他國家將相同系統應用至大規模的監測調查，除了顯示本署在建立檢驗方法之能力已與國際同步，期許本署未來能擴大應用高通量定量 PCR 技術，尤其是針對已完成定量 PCR 方法之病原微生物、益生菌及物種鑑別，建議可先調和各項定量 PCR 條件使其統一，再針對業務需求設計單次反應能同步檢測之標的，將能有效提升本署快

速檢測能力強度。

最後，感謝署內長官支持參加檢驗技術相關之國際研討會，此行筆者有幸能與多位知名專家學者面對面進行交流，在談話中獲得許多新知及最新國際趨勢，回國後將持續此行所建立之人脈網，並在自身專業更加精進，並針對研究成果進行發表，以提升本署之專業能見度，並將相關技術運用於檢驗業務並推廣之，以強化國內檢驗量能。

柒、 參考文獻

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捌、 附件

附件一、歐洲生物高峰會之研討會議程

CONGRESS SCHEDULE

DAY 1 MONDAY 4TH DECEMBER 2017

08:00-08:50 Room: Chablis Suite — Registration & Refreshments

08:50-09:00 Global Engage Welcome Address and Morning Chair's Opening Remarks

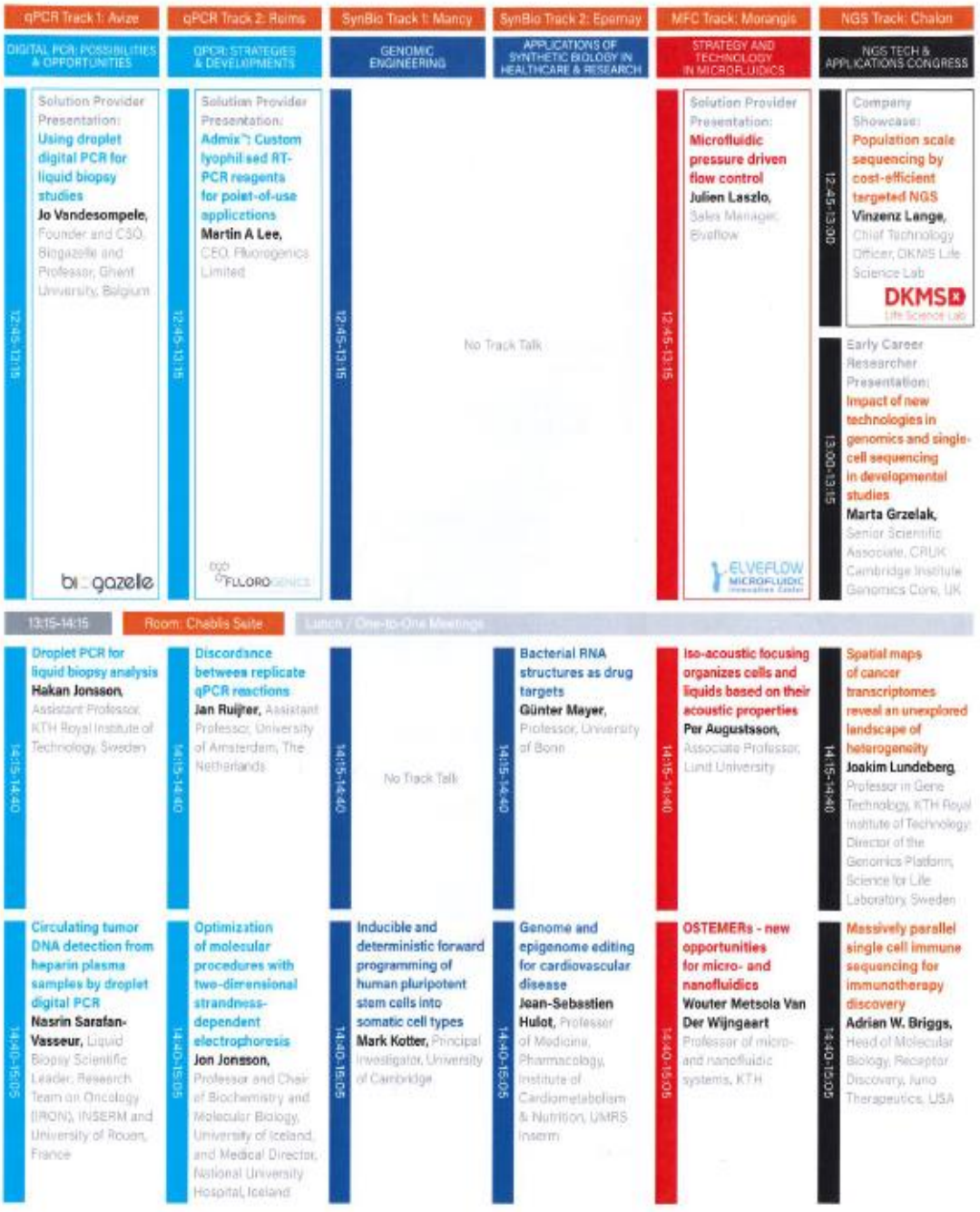
09:00-09:40	qPCR Track 1: Avize — qPCR & DIGITAL PCR CONGRESS	SynBio Track 1: Marcy — SYNTHETIC BIOLOGY & GENE EDITING CONGRESS	MFC Track: Morangis — MICROFLUIDICS CONGRESS	NGS Track: Chalon — NGS TECH & APPLICATIONS CONGRESS
	Keynote Address: **Digital PCR for high accuracy measurement of DNA Reference Materials** **Kerry Emslie,** Senior Research Scientist, National Measurement Institute, Australia	Keynote Address: **Improving Bio Design Reliability and Reproducibly through the use of Foundries** **Richard Kitney,** Professor of BioMedical Systems Engineering, Imperial College London	Keynote Address: **Droplet microfluidics for single cell studies** **Dave Weitz,** Mallinckrodt Professor of Physics and Applied Physics, Harvard University	Keynote Address: **A long view of genome analysis** **W. Richard McCombie,** Professor, Cold Spring Harbor Laboratory, USA
09:40-10:15	**Development and Clinical Validation of Liquid ddPCR Tests for Actionable Somatic Mutations for NSCLC** **Gary Pestano,** Vice President, Development and Operations, Biodesix	Keynote Address: **Synthetic Biology's Engineering Paradigm** **Lionel Clarke** Professor, co-Chairman, UK Synthetic Biology Leadership Council (SBLC)	Keynote Address: **Optical Tools for Ultra High-Throughput Cellular Analysis** **Andrew de Mello,** Professor of Biochemical Engineering & Chairman, ETH Zurich	Keynote Address: **Recent progress in genomics** **Jason Betley,** Senior Director, Technology Development, Illumina
10:15-10:45	Solution Provider Presentation: **Single Cell Analysis with the Naica System** **Alexandra Martin,** Application Specialist, Stilla Technologies	Solution Provider Presentation: **Discover Innovative Technologies to Rapidly Generate Synthetic Genes and Proteins** **Malathi Raman,** European Product Manager, Takara Bio Europe, St Germain en Laye, 78100, France	Solution Provider Presentation: **True lab-on-a-chip devices: Complexity and Manufacturing challenges** **Holger Becker,** Co-founder and CSO, microfluidic ChipShop GmbH	Solution Provider Presentation: **Improving exome sequencing, targeted sequencing, and low frequency variant detection with better coverage uniformity, higher on-target rates, and unique molecular identifiers** **Xiangyu Rao,** NGS Field Application Manager, Europe, Integrated DNA Technologies

10:45-11:55 Room: Chablis Suite — Morning Refreshments / Even Numbered Poster Presentations / One-to-One Meetings

11:55-12:20	qPCR Track 1: Avize — DIGITAL PCR: POSSIBILITIES & OPPORTUNITIES	qPCR Track 2: Reims — QPCR: STRATEGIES & DEVELOPMENTS	SynBio Track 1: Marcy — GENOMIC ENGINEERING	SynBio Track 2: Epernay — APPLICATIONS OF SYNTHETIC BIOLOGY IN HEALTHCARE & RESEARCH	MFC Track: Morangis — STRATEGY AND TECHNOLOGY IN MICROFLUIDICS	NGS Track: Chalon — NGS TECH & APPLICATIONS CONGRESS
	Prospects for digital PCR in absolute quantification of DNA and RNA **Ward De Spiegelaere,** Assistant Professor, Ghent University, Belgium	**Optimized design of broadly-detecting qPCR Primers and Probes using a conservation and hybridization prediction algorithm, 'ConSor'** **Jonas Blomberg,** Emeritus Professor of Clinical Virology, Uppsala University, Sweden	**Engineering orthogonal synthetic timer circuits in bacteria** **Georg Fritz,** Independent Group Leader, LOEWE Center for Synthetic Microbiology, Philipps-University Marburg	**Rational Design and Redesign of Natural Product Pharmaceuticals** **Paul Race,** Senior Lecturer, University of Bristol	**Laser printed flat optics metasurfaces for microfluidics integration** **Anders Kristensen,** Professor, Technical University of Denmark	**Bioelectronics applications with nanostructures** **Marija Drndic,** Fay R. and Eugene L. Langberg Professor of Physics, University of Pennsylvania, USA
12:20-12:45	**Application of digital PCR for quantification of minority targets in human disease and antimicrobial resistance monitoring** **Gerwyn Jones,** Senior Researcher, LGC, UK	**T oligo-primed polymerase chain reaction (TOP-PCR) and its applications** **Kuo-Ping Chiu,** Associate Professor, National Taiwan University, and Associate Research Fellow, Genomics Research Center, Academia Sinica, Taiwan	**Synthetic Biology via continuous directed evolution** **Mark Isalan,** Reader in Gene Network Engineering, Imperial College London	**Control of the T-cell fate by a chromatin-based timing control switch** **Hao Yuan Kueh,** Assistant Professor, University of Washington	**Centrifugal Microfluidics: Recent developments** **Nils Paust,** Head of Division of Microfluidic Platforms, Hahn Schickard	**Pushing the limits of mutation detection in circulating tumour DNA** **Iwanka Kozarewa,** Senior Scientist – Translational Science, IMED Oncology, AstraZeneca, UK

CONGRESS SCHEDULE

DAY 1 MONDAY 4TH DECEMBER 2017



15:05-15:30

Multiple hotspot mutations scanning by single droplet digital PCR
Amanda Silveira, Senior Researcher, Institut Curie, France

High Resolution melting: a novel workflow for the automated identification of a large number of variants
Jean-Christophe Avarre, Head of the High Throughput qPCR Platform and Research Group Leader, University of Montpellier, France

Escherichia coli HGT: a novel high glucose throughput chassis, engineered for large scale production and derived from systems biology studies
Ralf Takors, Professor, Director of the Institute of Biochemical Engineering, University of Stuttgart

Taking Inspiration from Nature for the Generation of Novel Antibiotics
Chris Willis, Professor of Organic Chemistry, University of Bristol

Development of porous microfluidic devices for precision health applications
Elain Fu, Assistant Professor in Bio Engineering, Oregon State University

How TOP-PCR can help NGS
Kuo Ping Chiu, Associate Research Fellow, Genomics Research Center, Academia Sinica, Taiwan

15:30-16:00

Solution Provider Presentation:
Clarity™ digital PCR system: clinical applications and possibilities
Johnson Ng, Founder and CEO, JN Medsys

Solution Provider Presentation:
Screening of tick-borne pathogens in European ticks using High-throughput real-time PCR on the Biomark™ HD System
Sara Moutailler, PhD, Researcher at ANSES, Animal Health Laboratory, IRU BIPAR, Vectotiq Team

Start-up Showcase:
Next-gen biotherapeutics for precise microbiome engineering and sequence-specific antimicrobials
Xavier Duportet, CEO, Eligo Bioscience

No Track Talk

Solution Provider Presentation:
Microfluidic functionalities and microfabrication technologies for Point-of-Care testing and Cell Culturing
Monica Brivio, Strategic R&D Manager, Microniz Microtechnologies

Solution Provider Presentation:
A Comparison of 16S Amplicons in Microbial Community Standards & Environmental Samples
Stephanie Wilbraham, Field Application NGS Specialist, Perkin Elmer

16:00-16:50 Room: Chablis Salle — Afternoon Refreshments / Odd Numbered Poster Presentations / One-to-One Meetings

16:50-17:15

Life beyond the pixels: single-cell phenotyping using machine learning, dPCR, and image analysis methods
Peter Horvath, Distinguished Professor and Group Leader, Institute of Molecular Medicine Finland and Hungarian Academy of Sciences, Finland

High through-put DNA methylation analysis of LungCancer - plasma cfDNA for biomarker development
Andreas Weinhausel, Associate Professor, University of Natural Resources and Applied Life Sciences, and Senior Scientist, Austrian Institute of Technology, Austria

Next-generation RNA circuits in living cells
Alfonso Jaramillo, Professor of Synthetic Biology, University of Warwick

Using Synthetic Biology and CRISPR/Cas9 bacterial genome engineering for drug development
Gareth Cooper, Investigator, Biological Technologies UK R&D, Advanced Manufacturing Technologies, GlaxoSmithKline

Multiplexed DNA Malaria Sensing using Origami Paper Folding in Uganda
Jon Cooper, Professor, University of Glasgow

Methylation-sensitive profiling of genomic CpG sites using TOP-seq
Saulius Klimassuskas, Division Director and Chief Scientist, Vilnius University, Lithuania

17:15-17:45

Clinical utility of ddPCR in the management of patients with castration resistant prostate cancer
Daniel Wetterskog, Senior Scientist, Institute of Cancer Research, UK

Targeted transcriptome profiling using single molecule Molecular Inversion Probes
William „eenders, Associate Professor of Tumor Targeting, Radboud UMC, The Netherlands

17:15-17:30

Early Career Researchers Presentation:
Transcriptional activation of endogenous transcription factors using novel all-in-one dCAS9-SAM system
Antonella Fidanza, University of Edinburgh (Scottish Centre for Regenerative medicine, UK)

Early Career Researchers Presentation:
Synthetic Phage Biosensors for Pathogen Detection and Eradication
Victor Rodrigo Ibarra Chavez, PhD Student, University of Glasgow

3D-Printed Bio-Microfluidics
Nirveek Bhattacharjee, Staff Scientist, Folch Lab, University of Washington

MitoRS, a method for high throughput, sensitive, and accurate detection of mitochondrial DNA variants
Julien Marquis, Genomics Associate Specialist, Nestlé Institute of Health Sciences, Switzerland

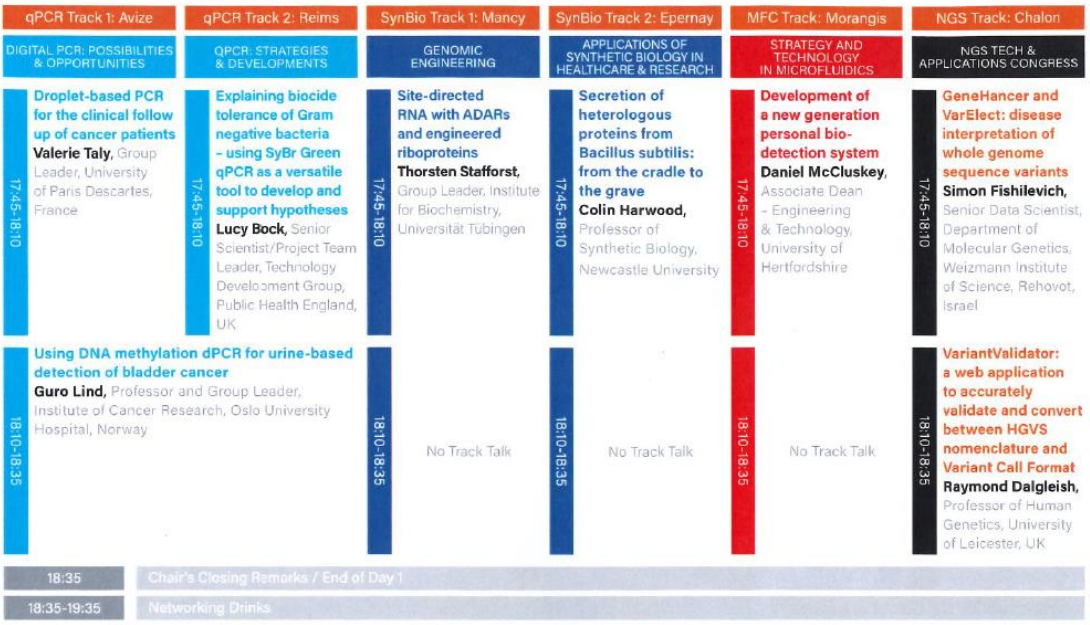
17:30-17:45

Early Career Researchers Presentation:
Rational engineering of Tal-effector recombinases for genome editing
Jumai Abioye, PhD Student, University of Glasgow

Early Career Researchers Presentation:
Engineering of minimal chassis as delivery system to dissolve biofilms
Maria Lluch Senar, Staff Scientist, Center for Genomic Regulation, Barcelona

CONGRESS SCHEDULE

DAY 1 MONDAY 4TH DECEMBER 2017



qPCR Track 1: Avize	qPCR Track 2: Reims	SynBio Track 1: Mancy	SynBio Track 2: Epernay	MFC Track: Morangis	NGS Track: Chalon
DIGITAL PCR: POSSIBILITIES & OPPORTUNITIES	QPCR: STRATEGIES & DEVELOPMENTS	GENOMIC ENGINEERING	APPLICATIONS OF SYNTHETIC BIOLOGY IN HEALTHCARE & RESEARCH	STRATEGY AND TECHNOLOGY IN MICROFLUIDICS	NGS TECH & APPLICATIONS CONGRESS
17:45-18:10 **Droplet-based PCR for the clinical follow up of cancer patients** **Valerie Taly**, Group Leader, University of Paris Descartes, France	17:45-18:10 **Explaining biocide tolerance of Gram negative bacteria - using SyBr Green qPCR as a versatile tool to develop and support hypotheses** **Lucy Bock**, Senior Scientist/Project Team Leader, Technology Development Group, Public Health England, UK	17:45-18:10 **Site-directed RNA with ADARs and engineered riboproteins** **Thorsten Stafforst**, Group Leader, Institute for Biochemistry, Universität Tübingen	17:45-18:10 **Secretion of heterologous proteins from Bacillus subtilis: from the cradle to the grave** **Colin Harwood**, Professor of Synthetic Biology, Newcastle University	17:45-18:10 **Development of a new generation personal bio-detection system** **Daniel McCluskey**, Associate Dean - Engineering & Technology, University of Hertfordshire	17:45-18:10 **GeneHancer and VarElect: disease interpretation of whole genome sequence variants** **Simon Fishilevich**, Senior Data Scientist, Department of Molecular Genetics, Weizmann Institute of Science, Rehovot, Israel
18:10-18:35 **Using DNA methylation dPCR for urine-based detection of bladder cancer** **Guro Lind**, Professor and Group Leader, Institute of Cancer Research, Oslo University Hospital, Norway		18:10-18:35 No Track Talk	18:10-18:35 No Track Talk	18:10-18:35 No Track Talk	18:10-18:35 **VariantValidator: a web application to accurately validate and convert between HGVS nomenclature and Variant Call Format** **Raymond Dalgleish**, Professor of Human Genetics, University of Leicester, UK
18:35	Chair's Closing Remarks / End of Day 1				
18:35-19:35	Networking Drinks				

DAY 2 TUESDAY 5TH DECEMBER 2017

08:00-08:35 | Room: Chablis Suite | Refreshments

08:35-08:40 | Morning Chair's Opening Remarks

	qPCR Track 1: Avize	SynBio Track 1: Nancy	MFC Track: Morangis	NGS Track: Chalon
	qPCR & DIGITAL PCR CONGRESS	SYNTHETIC BIOLOGY & GENE EDITING CONGRESS	MICROFLUIDICS CONGRESS	NGS TECH & APPLICATIONS CONGRESS
08:40-09:20	Keynote Address: **Challenges and opportunities for digital PCR in the CLIA laboratory of the Moffitt Cancer Experience** **Anthony Magliocco**, Chair of Anatomical Pathology, Moffitt Cancer Center, USA	Keynote Address: **Design, Construction, and Analysis of a Minimal Bacterial Cell** **John Glass**, Professor & Leader of the Synthetic Biology and Bioenergy Group, J. Craig Venter Institute	Keynote Address: **Microfluidic platforms to study gas-liquid interactions** **Eugenia Kumacheva**, Professor, University of Toronto	Keynote Address: **Contribution of non-coding DNA to complex diseases and cancer** **Emmanouil Dermitzakis**, Professor, Department of Genetic Medicine and Development, University of Geneva; Director, Health 2030 Genome Center, Switzerland

	qPCR Track 1: Avize	SynBio Track 1: Nancy	SynBio Track 2: Epernay	MFC Track: Morangis	NGS Track: Chalon
	HEALTHCARE CASE STUDIES	INNOVATION, INVESTMENT & START-UPS	APPLICATIONS OF SYNTHETIC BIOLOGY IN HEALTHCARE & RESEARCH	CASE STUDIES AND APPLICATIONS IN MEDICAL RESEARCH	NGS TECH & APPLICATIONS CONGRESS
09:20-09:50	Solution Provider Presentation: **6 years in: Bio-Rad and Digital PCR** **Kelly Kaihara**, Global Market Development, Bio-Rad Laboratories – Digital Biology Group	Solution Provider Presentation: **Empowering computer-aided biological design by using in vivo characterized Standard Biological Parts** **Davide De Lucrezia**, Doulix		Solution Provider Presentation: **Fluigent, a pioneer for advanced flow control in microfluidics** **Nour Yakdi**, PhD, Fluigent	Company Showcase: **Automating Analysis of Nucleic Acids** **Andy Higgs**, UK Operations Manager, Advanced Analytical Technologies Ltd.
09:50-10:15	**Two-tailed PCR - New ultrasensitive and ultraspecific technique for the quantification of microRNAs** **Mikael Kubista**, Department of Biotechnology, CAS and TATAA Biocenter	**Engineering cells and genes based on whole cell simulations for various biotechnological objectives** **Tamir Tuller**, Associate Professor of Computational Systems and Synthetic Biology, Tel Aviv University	**Synthetic Biology and Gene Editing – IP and Commercialisation** **Sarah Lau**, Partner, Kilburn & Strode	**Disease models on-a-Chip: Medical applications of Organ-on-a-Chip Technology** **Peter Ertl**, Professor, Vienna University of Technology	**Microfluidic applications in single cell RNA sequencing** **Bart Deplancke**, Associate Professor & Swiss Institute of Bioinformatics Group Leader, Institute of Bioengineering, School of Life Sciences, EPFL, Switzerland

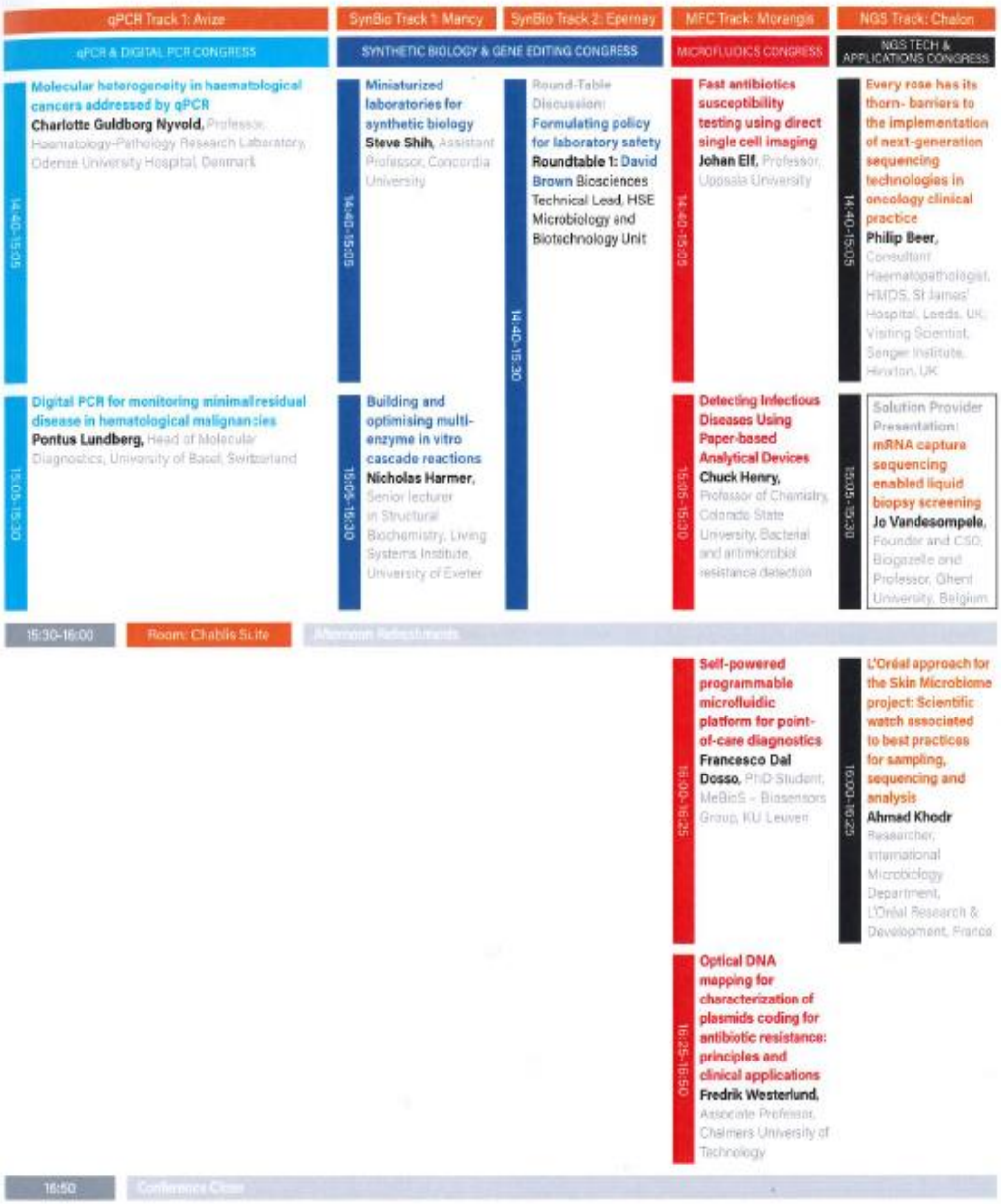
10:15-11:25 | Room: Chablis Suite | Morning Refreshments / Poster Presentations / One-to-One Meetings

	qPCR Track 1: Avize	SynBio Track 1: Nancy	MFC Track: Morangis	NGS Track: Chalon
	qPCR & DIGITAL PCR CONGRESS	SYNTHETIC BIOLOGY & GENE EDITING CONGRESS	MICROFLUIDICS CONGRESS	NGS TECH & APPLICATIONS CONGRESS
11:25-11:55	Solution Provider Presentation: **Development of gene signatures as cancer biomarkers using Applied Biosystems™ TaqMan® Array Cards** **Darren Roberts**, Postdoctoral Research Associate - University of Manchester - Division of Cancer Sciences **Multi-platform qPCR approaches to elucidating expression profiles in ageing** **Ben Lee**, Research Technician & PhD Researcher - University of Exeter Medical School	**Data-Driven Design of Cell Factories and Communities** **Niko Sonnenschein**, Senior Researcher, Novo Nordisk Foundation Center for Biosustainability	Solution Provider Presentation: **Optical Profilometry of Microfluidic Devices** **Vamsi Velidandla**, Marketing Manager, KLA-Tencor	**Exploiting NGS for clinical individualized neoantigen cancer vaccines** **John Castle**, CSO, Achilles Therapeutics, UK

CONGRESS SCHEDULE

DAY 2 TUESDAY 5TH DECEMBER 2017

DAY 2 TUESDAY 5TH DECEMBER 2017



附件二、海報展覽清單

POSTER PRESENTATIONS

	POSTER TITLE	PRINCIPAL AUTHOR(S)	AFFILIATION
Q1	Electrochemical Real-Time PCR based on Intercalation of Methylene Blue and its Diagnostics Application for Influenza Virus	Chang Yeol Lee, Jun Ki Ahn, Byoung Yeon Won, and Hyun Gyu Park*	Korea Advanced Institute of Science and Technology (KAIST)
Q2	Isothermal RNA detection method utilizing nicking/extension chain reaction system	Jun Ki Ahn, Hyo Yong Kim, Yong Ju, and Hyun Gyu Park*	Korea Advanced Institute of Science and Technology (KAIST)
Q3	Evaluation of quantitative ability of genetically modified contents by digital PCR	Yun-Ren Lai, Hsin-Ying Tsai, Yu-Chin Chen, Yu-Ting Wang, Shih-Ting Chiou, Hsiu-Wei Tsai, Che-Yang Lin, Der-Yuan Wang, Lih-Ching Chiueh and Hwei-Fang Cheng	Taiwan Food and Drug Administration
Q4	"One-click" imaging digital PCR	Paul Hung, Megan Dueck, Andrew Zayac & Wim Trypsteen	COMBiNATi
Q5	Food allergens: screening analysis of soybean and peanut by ELISA, real-time PCR and digital PCR	Elisa Pierboni[1], Martina Tomicelli[1], Letizia Ciccone[1], Cristina Rondini[1], Gloria R. Tovo[1], Maria Lucia Mercuri[1], Serena Altissimi[2], Hacuet M. Naceur[2]	[1]Istituto Zooprofilattico Sperimentale dell'Umbria e delle Marche, [2]Bio-Rad Laboratories, Italy
Q6	Accuracy validation of chip-based digital PCR by DNA certified reference material, including the evaluation of the partition volume on the chip by SEM	Sachie Shibayama, Kazuhiro Kumagai, Akiko Takatsu	National Metrology Institute of Japan (NMIJ)/AIST
Q7	PoDCall: Positive droplet calling for methylation ddPCR experiments	Marine Jeanmougin, Heidi D. Pharo, Kim Andresen, and Guro E. Lind	Department of Molecular Oncology, Institute for Cancer Research, Oslo University Hospital, the Norwegian Radium Hospital
Q8	MeltPlex multiplex QPCR - Detection of 17 hemorrhagic fever virus strains in a single PCR tube by MeltPlex probes	Søren Morgenthaler Echwald	Anapa Biotech A/S
Q9	Detection of Cytochrome P450 Gene Expression in Human Hepatocytes for Pre-clinical and Clinical Trials: Challenges in Validating RT-QPCR Assays in a Regulated Environment	Gilta Jaeckel, Keith Sutton	Charles River
Q10	Concordance of IHC and a new blood-based expression assay for the detection of PD-L1 in patients diagnosed with NSCLC	Hestia Mellert PhD, Leisa Jackson, and Gary A. Pestano PhD	Biodesix, Inc., Boulder, CO 80301
Q11	Methods to enable the translation of genetic tests using liquid biopsies into routine clinical diagnostics	Alison Devonshire, Alexandra Whale, Gerwyn M. Jones, Ana Fernandez-Gonzalez, Jim Huggett, Carole Foy	LGC
S1	Pinpointing a Mechanistic Switch Between Ketoreduction and "Ene" Reduction in Short-Chain Dehydrogenases/Reductases (Published in Angewandte Chemie International Edition)	Antonios Lygidakis, Dr. Vijaykumar Karuppiah, Dr. Robin Hoeven, Dr. Aisling Ní Cheallaigh, Prof. David Leys, Dr. John M. Gardiner, Dr. Helen S. Toogood, Prof. Nigel S. Scrutton	GSK/University of Manchester (Manchester Institute of Biotechnology)
S2	OMIC-ENGINE, a new Synthetic Biology Infrastructure in Greece	Mathiopoulos KD, Choli-Papadopoulou T, Grigoriou M, Hatzinikolaou D, Hatzopoulos P, Karpouzas D, Kekos D, Kolisis F, Leonidas DD, Mamouris Z, Mikros E, Moutou KA, Papadopoulou KK, Sianetas G, Spyroulias G, Stamatis C	University of Thessaly, Department of Biochemistry and Biotechnology
S3	PROlung – a mucus degrading lung probiotic	L. Vornholz, A. Pelinis, S. Dhanaraj, G. Nachmann, A. Fardellas, A. Kastensson, G. M. V. Morales, H. Micheva, J. Roth, M. Hjorth, S. Tong, S. Amoor Pour, S. Acosta Luis, R. Bengtsson	iGEM Stockholm 2017
S4	Towards the preparation of autotrophic protocells: transducing light giant lipid vesicles	Emiliano Altamura[1], Francesco Milano[2], Massimo Trotta[2], Pasquale Stano[3], Fabio Mavelli[1]	[1]Chemistry Department, University "Aldo Moro", Via Orabona 4, I-70126 Bari, Italy 2CNR-IPCF, Via Orabona 4, I-70126 Bari, Italy. [3]Science Department, Roma Tre University, Viale G. Marconi 446, I-00146 Rome, Italy
S5	DNASynth: a computer program to develop long DNA molecules coding genes	Robert Nowak	Warsaw University of Technology, Institute of Computer Science
S6	Combining synthetic biology and metabolic engineering for the production of industrially relevant compounds	Rodrigo Ledesma-Amaro	Imperial College London
S7	Recombinant adeno-associated virus for tumor therapy - capsid and genetic engineering	Rebecca C. Feiner, Kathrin Teschner, Julian Teschner, Oliver Scheiner, Kristian M. Müller	Bielefeld University
S8	Strategies for implementing Responsible Research and Innovation in a synthetic biology project	Dr Ken Taylor and Dr Simon Woods	Policy, Ethics and Life Sciences (PEALS) Research Centre, Newcastle University
S9	Fragrant plants used as air fresheners in private households	Henrik Toft Simonsen[1,4], Ikram NKK[1,2,3], Peramuna A[1], Bae H[4]	[1]Department of Biotechnology and Biomedicine, Technical University of Denmark, Lyngby, Denmark. [2]Department of Plant and Environmental Sciences, Copenhagen Plant Science Centre, University of Copenhagen. [3]Institute of Biological Sciences, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia. [4]Biospiration Biotech IVS, Hørsholm, Denmark

POSTER PRESENTATION

	POSTER TITLE	PRINCIPAL AUTHOR(S)	AFFILIATION
S10	Synthetic Phage Biosensors for Pathogen Detection and Eradication	Rodrigo Ibarra-Chavez[1,2], Julien Reboud[1], Jonathan M. Cooper[1], Jose R. Penadés[2]	[1]Division of Biomedical Engineering, College of Science and Engineering, University of Glasgow, Glasgow, UK [2]Institute of Infection, Immunity and Inflammation, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UK
S11	Development of Targeted Integration Platform for Expression of Therapeutic Molecules	Shawal Spencer	GlaxoSmithKline
S12	Using synthetic chromosomes to study centromere epigenetics in human cells	E. Pesenti, M. Liskovykh, N. Kouprina, V. Larionov, H. Masumoto, W. Earnshaw and O. Molina	University of Edinburgh
S13	Ultra-Sensitive Detection and Binary Quantification Utilising LAMP DNA Amplification coupled to the Bioluminescent Assay in Real-Time (BART)	Patrick Hardinge[1], Guy Kiddle[2], Laurence Tisi[2], Jim Murray[1]	Cardiff University[1]/ ERBA molecular Ltd[2]
S14	Transcription and DNA-topology: a reciprocal regulatory relationship?	Carlo Klein, Patrick Sobetzko	Philipps-Universität Marburg, LOEWE Center for Synthetic Microbiology, SYNMIKRO
S15	Glucosinolates production in yeast	Cuiwei Wang, Christoph Crocoll, Barbara Ann Halkier	University of Copenhagen
S16	UCL iGEM 2017 – Light Induced Technologies	Camilo Moschner, Paola Handal, Cecile Geier, Hongchang Fu, Stefania Tropeki, Hristina Dimitrova, Marisa Cvitanic, Florin Gheorghiu, Anima Sutradhar	UCL
S17	dCas9 guided light-driven reactive oxygen species production as a mutagenesis tool in E. coli	Slavil Peykov, Desislava Popova, Boris Kirov	iGEM Bulgaria
S18	Diagnosing snakebite using cleavable oligopeptides	P.H. Sørensen, C. Polheus, D. Valkani, A.M. Haack, C. A. Larsen, A. F. Treschow, F. Frehling, I. Doudka, K. Kalogeropoulos, L. M. Aastrup, M. El Lakany	DTU BioBuilders (iGEM DTU Denmark)
S19	Extracellular Metrology	Nilofar Faruqui, Angelo Bella, Jascindra Ravi, Emiliana de Santis & Maxim G Ryadnov	National Physical Laboratory
S20	Engineering minimal genomes. Mycoplasma pneumoniae as an example	Piñero-Lambea C[1,2], Montero-Blay A[1,2], Martinez S[1,2], Lluch-Senar M[1,2], Serrano L[1,2,3]	[1]EMBL/CRG Systems Biology Research Unit, Centre for Genomic Regulation (CRG), The Barcelona Institute of Science and Technology, Dr Aiguader 88, Barcelona 08003, Spain. [2]Universitat Pompeu Fabra (UPF), 08003 Barcelona, Spain. [3]Institució Catalana de Recerca i Estudis Avançats (ICREA), 08010 Barcelona, Spain
M1	A microdroplets platform for the analysis of circulating tumour cells by using surface-enhanced raman scattering	Sara Abalde-Cela, Lorena Diéguez, Silvina Samy, Alexandre Chicharo	International Iberian Nanotechnology Institute, INL
M2	Nanoporous Materials as Catalyst Supports for Microfluidic Devices	H. Becker, R. Warias, N. Wilde, D. Belder, R. Gläser	Institute of Chemical Technology, Universität Leipzig
M3	A microfluidic device for investigation of migratory potential of cancer cells	Karel Klepárník[1], Vojtěch Ledvina[1,2], Jan Balvan[3], Martina Raudenská[3] Jaromír Gumulec[3] and Michal Masařík[3]	[1]Institute of Analytical Chemistry, Czech Academy of Sciences, Brno, Czech Republic [2]Department of Chemistry, Faculty of Science, Masaryk University, Brno, Czech Republic [3]Department of Physiology, Faculty of Medicine, Masaryk University, Brno, Czech Republic
M4	Colloid particles self-assembly in drying droplet deposited on poor wetting substrate: beyond the lubrication approximation	Peter Lebedev-Stepanov	Institute of Chemical Technology, Universität Leipzig
M5	Investigation of cell cycle network of yeast using Lab-on-a-Chip platform	İrem Ezgi Dayan, Elif Gençtürk, Şenol Mutlu, S. Kutlu O. Ulgen	Boğaziçi University
M6	MICROLAB Project: Lab-on-chip laser micro-manufacturing	Anne Henrottin, Marc Décultot, Jose Ramos de Campos	LASEA
M7	Rapid prototyping of microfluidics for cell based assays	Cristian Scitu, Alexander Feuerborn, Ann Na Tan, Henry Walker, Peter R. Cook and Edmond J Walsh	University of Oxford
M8	Photothermal Spectroscopy Enables Ultra-Fast and Sensitive Absorbance Detection in Microdroplets	Richard Maceiczyk, David Hess, Flora W.Y. Chiu, Stavros Stavrakis and Andrew J. deMello	ETH Zürich
M9	Roll-to-Roll pilot line for large-scale manufacturing of microfluidic devices	Haase A[1], Neas D[1], Smolka M[1], Paltinger U[1], Ruttloff S[1], Götz J[1], Stadlober B[1], Hesse J[1], Hasenzhirl F[1], Rodriguez A[2], Flanschger A[2],Kafka J[3], Kofod G[3], Briz N[4], Ayerdi A[4], Bijelic G[5], Sonnleitner M[6], Lohse M[6], Thasen M[6], Ramos I[7], Geidl S[7], Nestler J[8], Eibelhuber M[9], Ladenhauf N[10]	[1]JOANNEUM RESEARCH Forschungsgesellschaft mbH Institute for Surface Technologies and Photonics, 8160 Weiz, Austria; [2]Islonic surface technologies GmbH, 8010 Graz, Austria; [3]Inkbit Bio Systems AS, 2800 Hongsens Lyngby, Denmark; [4]Tecnalia Research and Innovation, 20009 Donostia - San Sebastián, Spain; [5]GENSPEED Biotech GmbH, 4261 Rainbach, Austria; [6]micro swiss technology GmbH, 12555 Berlin, Germany; [7]Inaprot SL, 48160 Derio, Spain; [8]BFlow Systems GmbH, 09126 Chemnitz, Germany; [9]EV-Group, 4782 St.Florian/Inn, Austria; [10]BioNanoNet Forschungsgesellschaft mbH, 8010 Graz, Austria
M10	Pressure-assisted preconcentration : a nanofluidic route for stabilizing the focal point	Sokhna Mery NGOM, Francois-Damien Delapierre, Jean Gamby, Antoine Pallandre, Isabelle Le Potier and Anne-Marie Haghiri-Gosnet	C2N – Center of Nanosciences and Nanotechnology, route de Nozay, 91460 Marcoussis, FRANCE

POSTER PRESENTATION

	POSTER TITLE	PRINCIPAL AUTHOR(S)	AFFILIATION
M11	Developing a Neonatal Bilirubin Meter in the Country of Use	Lael Wentland, Chloe Nguyen	Oregon State University
M12	Droplet-based microfluidic system for nanoparticles preparation	Viola Tokárová, Hazal Aliye Koyuncu, Jakub Dvořák, Ondřej Kašpar	University of Chemistry and Technology, Prague
M13	Microfluidic fabrication of compartmentalised hydrogel microparticles for drug delivery systems and their antibody functionalisation	Anna Pittermannová[1,2] Zuzana Ruberová[1] Aleš Zadražil[1] Nicolas Bremond[2] Jérôme Bibette[2] Viola Tokárová[1] František Štěpánek[1]	1) UCT Prague, Technická 3, Praha 6, 16628, Czech Republic; 2) ESPCI, 10 rue Vauquelin, Paris, 75005, France
M14	Fluidic-walled microfluidics	Cristian Soitu, Edmond Walsh, Alexander Feuerborn, Henry Walker, Ann Na Tan, Peter R Cook	Oxford University
M15	Two-dimensional plasmonic structure array for enhanced biochemical sensing	Aaron D. Mueller, L.Y. M. Tobing, J. C. Tong, Lin Ke, Y. Luo and D. H. Zhang	Nanyang Technological University
M16	Microfluidic Application in Carbon Capture	Seyed Ali Nabavi, Goran T. Vladisavljević, Vasilije Manović	Cranfield University
M17	Cell-like microgel beads as mechanical probes for biophysical applications	S. Girardo[1], N. Träber[1,2], K. Wagner[1], G. Cojoc[1], C. Herold[1], R. Goswami[1], R. Schlüßler[1], M. Herbig[1], A. Taubenberger[1], M. Schürmann[1], P. Müller[1], S. Abuhattum[1], F. Reichel[1], D. Mokbel[1], T. Heida[3], G. Kesavan[3], K. Balz, M. Brand[3], J. Thiele[3,4], C. Werner[3], and J. Guck[1]	[1]Center for Molecular and Cellular Bioengineering (CMCB), Biotechnology Center, Technische Universität Dresden, Dresden, Germany [2]Center for Molecular and Cellular Bioengineering (CMCB), Center for Regenerative Therapies Dresden, Technische Universität Dresden, Dresden, Germany [3]Leibniz-Institut für Polymerforschung Dresden e. V., Dresden, Germany
M18	Engineering a microvascular 3D microenvironment of colorectal tumour-on-a-chip	M. Carvalho, D. Barata, L. Moreira Teixeira, S. Giselbrecht, R. L. Reis, J. M. Oliveira, R. Truckenmüller, P. Habibović	Department of Complex Tissue Regeneration, MERLN Institute for Technology-Inspired Regenerative Medicine, Maastricht University, The Netherlands
M19	Microfluidically generated single cell microgels for multi-scale tissue engineering	T. Kamperman, S. Henke, and J. Leijten	University of Twente
M20	Microfluidic integrated systems for cell and particle detection	R. Rodriguez-Trujillo, I. Bernat, J.J. González, M. Moreno, M. Dimaki*, W. E. Svendsen*, A. Romano-Rodriguez	Universitat de Barcelona, Dept. of Electronics, Martí i Franquès 1, 08028 Barcelona, Spain *Technical University of Denmark, Ørsteds Plads, 2800 Kgs. Lyngby, Denmark
M21	Towards the development of transplantable artificial lung based on microfluidic technologies	Julie Lachaux, Gilgueng Hwang, Anne-Marie Haghiri-Gosnet	C2N CNRS
M22	Local deposition assisted laser-based direct-write method for fabrication pf paper-based microfluidic devices	Peijun J. W. He, Ioannis N. Katis, Robert W. Eason and Collin L. Sones	Optoelectronic Research Centre, University of Southampton
M23	Perfused tissue model for antibody targeting studies of nanocarriers in cancer therapy	Monika Majerská, Nina Sarvašová, Anna Krejčí, Denisa Lizoňová, Vlastimil Král, Viola Tokárová, František Štěpánek	University of Chemistry and Technology Prague
M24	RNASwift-Quant platform: A versatile analytical platform for the purification and quantification of nucleic acids	Alison O. Nwokeoji[1], Peter M. Kilby[2], David E. Portwood[2] and Mark J. Dickman[1]	[1]Department of Chemical and Biological Engineering, ChELSI Institute, Mappin Street, University of Sheffield, S1 3JD, UK [2]Syngenta, Jealott's Hill International Research Centre, Bracknell, Berkshire, RG42 6EY, UK
N1	Role of genetic variability in solute carrier (SLC) drug transporters in breast carcinoma	Viktor Hlaváč, Marie Ehrlichová, Kateřina Elsnerová, Renata Koževnikovová, David Vrána, Jiří Gatěk and Pavel Souček	National Institute of Public Health, Srobarova 48, 10042 Prague, Czech Republic
N2	RNA Fusions in Hepatocellular Cancer	Rajai Al-Jehani, Ebtihal Farraj, Tu-Vinh Luong, Massimo Pinzani	Royal Free Hospital NHS Foundation Trust & UCL Institute for Liver & Digestive Health
N3	Colorectal cancer: functional evaluation of specific immune response and comparison of oral and gut microbiota in patients after treatment with probiotic / prebiotic	Edda RUSSO[1], Giovanni BACCI[2], Elena NICCOLAI[1], Antonio TADDEI[3], Federica RICCI[1], Maria Novella RINGRESSI[1], Carolina CHIELLINI[1], Camilla FAGORZI[1], Paolo BECHI[3], Alessio MENGONI[2], Renato FANI[2], Amedeo AMEDEI[1]	[1]Department of Clinical and Experimental Medicine, University of Florence, Florence, Italy [2]Department of Biology, University of Florence, Sesto Fiorentino (Florence), Italy [3]Department of Surgery and Translational Medicine, University of Florence, Florence, Italy [4]Department of Experimental, Clinical and Biomedical Sciences, "Mario Serio", Italy

Full abstracts can be read at: www.globalengage.co.uk/posters4bio.pdf

附件三、本署於研討會發表海報內容及投稿摘要

Evaluation of quantitative ability of genetically modified contents by digital PCR

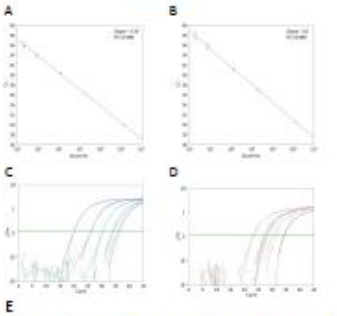
Yun-Ren Lai, Hsin-Ying Tsai, Yu-Chin Chen, Yu-Ting Wang, Shih-Ting Chiou, Hsiu-Wei Tsuei, Che-Yang Lin, Der-Yuan Wang, Lih-Ching Chiueh and Hwei-Fang Cheng

Taiwan Food and Drug Administration, Taiwan

In the past, quantification of genetically modified (GM) contents in foods mostly relayed on real-time PCR (qPCR) by standard curves which were set up by certificated reference materials. Digital PCR (dPCR) provides a route of absolute DNA quantification without standard curves, which has the potential to enhance the efficiency of precisely measurements of GM contents in food. In this study, we used 3 different platforms of quantitative PCR and digital PCR systems including ABI 7900, Fluidigm Biomarker HD system and Bio-Rad QX200 to evaluate their ability of quantification of GM contents. We took the samples containing the varied concentration of GM soybean events MON89788 (0.1%, 0.5%, 1%, 3%, 5%, 10% and 100%) to determine the copy number of MON89788-specific genetic elements and validated the data by minimal performance requirements for analytical methods for GMO testing published by Joint Research Centre in 2015. It was showed that data from three platforms were able to fit the predicted values in varied concentrations and limitation of detections (LOD) in each platform was 0.1%. However, the LOD was attenuated by increasing the dilution ratio in Fluidigm Biomark HD system, which could be improved to 0.5% by increasing sample concentration. Overall, there was no difference between qPCR and dPCR in quantitative ability of GM contents. The dPCR also can provide a reliable way for quantification of GM contents. It also can solve the problem of testing when GM reference materials are in absence.

Flowchart

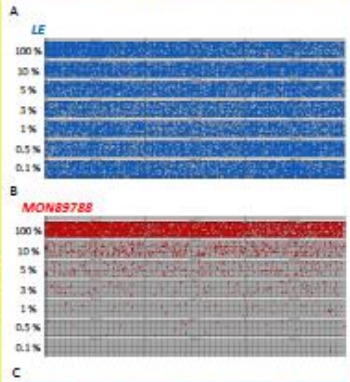
Result



E

Ct=23	AVG	SD	RSDr (<25 %)	Bias (≤25 %)
100 %	113.46 %	7.90 %	6.96 %	13.46 %
10 %	11.31 %	0.61 %	5.41 %	13.11 %
5 %	5.54 %	0.40 %	7.21 %	10.75 %
3 %	3.66 %	0.52 %	14.27 %	22.12 %
1 %	1.24 %	0.14 %	11.22 %	23.72 %
0.5 %	0.56 %	0.04 %	6.70 %	12.73 %
0.1 %	0.12 %	0.02 %	18.13 %	16.62 %

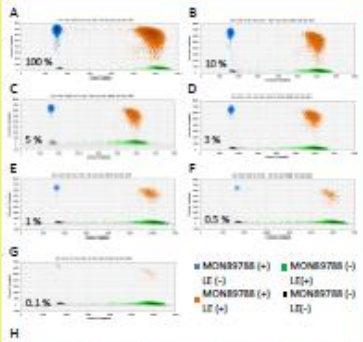
Fig. 1 Standard curves and amplification curves of *LE* and *MON89788* by a serial dilution of pGM7-3 reference plasmid and results of GM content in varied concentrations of GM soybean events MON89788 by ABI PRISM 7900. (*N*=3)



C

Ct=23	AVG	SD	RSDr (<25 %)	Bias (≤25 %)
100 %	103.50 %	5.97 %	5.74 %	3.50 %
10 %	10.63 %	0.92 %	8.68 %	6.29 %
5 %	5.07 %	0.34 %	6.76 %	1.46 %
3 %	3.52 %	0.35 %	9.82 %	17.40 %
1 %	1.06 %	0.23 %	21.42 %	5.75 %
0.5 %	0.6 %	0.14 %	24.10 %	17.28 %
0.1 %	0.07 %	0.09 %	131.69 %	-33.28 %

Fig. 2 Results of GM content in varied concentrations of GM soybean events MON89788 by Fluidigm Biomark HD system . (*N*=3)



H

Ct=23	AVG	SD	RSDr (<25 %)	Bias (≤25 %)
100 %	110.53 %	2.29 %	2.08 %	10.53 %
10 %	11.20 %	0.21 %	1.89 %	12.03 %
5 %	5.32 %	0.03 %	0.48 %	10.40 %
3 %	3.41 %	0.11 %	3.16 %	13.78 %
1 %	0.96 %	0.10 %	10.57 %	-4.33 %
0.5 %	0.50 %	0.05 %	10.39 %	0.00 %
0.1 %	0.12 %	0.01 %	5.15 %	23.50 %

Fig. 3 Results of GM content in varied concentrations of GM soybean events MON89788 by BIO-RAD QX200 system . (*N*=3)

A

	Ct	AVG	SD	RSDr	Bias
ABI PRISM 7900	Ct=23	3.66%	0.52%	14.27%	22.12%
	Ct=24	3.57%	0.36%	10.18%	18.95%
	Ct=25	3.64%	0.30%	8.34%	21.50%

B

	Ct	AVG	SD	RSDr	Bias
Fluidigm Biomark HD	Ct=23	3.52 %	0.35 %	9.82 %	17.40 %
	Ct=24	2.86 %	0.53 %	18.61 %	-4.54 %
	Ct=25	3.28 %	0.51 %	15.41 %	9.45 %

C

	Ct	AVG	SD	RSDr	Bias
BIO-RAD QX200	Ct=23	3.41 %	0.11 %	3.16 %	13.78 %
	Ct=24	3.31 %	0.13 %	4.00 %	10.33 %
	Ct=25	3.25 %	0.21 %	6.36 %	8.33 %

Fig. 4 Testing for a serial dilution of 3 % GM soybean events MON89788 in 3 different platforms. (*N*=3)

LOQ	Ct=23	Ct=24	Ct=25	Ct=26	Sample vol.
ABI PRISM 7900	0.1 %	0.1 %	0.5 %	1 %	5 µl
Fluidigm Biomark HD	0.5 %	1 %	1 %	10 %	1.2 µl
BIO-RAD QX200	0.1 %	0.5 %	0.1 %	0.1 %	5 µl

Fig. 5 Limitation of quantification (LOQ) for a serial dilution of GM soybean events MON89788 in 3 different platforms. (*N*=3)

Conclusion

Advantages of dPCR

- Absolute quantification
- Don't worry about reference materials

qPCR + dPCR → Analysis of GM Foods

Reference

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Poster Title	Evaluation of quantitative ability of genetically modified contents by digital PCR
Abstract	In the past, quantification of genetically modified (GM) contents in foods mostly relayed on real-time PCR (qPCR) by standard curves which was set up by certificated reference materials. Digital PCR (dPCR) provides a route of absolute DNA quantification without standard curves, which has the potential to enhance the efficiency of precisely measurements of GM contents in food. In this study, we used 3 different platforms of quantitative PCR and digital PCR systems, including ABI 7900, Fluidigm Biomarker HD system and Bio-Rad QX200 to evaluate their ability of quantification of GM contents. We took the samples containing the varied concentration of GM soybean events MON89788 (0.1%, 0.5%, 1%, 3%, 5%, 10% and 100%) to determine the copy number of MON89788-specific genetic elements, and validated the data by minimal performance requirements for analytical methods for GMO testing published by Joint Research Centre in 2015. It was showed that data from three platforms can fit the predicted values in varied concentrations and limitation of detections (LOD) in each platform was 0.1%. However, the LOD was attenuated by increasing the dilution ratio in Fluidigm Biomark HD system, which could be improved to 0.5% by increasing sample concentration. Overall, there are no different between qPCR and dPCR in quantitative ability of GM contents. The dPCR also can provide a reliable way for quantification of GM contents. It also can solve the problem of testing when GM reference materials are in absence.